esd Protocol
for
CAN Modules

N O T E

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1. Introduction

1.1 Notes to this Manual

This manual describes the '*esd*-CAN protocol' for *esd*-CAN modules. By this protocol it is possible to set the CAN parameters of the modules, as for example, the Rx and Tx identifiers or the baudrate. Apart from the CAN parameters it is also possible to set and play back module-specific parameters (user parameters) with the help of the protocol.

In the chapter 'Overview of the implemented commands and parameters' all commands supported at the moment are shown in a tabular summary.

Depending on the respective module type restrictions of the functions might possibly occur. Notes on this can be found in the description of the module-specific software. There the individual user parameters of the used module are described in detail, too.

1.2 Specification of the *esd* Protocol

On the basis of its problem-oriented structure the *esd* protocol cannot be categorized clearly into a layer of the ISO layer model: It offers services which range from fundamental functions, as e.g., the inquiry of the status of the CAN hardware controller up to application-specific adjustments, as, e.g., the setting of so-called 'user parameters'.

The *esd* protocol offers functions which are comparable, e.g., with the LMT (layer management) in the CAL (CAN application layer). Because the identifier allocation occurs by the *esd* protocol, too, its functionalities are partly similar to those of the DBT (identifier distributor) in the CAL, as well.

But the *esd* protocol is operated totally independently and has got no interface to the CAL!

1.3 General Notes on Data Transmission

In the following descriptions the transmission direction of data is looked at, if not other wisely stated, from the module. The module receives data on the 'Rx identifier' and transmits data on the 'Tx identifier'.

The data bytes are counted from 1 to 8 and are always transmitted in the order byte 1...byte 8. The number of transmitted bytes can vary from 0 to 8. The data transmission has to start with byte 1 and progress in continuous order (e.g., byte 1, byte 2, byte 3 - not possible, e.g., byte 1, byte 7, byte 8).

Generally only those bytes are overwritten which are received by the module. The data of not recorded bytes remain unchanged.

1.4 General Hardware Functions

To use the esd CAN protocol at the CAN modules at each module the following hardware circuits are necessary:

CAN controller 8xC592 (or compatible)
: The controller has a internal RAM, that is used as a working memory. In this RAM the dynamical parameters are stored. The RAM ist deleted with each RESET.

I²C EEPROM
: The I²C EEPROM is used for storing the configuration parameters. The data will remain stored in power off condition or after a RESET.

Coding switch
: Via the coding switch, e.g. the default value of the module no. is set.

Further descriptions can be read in the hardware manual of the module.

1.5 Parameters after a RESET

The module offers various possibilities to trigger a RESET:

A power-on RESET, a RESET by the EMERGENCY-STOP inputs and a RESET by the general command 'RESET module' reset the local components.
Furthermore the module is able to trigger a RESET independently when the hardware watchdog has expired. This RESET also resets the local components without changing the stored parameters.

The listed RESETs only change the parameters of the module filed in the I²C EEPROM, if the conditions apply which are listed in the table below.

The module also supports the command 'default RESET'. By this command a local RESET is triggered and the parameters of the module are always overwritten with the default parameters.

The used parameters with which the module operates after a power-on RESET, a RESET by the EMERGENCY STOP inputs or a RESET by the general command 'RESET module', depend mainly on three factors:

The switch position of the coding switches, the availability of the I²C EEPROM data and the module number (parameter 'module no.') stored in the I²C EEPROM.

The following table should give an overview of the resulting parameters. It does not contain the 'default RESET', because this does always lead to the activation of the default parameters.

	Actual position of the coding switches after RESET	I²C EEPROM status	I²C EEPROM module no.	CAN identifier (CAN Id.), parameter, module no.
1	$00	x	x	CAN Id. = f6Coding switches› Parameter = default I²C EEPROM mod no. = previous mod no. active mod no. = $00
2	… $00	ERROR	x	CAN Id. = f6Coding switches› Parameter = default I²C EEPROM mod no. =$00 active mod no. = Coding switch no.
3	… $00	OK	$00	CAN Id. = f6Coding switches› Parameter = default I²C EEPROM mod no. = $00 active mod no. = Coding switch no.
4	(*) … $00	OK	… $00	CAN Id. = f6I²C EEPROM› Parameter = f6I²C EEPROM› active mod no. = I²C EEPROM mod no.

(x) This value or status is of no importance in this case.
(*) If a CAN error is found after a RESET, the local software sets the bitrate to the default value (=adjustment at configuration jumper).

Table 1.5.1: Parameter after a RESET

Explanations to Table 1.5.1:

Some of the terms from the table above will be described in detail in following sections of this manual. For a general understanding of the table, a short explanation of the terms:

Module no. ...	Serial number (1...255) which can be allocated to the module by the user independently from the module type.
active mod no. ...	The module no. with which the module is selected by the initialisation identifier (INIT Id) during the parameter interchange.
I²C EEPROM mod no. ...	The module no. which was stored in the local I²C EEPROM of the module. If no change in this number had been made after the storing, the actual mod no. is identical with the I²C EEPROM module no..

Below the combinations of factors, shown in table 1.4.1, which are decisive for the selection of the default parameters will be explained:

Combination 1

If the positions of the coding switches are $00 when the module starts after a RESET, the I²C EEPROM data, previously stored, will be overwritten at the moment in which the adjustment is changed from $00 to any other value. The firmware needs about five seconds for this. Afterwards a local RESET is triggered by the firmware. During the RESET the message outputs are activated.

The CAN identifier corresponds to the value adjusted at the coding switches.

The module operates with the default parameters.

Combination 2

The second listed combination occurs if no I²C EEPROM is available or the I²C EEPROM data are faulty. If this is the case, the local software would use the default parameters.

The CAN identifier corresponds to the value adjusted at the coding switches. The actual module no. corresponds to the value which is adjusted on the coding switches.

Combination 3

The third combination describes the condition of the module which occurs, e.g., if the position of the coding switches is changed from $00 to any other value.

The I²C EEPROM module no. had been set by the local software (see combination 1) to $00. (The I²C EEPROM module no. can also be set to $00 by interchanging the parameter 'module no.')

If the status of the I²C EEPROM data are correct, the module operates with the identifier on the CAN, in this combination, which is adjusted by the coding switches.
The actual module no. corresponds to the value adjusted on the coding switches.

Combination 4

In this combination of the factors listed above, the module operates after a RESET with the previously changed and in the I²C EEPROM stored parameters.

Requirements for this are a faultless CRC check of the I²C EEPROM data (I²C EEPROM status=OK), a coding switch position unequal $00 and a module no., stored in the I²C EEPROM, which has got a value unequal $00.

The CAN identifier with which the module operates and all used parameters are taken from the I²C EEPROM.

The actual module no. with which the module is selected in the initialisation phase corresponds to the module no. stored in the I²C EEPROM.

1.6 Calling the Commands and Setting the Parameters

If an *esd*-CAN module is in original condition (default condition at delivery), it operates only by the CAN identifiers on the CAN (see hardware manual) adjusted by hardware.

To report the initialisation parameters to the module nevertheless, a special CAN identifier (INIT Id) has been reserved which is the same for all *esd*-CAN modules.

In spite of the identifier adjusted by the coding switches, the module receives and processes every CAN frame transmitted on the INIT Id.

The INIT Id determined by *esd* has got the value:

$700

(valid since software version V0.8, subject to alterations)

The identifier $700 is reserved for the initialisation, i.e., if this identifier should wrongly be allocated to other functions, the transmitted data will be interpreted as initialisation parameter, nevertheless!

Generally not all modules should be initialized with the same parameters. To distinguish the modules the fourth byte of the six INIT Id bytes has to have the 'actual Module no.' of the wanted module at the initialisation.

The module no. is a characteristic number in the area of $00...$FF which can be freely defined by the user. It is possible, e.g., to number all existing modules (max. 255 modules), independent from the type, continuously.

In a CAN net the same module no. should only be used once. The module no. $00 should not be used, because it is used during the initialisation sequence with global commands, which are valid for all modules.

The actual module no. is identical with the number adjusted at the coding switches, when the module is operated with the default parameters.

But it is also possible to program the module no. freely during the initialisation.

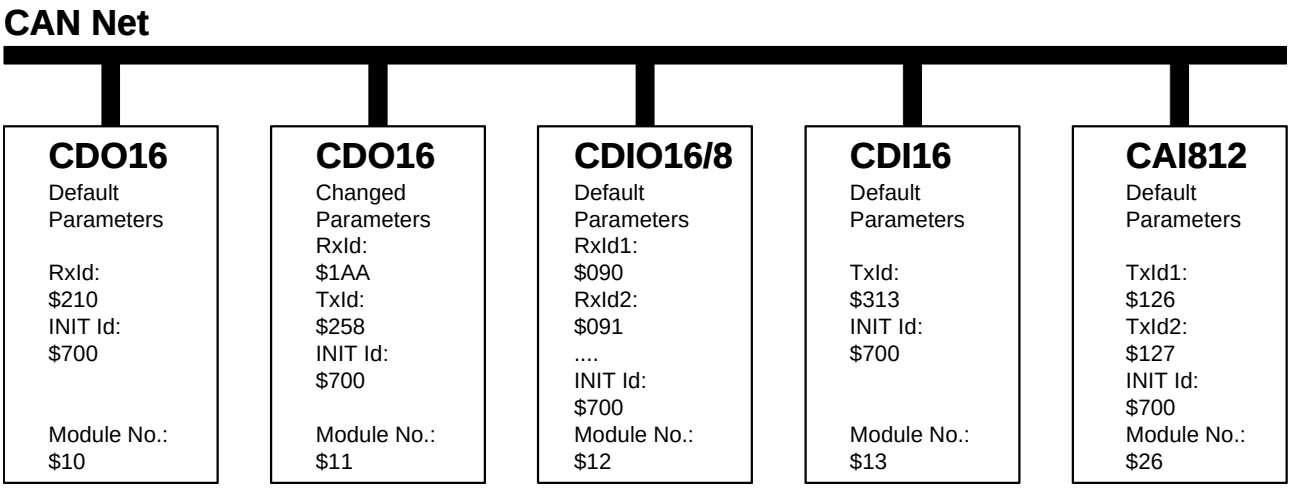


Fig. 1.6.1: Examples for the module no. and the CAN identifier

6 bytes are necessary for the initialisation of a module. The transmitted structure has to have the correct length and the functions corresponding to the module type of board. If this is not the case, the module would not react to the initialisation.

The table below shows the construction of the INIT Id. In the command byte and the sub command bytes the function of the respective initialisation level is determined. The module no. selects the wanted module. In the cells parameter 1 and 2 the wanted parameters are transmitted.

Byte no.	Function	Value range
1	Command	$00...$FF
2	Sub command 1	$00...$FF
3	Sub command 2 1*)	$00...$FF 1*)
4	Module no.	$00, $01...$FF
5	Parameter 1	$00...$FF
6	Parameter 2	$00...$FF
7	Not used	-
8		

(*) Byte 3 (sub command 2) is not needed for the majority of commands and parameters. In this case it should always be allocated with $00.

Table 1.6.1: Data bytes of the INIT Id ($700)

Overview

The parameter interchange can lead to the setting of parameters, to the reply of already adjusted parameters or to the execution of a command. At the command interchange and the setting of parameters the highest bit of the command byte is always '1', at the request of parameters it is always '0'.

The requested reply of the module is only sent once by the module. The identifier (CTxId) which had been allocated to the module for this transmission is not stored on the module. If another transmission is desired an INIT Id with the corresponding parameters has to be transmitted to the module again.

If the module processes faultlessly and the CAN is free, it transmits the reply within 10msec.

Normally, at the reply of the actual parameter condition of the modules, in the first byte the contents of the received command byte and in the second byte the contents of the sub command byte is given.

This is not the case if the second byte is used for the display of other parameters or an unknown command or sub command byte had been sent to the module. In the second case a message containing only one byte with the contents $FF is given back to the CAN.

The given value ranges of the parameters have to be kept, because otherwise the faultless execution of commands is not guaranteed! No error message occurs after wrong entry of the parameter values.

Below the parameters and commands will be specified. The instructions are kept general, so that they apply to all *esd*-CAN modules which have the software versions from V1.4c. The examples added subsequently to the specification should clarify the function course further.

The description of the bytes of the INIT Id restricts to those which are relevant for the corresponding mode.

Byte 3 (sub command 2) should, if it is not needed, always be recorded with $00. In byte 4 the actual module no. has to be entered, as already mentioned above.

2. Overview of the Implemented Commands and Parameters

The two following tables give a complete summary of all bytes implemented until now and the parameters given back by the module. The individual designations of the commands and parameters will not be explained in detail in the tables in favour of the clarity. The descriptions of the used expressions can be taken from the following chapters in which the individual commands will be described.

The value ranges of the parameters cover all possible entries which are evaluated correctly by the software. Here it has to be noted that partly special functions (e.g. 'function switched off') have been allocated to individual values of the parameters (e.g. $00). The allocation of values which are outside of the given limits is not permissible, because otherwise the perfect function of the addressed module will not be guaranteed anymore.

2.1 Overview of the Commands

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	don't care	Module No.	Parameter 1	Parameter 2	not used	not used
Request Configuration $00	$00 - Module Type $01 - Active Switch $02 - ASCII Id $03 - Software Rev. $04 - Module Time $05 - Serial No.	Please write always $00.	selected Module No. $01...$FF	CTxId $0000...$07FF		These Bytes are not used.	

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command 1	Sub-Command 2	Module No.	Parameter 1	Parameter 2	not used	not used
System Parameter: $81	$00 - Save Parameter			selected Module No. (= Byte 4)	-		
$81 - set	$01 - Module No	>	>	new Module No. $00...$FF	-	>	
$01 - request				CTxId $0000...$07FF			
$81 - set	$02 - CAN-Status-Byte	Please write always $00.	selected Module No. $01...$FF	cstat $00	-	These Bytes are not used.	
$01 - request				CTxId $0000...$07FF			
$81 - set	$03 - Bitrate	?	?	bust 0 (=BTR0) (see Controller-Manual)	bust 1 (=BTR1) (see Controller-Manual)	?	
$01 - request				CTxId $0000...$07FF			
$81 - set	$04 - Watchdog Tx Identifier			WTxId $0000...$07FF			
$01 - request				CTxId $0000...$07FF			
$81 - set	$05 - Watchdog Time	WDLife TimeFactor		WDtime $0000...$FFFF [ms]			
$01 - request				CTxId $0000...$07FF			

Overview

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	don't care	Module No.	Parameter 1	Parameter 2	not used	not used
TxIds $82 - set	$00 - TxId1 $01 - TxId2 $02 - TxId3 : n - TxId(n+1)	Please write always $00.	selected Module No. $01...$FF	TxId $0000...$07FF		These Bytes are not used.	
$02 - request				CTxId $0000...$07FF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	don't care	Module No.	Parameter 1	Parameter 2	not used	not used
RxIds $83 - set	$00 - RxId1 $01 - RxId2 $02 - RxId3 : n - RxId(n+1)	Please write always $00.	selected Module No. $01...$FF	RxId $0000...$07FF		These Bytes are not used.	
$03 - request				CTxId $0000...$07FF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	don't care	Module No.	Parameter 1	Parameter 2	not used	not used
Tx-Activate-Time $84 - set	$00 - act.-T. TxId1 $01 - act.-T. TxId2 $02 - act.-T. TxId3 : n - act.-T. TxId(n+1)	Please write always $00.	selected Module No. $01...$FF	tx_act $0000...$FFFF [ms]		These Bytes are not used.	
$04 - request				CTxId $0000...$07FF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command 1	Sub-Command 2	Module No.	Parameter 1	Parameter 2	not used	not used
Module Memory/ Controller Ports $85 - set	Memory Address or Port Select $00...$FF	$00- RAM $01- XRAM $02...$09- EEPROM $7F - µC-Ports $8F...$FF- reserved	selected Module No. $01...$FF	data $00...$FF	-	These Bytes are not used.	
$05 - request				CTxId $0000...$07FF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	don't care	Module No.	Parameter 1	Parameter 2	not used	not used
User Parameter $86 - set	User Parameter No. $00...$7F	Please write always $00.	selected Module No. $01...$FF	Para $0000...$FFFF		These Bytes are not used.	
$06 - request				CTxId $0000...$07FF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	don't care	Module No.	Parameter 1	Parameter 2	not used	not used
Rx Block Mode $87 - set	$00 - Block 1 $01 - Block 2 $02 - Block 3 : n - Block (n+1)	Please write always $00.	selected Module No. $01...$FF	rxmode $00 - normal Rx $01 - Rx Block Mode active	-	These Bytes are not used.	
$07 - request				CTxId $0000...$07FF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command 1	Sub-Command 2	Module No.	Parameter 1	Parameter 2	not used	not used
Pin Name $88 - set (don't use!)	$00 - Pin 1 $01 - Pin 2 ... $FF - Pin 256	$00-Byte 0 $01-Byte 1 ... $17-Byte 23	selected Module No. $01...$FF	Byte Name $00...$FF	-	These Bytes are not used.	
$08 - request (don't use!)				CTxId $0000...$07FF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command 1	Sub-Command 2	Module No.	Parameter 1	Parameter 2	not used	not used
External Memory $89 - set (don't use!)	Memory Address Low $00...$FF	Memory Address High $00...$FF	selected Module No. $01...$FF	Memory Data $00...$FF	-	These Bytes are not used.	
$09 - request				CTxId $0000...$07FF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command 1	Sub-Command 2	Module No.	Parameter 1	Parameter 2	Parameter 3	Parameter 4
Extended Memory $8A - set (don't use!)	Memory Address Low $00...$FF	Memory Address High $00...$FF	selected Module No. $01...$FF	data(addr) $00...$FF	data(addr+1) $00...$FF	data(addr+2) $00...$FF	data(addr+3) $00...$FF
$0A - request				CTxId $0000...$07FF		These Bytes are not used.	

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command 1	Sub-Command 2	Module No.	Parameter 1	Parameter 2	Parameter 3	Parameter 4
Programm Code $0B - request	Memory Address Low $00...$FF	Memory Address High $00...$FF	selected Module No. $01...$FF	CTxId $0000...$07FF		These Bytes are not used.	

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command 1	Sub-Command 2	Module No.	Parameter 1	Parameter 2	not used	not used
Service Request $7F	Module No_LOW $00...$FF	Module No_HIGH $00...$FF	Please write always $00.	CTxId $0000...$07FF		These Bytes are not used.	

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	not used	Module No.	Parameter 1	Parameter 2	Parameter 3	Parameter 4
Set Module Time absolute $FD	Please write always $00.	Please write always $00.	selected Module No. $00...$FF	absolute_time $00000000...$05265BFF [ms]			

Overview

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	not used	Module No.	Parameter 1	Parameter 2	Parameter 3	Parameter 4
Sync. Module $FE	Please write always $00.	Please write always $00.	selected Module No. $00...$FF	sync_time_master $000000000...$FFFFFFFF			

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Command	Sub-Command	don't care	Module No.	Parameter 1	Parameter 2	not used	not used
Supervisor Commands $FF	$00 - RESET Module	Please write always $00.	$00 - all Modules $01...$FF - selected Module	$AAAA - RESET		These Bytes are not used.	
	$01 - reserved			-			
	$02 - Supervisor Watchdog			-			
	$03 - Default RESET			$AAAA - Default-Reset			
	$04 - Suspend/ Continue Module			$5A5A - suspend $A5A5 - continue			
	$05 - RESET CAN-Status			-			

2.2 Overview of the Returned Parameter Values

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Configuration $00	$00-Module Type	$00	$00	type	iomode	-	-	-	-
	$01-Active Switch	$00	$01	switch	-	-	-	-	-
	$02- ASCII Id	$00	a (ASCII)	b (ASCII)	c (ASCII)	d (ASCII)	e (ASCII)	Module No.-H (ASCII)	Module No.-L (ASCII)
	$03- Software Revision	$00	'V' in ASCII	level H	'.' in ASCII	level L	revision	esd/cms	protocol-revision
	$04- Module Time	$00	$04	Îtime		module_time			
	$05- Serial No.	$00	$05	u (ASCII)	v (ASCII)	w (ASCII)	x (ASCII)	y (ASCII)	z (ASCII)

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
System Parameter: $01	$00-Saved Module No.	$01	$00	saved Module No.	-	-	-	-	-
	$01-Active Module No.	$01	$01	active Module No.	-	-	-	-	-
	$02 - CAN-Status Byte	$01	$02	cstat	constat	-	-	-	-
	$03 - Saved Bitrate	$01	$03	bust 0	bust 1	-	-	-	-
	$04 - WD-Tx-Id	$01	$04	WTxId		-	-	-	-
	$05 - WD-Time	$01	$05	WDtime [ms]		WDLifeTime Factor	-	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
TxIds $02	$00-TxId1	$02	$00	TxId1		-	-	-	-
	$01-TxId2	$02	$01	TxId2		-	-	-	-
	$02-TxId3	$02	$02	TxId3		-	-	-	-
	:	$02	:	:		-	-	-	-
	n -TxId(n+1)	$02	n	TxId(n+1)		-	-	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
RxIds $03	$00-RxId1	$03	$00	RxId1S		RxId1E		-	-
	$01-RxId2	$03	$01	RxId2S		RxId2E		-	-
	$02-RxId3	$03	$02	RxId3S		RxId3E		-	-
	:	$03	:	:		:		-	-
	n -RxId(n+1)	$03	n	RxId(n+1)S		RxId(n+1)E		-	-

Overview

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Tx Activate Time $04	$00- Time TxId1	$04	$00	tx-act1 [ms]		-	-	-	-
	$01- Time TxId2	$04	$01	tx-act2 [ms]		-	-	-	-
	$02- Time TxId3	$04	$02	tx-act3 [ms]		-	-	-	-
	:	$04	:	:		-	-	-	-
	n-Time TxId(n+1)	$04	n	tx-act(n+1)		-	-	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Module Memory/ Controller-Ports $05	$00- Addr. 00/ Port P0.x	$05	$00	data 00/ Port P0.0...P0.7	-	-	-	-	-
	$01- Addr. 01/ Port P1.x	$05	$01	data 01/ Port P1.0...P1.7	-	-	-	-	-
	...	$05	...	...	-	-	-	-	-
	$FF-Addr.FF	$05	$FF	data FF	-	-	-	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
User Parameter $06	$00-Para 0	$06	$00	Para0		-	-	-	-
	$01-Para 1	$06	$01	Para1		-	-	-	-
	...	$06	...	...		-	-	-	-
	$7F-Para127	$06	$7F	Para7F		-	-	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Rx Block Mode $07	$00-Block 1	$07	$00	rxmode 1	-	-	-	-	-
	$01-Block 2	$07	$01	rxmode 2	-	-	-	-	-
	$02-Block 3	$07	$02	rxmode 3	-	-	-	-	-
	:	$07	:	:	-	-	-	-	-
	n-Block (n+1)	$07	n	rxmode(n+1)	-	-	-	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Pin Name $08 (don't use!)	$00-Pin 1	$08	$00	selected Byte of Pin 1	-	-	-	-	-
	$01-Pin 2	$08	$01	selected Byte of Pin 2	-	-	-	-	-
	...	$08	...	...	-	-	-	-	-
	$FF-Pin 256	$08	$FF	selected Byte of Pin 256	-	-	-	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
External Memory $09	$00- Addr. 00	$09	$00	data 00	-	-	-	-	-
	$01- Addr. 01	$09	$01	data 01	-	-	-	-	-
	...	$09	...	...	-	-	-	-	-
	$FF- Addr. FF	$09	$FF	data FF	-	-	-	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Extended Memory $0A	$00- Addr. 00	$0A	$00	data 00	data 01	data 02	data 03	-	-
	$04- Addr. 04	$0A	$01	data 04	data 05	data 06	data 07	-	-
	...	$0A	...	...	...	...	...	-	-
	$FC- Addr. FC	$0A	$FC	data FC	data FD	data FE	data FF	-	-

Command: Request...	Sub-Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Programm Code $0B	$00- Addr. 00	$0B	$00	code 00	code 01	code 02	code 03	-	-
	$04- Addr. 04	$0B	$01	code 04	code 05	code 06	code 07	-	-
	...	$0B	...	...	...	...	...	-	-
	$FC- Addr. FC	$0B	$FC	code FC	code FD	code FE	code FF	-	-

(-) This Byte is not transmitted.

3. Description of the Individual Commands and Parameters

3.1 Configuration Reply

The transmission is called by transmitting a 'request configuration' command. The identifier on which the module should transmit the information on the CAN is reported to it by byte 5 and 6.

Contrary to the other commands only parameters are called with this command.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command	Not used	Module no.	Parameter 1	Parameter 2
Value	$00	$00...$05	Always write $00	Selected module no. $01...$FF	CTxId $0000...$07FF	

Table 3.1.1: Bytes of the command 'request configuration'

Explanation of the Bytes Transmitted to the Module:

Command... The command 'request configuration' requests the transmission of the actual parameters of the module.

Sub command... The sub command determines the configuration bytes which should reply:

Sub command	Reply of the parameters
$00	Module type
$01	Active switch
$02	ASCII Id
$03	Software rev.
$04	local module time
$05	serial number

Table 3.1.2: Selection of the configuration reply by sub command

Parameter 1 and 2... With these parameters it is reported to the module to which CAN Id. it should transmit the requested reply.
The module does only transmit once on this identifier. The identifier is not stored on the module.
If another transmission is desired another INIT Id with the corresponding parameters has to be transmitted to the module.

Transmission of the adjusted configuration by the module:

Decisive for the selection of the message to be transmitted is the value of the sub command received by the module. The following table shows the information which is transmitted to the CAN by the module.

Sub command	Reply of the parameter	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	Module type	$00	$00	type	iomode	-	-	-	-
$01	Active switch	$00	$01	switch	-	-	-	-	-
$02	ASCII Id	$00	a	b	c	d	e	Mod No ASCIIH	Mod No ASCIIL
$03	Software rev.	$00	'V' ASCII	level H	'.' ASCII	level L	rev.	esd/cms	prot-rev
$04	Local module time	$00	$04	Î time		module_time			
$05	Serial number (*)	$00	$05	u	v	w	x	y	z

(-) Byte is not transmitted.
(*) No support at the moment.

Table 3.1.3: Transmitting the adjusted configuration

Explanation of the bytes transmitted by the module:

Sub command $00 --< module type

Byte 1... The first byte replies the contents of the received command byte (here always $00).

Byte 2... The second byte replies the contents of the received sub command (here always $00).

Byte 3:
type... In this cell the type of the *esd*-CAN module is coded. The following table shows examples of the existing type designations:

type	Modules (examples)
$00	reserved
$01	CDO16
$02	CDI16
$03	CAI810
$04	CAO812
$05	CDIO16/16
$06	CAI812
$07	reserved
$08	CREL8
$09	CSC595
$0A	CPIO16/8
$0B	CCOM4
$0C	CCOM1
$0D	PTIDAC
$0E	SPS16
$0F	CMIO
$10	reserved
$11	CTERM
$12	CBIP
$13	CANSAT
$14	AIS16
$15	CI488
$16	CAN-PT100/DMS4
$17	CDMS4I
$18	CAN-PCC
$19	CCOM1
$1A	XMIO4
$1B	reserved
:	:
$1F	reserved
$20	LasCon I/O
:	:
$FE	reserved
$FF	reserved

Table 3.1.4 Examples for module type designations

Byte 4:
iomode...

The byte 'iomode' contains, broken down into 6 bits, information about the operating mode of the addressed module. A '1' of the respective bit signalizes the operating mode possible for this module:

Bit	Function	Example: CMIO
0	Output	1
1	Input	1
2	Digital	1
3	Analog	1
4	Controller	0
5	Serial	0
6	Reserved 1*)	0
7	Reserved 1*)	0

1*) These bits are read as '0'.

Table 3.1.5: Bits in parameter 'iomode'

Example: At a CMIO module the value $0F would be replied for 'iomode'.

Sub command $01 --< active switch

Byte1,
Byte2...

See sub command $00.

Byte 3:
switch...

The byte 'switch' replies the number adjusted on the coding switches.

If the module no. filed in the EEPROM has got the value $00 or if the EEPROM data are not OK, the actual module no. by which the module is addressed during the initialisation corresponds to this coding switch number.

Sub command $02 --< ASCII Id

Byte 1... See sub command $00.

Byte 2 - Byte 6
a, b, c, d, e... These bytes describe the module type in ASCII code.

Byte 7, Byte 8:
mod no. ASCII... These two bytes describe the module name and the active module number in ASCII code. The following table gives an example for the display of these bytes in ASCII code. It is a CMIO module with the module no. $99.

Byte	2	3	4	5	6	7	8
Parameter	a	b	c	d	e	Module no. H	Module no. L
ASCII Id CMIO	M	I	O	4	2	9	9

Table 3.1.6: Example for an ASCII Id
(CMIO module with module no. $99)

Sub command $03 --< software revision

Byte 1... See sub command $00.

Byte 2 - Byte 5
'V', level,
'.', rev.... In ASCII code these bytes describe the revision number of the firmware of the CAN core used on the module.
Byte 2 and byte 4 are permanently allocated with the ASCII symbols 'V'($56) or '.'($2E).
In byte 3 and byte 5 the actual revision number is described.
Byte 6 contains a letter which stands for the revision of the module-specific firmware.
In byte 7 is returned, which protocol is implemented (esd CAN protocol or CMS protocol). An 'e' means, that the esd CAN protocol is implemented and a 'c' means, that the CMS protocol is implemented.
Byte 8 returns the actual revision number of the used protocol (e.g. of the esd CAN protocol).

Byte	2	3	4	5	6	7	8
Parameter	'V'	level H	'.'	level L	rev.	esd/cms	prot-rev
ASCII display	V	1	.	7	e	e	7

Table 3.1.7: Example for the ASCII software rev no. 'V1.7ee7'

Sub command $04 --< local module time

At the esd CAN modules a 32-bits counter is working, that runs with microsecond steps. The counter is reset to ‘0’ with every power-on. If the absolute module time will not be triggered with the command ‘Set absolute module time’ ($FD), the counter counts up to $FFFFFFFF. The setting of the absolute module time sets the local clock and sets additionally the overflow value of the counter to 24 h, e.g. $05265BFF.

A synchronisation with the time of the CAN master is possible using the supervisor command $FE. The supervisor commands are described in a following chapter in detail.
With the request configuration command $00 with the sub command $04, that is described here the time difference between the master time and the module time can be requested:

Byte 1, Byte 2 ... refer to sub command $00.

Byte 3, Byte 4 -
'Î time'... Time difference between CAN master and CAN module as 16-bits value in milliseconds. If no synchronisation happens, always '0000' is returned.

Byte 5...8
'module_time'... Absolute module time as a 32-bits value in milliseconds
Value range (after clock setting by command $FD):
0 ... 86 400 000 ms (24 h)
(0 ... $ 05 26 5B FF)

Sub-Command $05 --< serial-number

Byte 1, Byte 2 ... refer to sub command $00.

Byte 3...8 ... serial number of the CAN module.
This function is not supported at the moment.

3.2 System Parameters

With the command $81 the parameters described below are set. By command $01 and the according sub command the module is lead to reply the actual parameters.

If the command 'store parameter' (sub command $00) is transmitted to the module, all previously interchanged parameters are stored in the local I²C EEPROM.
If the module is reset (RESET) or the supply voltage is switched off, the entered parameters are lost if this command has not been entered before.

After a RESET command or a power-on RESET the module operates with the stored parameters (identifiers etc.). If the programming has been unsuccessful (e.g. no I²C EEPROM or defect) the module uses the standard parameters (e.g. identifier =< coding switches).

The module no. with which the module is selected at the parameter interchange corresponds to the adjustment of the coding switches (provided no modification had been made so far). By the sub command $01 it is possible to allocate another module no. to the module. The new number is active immediately after the setting and the number adjusted by the coding switches is ignored.

The CAN-status byte offers various information about the condition of the module: It is shown if the module had previously not been connected to the CAN, if the default parameters had been activated after a RESET, if the last RESET had been caused by a power-on cycle, etc.

By the sub command $03 it is possible to change the CAN bitrate of the module which was adjusted by the configuration jumper of the module. The new bitrate is only activated after the parameters have been stored by sub command $00Command and a RESET has been triggered.

Between the modules and a supervisor (master) a mutual function control by a watchdog protocol similar to the CMS specification can occur. By the sub commands $04 and $05 it is possible to interchange a watchdog identifier and a watchdog time.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command	Not used	Module no.	Parameter 1	Parameter 2
Value	Request: $01	$00...$03	Always allocate $00	Selected module no. $01..$FF = active module no.	CTxId $0000...$07FF	
	Set: $81	$00 store parameter			active mod no.	-
		$01 module no.			new mod no.	-
		$02 status			cstat	-
		$03 bitrate			bust 0	bust 1
		$04 watchdog Id			WTxId $0000...$07FF	
		$05 watchdog time	WDLife TimeFactor $00...$FF		WDtime $0000...$FFFF	

Table 3.2.1: Bytes of the commands 'store parameter, module no., bitrate and watchdog'

Setting the Commands and Parameters (Command $81):

Command... The command $81 leads to the setting of parameters or to the activation of the commands.
The command $01 leads to the reply of the actual parameters.

Sub command... The sub command selects the desired parameter interchange or the command to be executed.

Parameter1, Parameter2 Following sub commands are implemented:

Sub command	Function
$00	Storing the actual parameter
$01	Setting a new module no.
$02	Setting the CAN-status byte
$03	Setting a new bitrate
$04	Setting the watchdog Tx identifier
$05	Setting the watchdog time

Table 3.2.2: Function of the sub commands

The kind of the parameters interchanged to the module depends on the selected sub command:

Sub command $00 --< store parameter

active
mod. no...

To store all interchanged parameters (also those of other commands) the actual module no. has to be entered into byte 5 when calling this sub command.
The actual module no. is either the number adjusted by the coding switches (default parameter active) or the number changed by sub command 'set module no.'.

Sub command $01 --< set module no.

new. mod. no..

Here the desired new module no. is entered. The module is addressed immediately after this command by the new module no. The module no. adjusted by the coding switches is ignored.
If the new module no. should remain active after a RESET, the parameters have to be stored by the sub command 'store parameters' before a power down or a RESET.

Sub command $02 --< set CAN-status byte

cstat...

A 'set' access onto the CAN-status byte sets the bits 2 and 7 of the byte to '0'. All other bits of the status byte remain unchanged, because they serve as read only information (see also 'requesting the actual parameters').

Bit 2 shows that a CAN error has been detected by the module. The bit serves the documentation of errors which do not cause a 'standstill' for the CAN, but remain only for a short period. Error arising for a short time can easily be overlooked, because they make themselves visible only by a temporal limited flashing of the status LED.
The bit is set to '1' when an error has been detected. A 'set' access with any data (recommended: byte 5 = $00) onto the status byte or each RESET reset the bit back to '0'.

The CAN-error bit can also be reset by the supervisor command 'reset CAN error' (sub command $05). The other bits remain unchanged by this command.

Notes on the internal management of the CAN-error bit:
The CAN-error bit is set by the local software if the status bit of the CAN controller 'error status' is activated. (see constat).
After the first recognition of a CAN error the controller at first tries to transmit or receive data repeatedly. If it recognizes after several attempts that the error does not occur anymore, it does not take back its error bit at once. First further successful transmissions have to take place to count back the internal error counter again. Supervised Tx transfers which are addressed to other modules are also counted as successful transmissions. But if only one module and one CAN master are installed on the bus, the master possibly has to transmit some messages first to reset the error counter and therefore reset the controller status bit.
Therefore it is possible that the CAN-error bit of the CAN-status byte is still active after only one reset, because the error bit of the controller is still active.

Bit 7 of the byte has got the designation 'new on bus' and shows if the module processes for the first time on the CAN:
A CAN master is able to evaluate and set the bit to zero to document on the module that it noted the presence of the module on the CAN. If the bit has got the value '1' at the reading, in this application of the bit the module had not been found by a master so far after the last RESET.

A 'set' access with any data (recommended: byte 5 = $00) onto the status byte sets the bit onto '0'.

Sub command $03 --< set bitrate

bust0, bust1.. These two bytes set the contents of the registers BTR0 and BTR1 of the CAN controller 8xC592/82C200 which determine the bitrate of the CAN interface.

An allocation of the register contents to the bit rates can be taken from the table below.

Contrary to the other commands this parameters only become active after the actual parameter set was stored in the EEPROM (store parameters) and a RESET was triggered on the module.

If no communication is possible with the module, this is often due to a wrong adjustment of the bitrate.
If the local software discovers a malfunction on the CAN, the bitrate is adjusted again to the default value (adjustment at the configuration jumper of the module), but without changing the other parameters.

The specified typical line lengths base on experimental values from experience. The minimum reachable line lengths result from the 'worst case' delay times of the used components.

CAN controller register		Bit rate [kBit/s]	Typical values of the reachable line length l_{max} [m]	Minimum values of the reachable line length l_{min} [m]
BTR0 [HEX]	BTR1 [HEX]			
00	14	1000	37	20
00	16	800	59	42
00	18	666.6	80	65
00	1C	500	130	110
01	18	333.3	180	160
01	1C	250	270	250
02	1C	166	420	400
03	1C	125	570	550
04	1C	100	710	700
45	2F	66.6	1000	980
09	1C	50	1400	1400
4B	2F	33.3	2000	2000
18	1C	20	3600	3600
5F	2F	12.5	5400	5400
31	1C	10	7300	7300

The specifications in the table base on the limit values of the bit timing of the CAN protocol, the runtime of the local CAN interface and the runtime of the cable. The runtime of the cable is assumed with about 5.5 ns/m. Further influences, e.g., by the terminal resistances, the specific resistance, the geometry of the cable of outer interference effects at the transmission have not been included in the specifications!

Table 3.2.3: Allocation of the bitrate to the registers of the controller 8xC592 or 82C200

Sub command $04 --< set watchdog Tx identifier Sub command $05 --< set watchdog time (guard time)

The watchdog protocol functions with following scheme:

1. After a RESET, the watchdog is inactive. The 'master' interchanges with these sub commands a Tx identifier, a watchdog time (Guard Time) and a life time factor to the module. Setting the watchdog time to values > '0' and setting the life time factor to values > '0' enables the local watchdog on the module. The watchdog is not activated at that moment!

2. First a remote request has to be received for this Tx identifier or the command 'Supervisor Watchdog' ($FF) has to be received, before the watchdog time is counted down for the first time. After this the master has to send a RTR or a supervisor command at the given Tx identifier within the time (WDtime x WDLifeTimeFactor), otherwise a RESET is triggered at the module.
   Receiving the RTR or the command shows the module that the master is still active.

3. If the remote request or the supervisor command arrives within the given time, the module transmits a one byte containing message back on the Tx identifier. The byte is constructed as follows:

Bit	7	6	5	4	3	2	1	0
Contents	Toggle bit	1	1	1	1	CMS State		

Table 3.2.4: Watchdog reply of the modules

   The toggle bit changes its condition with each transmission. In normal position, i.e. before the first transmission, it has got the value '0'. The bits 6 to 3 are always transmitted as '1'. The bits 2 to 0 contain a CMS status message which is permanently programmed on '111' with all modules. Possible replies therefore are: **$7F** and **$FF**.

4. The master can recognize from the reply that the module is still active. After a RESET that is generated by the watchdog the module will not answer to receiving RTR frames of the master (first the watchdog time and the life time factor has to be set).

The interchanged parameters of the sub command $04 and $05 have the following meaning:

WTxId ... In this word the Tx identifier is interchanged on which the master transmits the remote request and on which the module transmits the response.

WDtime... The watchdog time after that a local RESET is generated results from the time set in WDtime multiplied by the life time factor, that is set in WDLifeTimeFactor. **The product has to be greater than '0' to enable the watchdog!**

WDtime [HEX]	Watchdog time in [ms]
0000	Watchdog disable (default adjustment)
0001 0002 0003 .. FFFF	1 2 3 ... 65.535

Table 3.2.5: Allocation of the parameters to the watchdog time

WDLifeTime Factor... Multiplier for the watchdog time (function is described at WDtime).
value: $00...$FF

Requesting the actual parameters by the module (command $01):

Command... The command $01 leads to the reply of the actual parameters.

Sub command... The sub command determines the configuration bytes which should be returned:

Sub command	Reply of the parameter
$00	Saved module no.
$01	Active module no.
$02	CAN-status byte
$03	Saved bitrate
$04	Watchdog Tx identifier
$05	Watchdog time

Table 3.2.6: Definition of the reply by sub command

Parameter 1 and 2... With these parameters it is reported to the module onto which CAN Id it should transmit the requested reply.

Decisive for the selection of the requested message is the sub command value received by the module.

The following table shows the information which the module transmits onto the CAN if a request command has been received.

Sub command	Reply of the parameter	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	Saved mod. no.	$01	$00	saved mod no	-	-	-	-	-
$01	Active mod. no.	$01	$01	active mod no	-	-	-	-	-
$02	cstat and constat	$01	$02	cstat	constat	-	-	-	-
$03	Saved bitrate	$01	$03	bust0	bust1	-	-	-	-
$04	Watchdog TxId	$01	$04	WTxId		-	-	-	-
$05	Watchdog time	$01	$05	WDtime		WDLife TimeFactor	-	-	-

(-) Byte is not transmitted

Table 3.2.7: Transmitting the actual parameters module no. and bitrate

Explanation of the bytes transmitted by the module:

Sub command $00 --< stored module no.

Byte 1... The first byte returns the contents of the received command byte (here always $01).

Byte 2... The second byte returns the contents of the received sub command byte (here always $00).

Byte 3: saved mod no... In this cell the module no. is returned which is actually stored in the EEPROM. After a power-on RESET or a RESET command this module no. is the number with which the module is selected if no other module no. had been stored after a RESET.
If the module operates with the default parameters, then the value $00 is returned here always.

Sub command $01 --< actual module no.

Byte1,
Byte2... See sub command $00.

Byte 3:
active
mod no... Here the module no. is returned which is active at the moment. This number is identical with the number of this INIT Id entered into byte 4.

Sub command $02 --< CAN-status byte

Byte1,
Byte2... See sub command $00.

cstat... Byte 3 describes status information about the condition of the CAN components of the selected module (see the following table).

Bit	Designation
0	Power-down RESET
1	Suspend bit
2	Error on CAN
3	I²C error
4	EEPROM size
5	I²C busy
6	Default wake up
7	New on bus

Table 3.2.8: Bits of the parameter 'cstat'

Explanation of the bits of parameter 'cstat':

Power-down RESET (bit 0)
Bit 0 shows if the last RESET on the module had been triggered by a power-down RESET. If the bit has got the value '1', the last RESET had been triggered by removing the supply voltage. For all other RESET causes (RESET by supervisor command, RESET by EMERGENCY STOP) the bit is '0'.

Suspend bit (bit 1)
In bit 1 is described if the module is in condition 'suspended' or in active condition:

By the supervisor command 'suspend module' it is possible to put individual or all modules of the CAN into a delay condition. In this operating mode the actual condition of the outputs of the selected module remains unchanged (if available) and cannot be changed anymore until the module is enabled again. Parameters and commands are received and filed by the module but not evaluated: It is possible, e.g., to set raw data on the module without changing the normal conditions at once.

In condition 'suspended' the module does not transmit data onto the CAN. This is valid for each kind of Tx transfer with the exception of this configuration reply.
If the module is activated again by the command 'continue', possibly existing outputs are set at once corresponding to the last received data and the module operates with the last received parameters.

If bit 1 has got the value '1', the module is in condition 'suspended'. In normal operating mode (continue) bit 1 has got the value '0'.

Error on CAN (bit 2)
With this bit the module shows that it recognized a CAN error (bit = '1'). The bit serves the documentation of errors which do not lead to a 'standstill' of the complete CAN net, but only occur for a short time and then disappear again. By the command 'set CAN-status byte' (sub command $02) or a RESET it is possible to reset the bit.

I²C error (bit 3)
If the micro controller recognizes an error while reading or writing onto the I²C EEPROM (e.g. CRC error or write error), this bit is set to '1'.

EEPROM size (bit 4)
If bit 4 has got the value '1', the module has got an EEPROM whose memory capacity is bigger than 128 bytes. An EEPROM of this size is prerequisite for the allocation of pin names for each individual connection pin, because the names are filed in the EEPROM (see also chapter 'Allocation of Pin Names').

I²C busy (bit 5)
The bit 'I²C busy' signalizes with the value '1' that the local software accesses the I²C EEPROM. The operating speed of the local firmware reduces itself at frequent access onto the EEPROM. This can occur if many different pins are given pin names subsequently. The EEPROM access 'store parameter' or the reading of the EEPROM is processed so quickly that the user normally reads this bit always as '0' (store duration is approx. 50 ms).

Default wake up (bit 6)
If the bit 'default start' has the value '1', the module 'awoke' with the default parameters after the last RESET.

New on bus (bit 7)
The bit 'new on bus' can be evaluated by the CAN master to recognize if it already found this module after the last RESET or if the module is new on the bus. The bit is set to the value '1' after each RESET which corresponds to condition 'new on bus'. The master can reset the bit to show that it found the module. Apart from 'error on CAN' it is the only bit of this byte which can be reset.

constat... In the fourth byte the status register of the CAN controller is returned. The bits correspond exactly to the status bits described in the controller manual. The following table shows a short overview of the status bits. Further information can be taken from the controller manual.

Bit (assembler)	Function	Value	Status	'Standard'-value
0	Receive Buffer Status	1	full	
		0	empty	0
1	Data Overrun	1	overrun	
		0	absent	0
2	Transmit Buffer Access	1	released	1
		0	locked	
3	Transmission Complete Status	1	complete	1
		0	incomplete	
4	Receive Status	1	receive	
		0	idle	0
5	Transmit Status	1	transmit	
		0	idle	0
6	Error Status	1	error	
		0	ok	0
7	Bus Status	1	Bus-Off	
		0	Bus-On	0
				= $0C (higher language counting)

Table 3.2.9: Bits of the controller status

At some of the status bits level changes are hardly perceptible, because the changes are only for a short period.

Sub command $03 --< stored bitrate

Byte1,
Byte2... See sub command $00.

Byte 3, 4:
bust 0,
bust1 ... These two bytes describe the contents of the registers BTR0 and BTR1 of the CAN controller 8xC592/82C200 which determine the bitrate of the CAN interface. The allocation of the register contents to the bit rates has already been explained in the description of setting these registers.

Sub command $04 --< watchdog Tx identifier

Byte1,
Byte2... See sub command $00.

Byte 3, 4:
WTxId-H,
WTxId-L ... These two bytes return Tx identifiers on which the module transmits the watchdog reply.

Sub command $05 --< watchdog time

Byte1,
Byte2... See sub command $00.

Byte 3, 4:
WDtime... Here the watchdog time is returned (value range see 'Setting the watchdog time').

Byte 5:
WDLifeTime
Factor... Return of the Life Time Factor ($00...$FF).

3.3 Process TxIds

By this command one or more Tx identifiers are allocated to the module, depending on the module type, by which it is able to transmit the data onto the CAN (set TxIds).

The new Tx identifier replaces immediately after he had been received by the module the default identifier adjusted by the coding switches. If the new Tx identifier should remain after a RESET or a power-down, it has to be filed into the local EEPROM by command 'store parameter'.

Apart from that the module can be forced to transmit a reply about the Tx identifiers actually used by it onto the CAN by the Tx identifier CTxId (request TxIds).

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command	Not used	Module no.	Parameter 1	Parameter 2
Value	Request: $02	$00...n	Always allocate with $00	Selected module no.	CTxId $0000...$07FF	
	Set: $82			$01...$FF	TxId $0000...$07FF	

Table 3.3.1: Bytes of the command set/request TxIds

Command... By the command $02 the actual Tx identifiers are requested by the module. After this request the module transmits the information on the identifier 'CTxId', entered into byte 5 and 6.
By the command $82 new Tx identifiers (TxId) to transmit I/O data are allocated to the module corresponding to the sub command. The new Tx identifiers are interchanged by byte 5 and 6.

Sub command... By the sub command it is selected which Tx identifier should be interchanged. Depending on the module type a different number of Tx identifiers can be set.

Parameter 1 and 2... With these parameters it is reported to the module at a request command onto which CAN Id (CTxId) it should transmit the requested reply.
The module only transmits once on this identifier. The identifier is not stored on the module. If another transmission is wanted, another INIT Id with the corresponding parameters has to be transmitted to the module again.

At a set command the 11 bit wide Tx identifier on which it should transmit the data is interchanged to the module by the parameters.

By the sub command it is selected which one of the possible Tx identifiers should be set or reset:

Sub command	Tx identifiers on parameters 1 and 2
$00	TxId1
$01	TxId2
$02	TxId3
:	:
n	TxId(n+1)

Table 3.3.2: Selection of the identifiers by the sub command

The following table shows how the bits of Tx identifiers have to be allocated to the bytes 5 and 6:

	Byte 5								Byte 6							
	Parameter 1								Parameter 2							
Bits in byte 5 and 6	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	TxId-H								TxId-L							
Bits of the TxId	-	-	-	-	-	id11	id10	id9	id8	id7	id6	id5	id4	id3	id2	id1

(-) These bits are not evaluated.

Table 3.3.3: Bits of the Tx identifiers in byte 5 and byte 6

Reply of the modules to the command 'request TxIds':

The reply of a Tx identifier depends on the value of the received sub command.

The following table shows the information which the module transmits onto the CAN.

Sub command	Reply of the parameter	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	TxId 1	$02	$00	TxId1		-	-	-	-
$01	TxId 2	$02	$01	TxId2		-	-	-	-
$02	TxId 3	$02	$02	TxId3		-	-	-	-
:	:	$02	:	:		-	-	-	-
n	TxId (n+1)	$02	n	TxId(n+1)		-	-	-	-

(-) Byte is not transmitted

Table 3.3.4: Transmitting the actual Tx identifiers

Explanation of the bytes transmitted by the module:

Byte 1... The first byte returns the contents of the received command byte (here always $02).

Byte 2... The second byte returns the contents of the received sub command byte. The sub command designates the selected identifier.

Byte 3,
Byte 4... In these two cells the actual Tx identifier is returned. The bits of the identifier are described in byte 3 and 4 and returned in that form as they have to be entered at setting in byte 5 and 6. (See also table 'Bits of the Tx identifier in byte 5 and 6'.)

3.4 Process RxIds

Depending on the module type one or more Rx identifiers are allocated to the module on which it is able to receive data to the CAN (set RxIds).

The new Rx identifier replaces the default identifier adjusted by the coding switches immediately after it had been received by the module. If the new Rx identifier should remain after a RESET or a power-down, it has to be filed into the local EEPROM by the command 'store parameter'.

Apart from this it is possible to make the module transmit a reply onto the CAN by the Tx identifier CTxId (request RxIds) about the Rx identifiers actually used by the module.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command	Not used	Module no.	Parameter 1	Parameter 2
Value	Request: $03	$00...n	Always allocate with $00	Selected module no. $01...$FF	CTxId $0000...$07FF	
	Set: $83				RxId $0000...$07FF	

Table 3.4.1: Bytes of the command set/request RxIds

Command... By the command $03 the actual Rx identifiers are requested by the module. The module transmits the information on the identifier 'CTxId' entered in byte 5 and byte 6 after this request.

By the command $83 new Rx identifiers for the transmission of I/O data are allocated to the module. The new Rx identifier are interchanged by byte 5 and byte 6.

Sub command... By the sub command it is selected which Rx identifier should be interchanged. Depending on the module type a different number of Rx identifiers can be set.

Parameter 1 and 2... With these parameters it is reported to the module at a request command onto which CAN Id (CTxId) it should transmit the requested reply.
The module only transmits once on this identifier. The identifier is not stored on the module. If another transmission is wanted, another INIT Id with the corresponding parameters has to be transmitted to the module again.

At a set command the Rx identifier is interchanged to the module by these parameters on which it should transmit the data.

By the sub command it is selected which one of the possible Rx identifiers should be set or reset:

Sub command	Rx identifiers on parameter 1 and 2
$00 $01 : n	RxId1 RxId2 : RxId(n+1)

Table 3.4.2: Selection of the Rx identifiers by the sub command

The following table shows how the bits of Rx identifiers have to be allocated to the bytes 5 and 6:

	Byte 5								Byte 6							
	Parameter 1								Parameter 2							
Bits in byte 5 and 6	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	RxId-H								RxId-L							
Bits of the RxId	-	-	-	-	-	id11	id10	id9	id8	id7	id6	id5	id4	id3	id2	id1

(-) These bits are not evaluated.

Table 3.4.3: Bits of the Rx identifier in byte 5 and byte 6

Reply of the modules to the command 'request RxIds':

The reply of the Rx identifiers depends on the value of the received sub command.

The following table shows the information which the module transmits to the CAN.

Sub command	Reply of the parameter	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	RxId 1	$03	$00	Rx1S		Rx1E		-	-
$01	RxId 2	$03	$01	Rx2S		Rx2E		-	-
$02	RxId 3	$03	$02	Rx3S		Rx3E		-	-
:	:	$03	:	:		:		-	-
n	RxId (n+1)	$03	n	Rx(n+1)S		Rx(n+1)E		-	-

(-) Byte is not transmitted

Table 3.4.4: Transmitting the actual Rx identifiers

Explanation of the bytes transmitted by the module:

Byte 1... The first byte returns the contents of the received command byte (here always $03).

Byte 2... The second byte returns the contents of the received sub command byte. The sub command designates the selected identifier.

Byte 3-
Byte 6... In these cells the actual Rx identifier is returned. The bits of the identifier are described in byte 3 and 4 (or byte 5 and 6) and returned in that form as they have to be entered at setting in byte 5 and 6. (See also table 'Bits of the Rx identifier in byte 5 and 6'.)

Apart from the allocation of Rx identifiers described above there is the possibility to allocate, depending on the module type, an own identifier to each output bit, byte or word (see chapter 'Rx Block Mode'). If this block mode is activated, the first (Rxm_S) and the last (Rxm_E) identifier of the block are returned at an RxId request command (m=1,2,3,4...).

If the module is not in Rx block mode, the returned identifier in byte 3 and byte 4 is identical with the one in byte 5 and byte 6.

3.5 Cyclic Tx Transfers (Tx Activate Time)

The interchange of the parameter 'Tx activate time' makes the module transmit I/O data onto the CAN in regular periods of time.
The data are transmitted on the actual Tx identifier (see also chapter 'Setting/Reading TxIds', and 'Parameters after RESET').

Apart from that the module can be forced to transmit a reply by the Tx identifier CTxId onto the CAN about the 'activate times' it uses at the moment.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command	Not used	Module no.	Parameter 1	Parameter 2
Value	Request: $04	$00...n	Always allocate with $00	Selected module no.	CTxId $0000...$07FF	
	Set: $84			$01...$FF	tx_act $0000...$FFFF	

Table 3.5.1: Bytes of the command set/request TxIds

Command... By the command $04 the actual Tx activate times are requested by the module. After this request the module transmits the information on the identifier 'CTxId' of byte 5 and 6.
By the command $84 new Tx activate times to transmit I/O data are allocated to the module. The new period time is interchanged by byte 5 and byte 6.

Sub command... By the parameter sub command it is selected for which Tx identifier the new Tx activate time should be interchanged. Depending on the module type it is possible to allocate an activate time for a different number of Tx identifiers.

Parameter 1 and 2... By these parameters it is reported to the module at a request command onto which CAN Id (CTxId) it should transmit the requested reply.
The module transmits only once on this identifier. The identifier is not stored on the module. If another transmission is wanted, another INIT Id with the corresponding parameters has to be transmitted to the module again.

At a set command the activate time is interchanged to the module by these parameters.

By the sub command it is selected to which one of the four possible Tx identifiers the transmitted activate time should be allocated.

Sub command	Tx activate time (parameters 1 and 2)
$00	tx_act 1
$01	tx_act 2
$02	tx_act 3
:	:
n	tx_act (n+1)

Table 3.5.2: Selection of the Tx activate time by the sub command

The parameters of the activate time show the period of time from the last data transmission, after which the module automatically starts a new transmission. The last data transmission could have been the previous Tx transfer of this cycle, but also every other Tx transfer transmitted by the module (e.g. a transmission initiated by a 'remote request').

tx_act [HEX]	Activate time in [ms]
0000	Function switched off
0001	1
0002	2
0003	3
..	...
FFFF	65.535

Table 3.5.3: Allocation of the parameters to the Tx activate time

Reply of the modules to the command 'request Tx activate time':

The reply of the activate time depends on the value of the received sub command.

The following table shows the information which the module transmits onto the CAN.

Sub command	Activate time for TxId	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	TxId 1	$04	$00	tx_act1		-	-	-	-
$01	TxId 2	$04	$01	tx_act2		-	-	-	-
$02	TxId 3	$04	$02	tx_act3		-	-	-	-
:	:	$04	:	:		-	-	-	-
n	TxId (n+1)	$04	n	tx_act(n+1)		-	-	-	-

(-) Byte is not transmitted

Table 3.5.4: Transmitting the actual Tx activate times

Explanation of the bytes transmitted by the module:

Byte 1... The first byte always returns the contents of the received command byte (here always $04).

Byte 2... The second byte returns the contents of the received sub command. The sub command designates the selected identifier.

Byte 3,
Byte 4... In these two cells the actual Tx activate time is returned (see also 'parameter 1 and 2').

3.6 Process Module Memory

3.6.1 Internal RAM and XRAM, EEPROM

By this command it is possible to display or change the contents of the local memories and to set or read the microcontroller's ports. The memories contain the parameters which have already been described and are still to come. The contents of the memory should only be changed by the described parameter set commands and not by the command 'process module memory'.

If the command 'store parameter' is called after the modification of a memory cell of the internal RAM or XRAM of the CAN controller, the new data are filed in the local EEPROM. At direct accesses onto the EEPROM the transferred data are filed in the EEPROM at once.

The user should not change the cells of the local memories by this command, because the functioning of the modules cannot be guaranteed at improper programming of the memories!

At write accesses onto the memory the address is interchanged by the sub command 1, the desired memory components by sub command 2 and the data by parameter 1.

The user should only read the controller ports, because most of the ports are used for controlling the local circuits and are set by the firmware!

The request of the port status is permitted. The assignment of the ports depends of the module type. The assignament of the ports is shown in the circuit diagrams.

The request of data from the memory occurs like the setting of the data with the difference that in the parameters 1 and 2 the Tx identifier is interchanged on which the module should transmit the data.

<table>
<tr><th></th><th>Byte 1</th><th>Byte 2</th><th>Byte 3</th><th>Byte 4</th><th>Byte 5</th><th>Byte 6</th></tr>
<tr><td>Function</td><td>Command</td><td>Sub command 1</td><td>Sub command 2</td><td>Module no.</td><td>Parameter 1</td><td>Parameter 2</td></tr>
<tr><td rowspan="2">Value</td><td>Request: $05</td><td rowspan="2">$00...$FF

Memory address or port select.</td><td rowspan="2">$00 - int. RAM
$01 - int.XRAM
$02...$09 - I²C EEPROM
$7F - µC ports</td><td rowspan="2">Selected module no.

$01...$FF</td><td colspan="2">CTxId
$0000...$07FF</td></tr>
<tr><td>Set: $85
do not use</td><td>data
$00...$FF</td><td>Not used.</td></tr>
</table>

Table 3.6.1: Bytes of the command set/request memory data

Command... By the command $05 the memory data are requested by the module. After this request the module transmits the information on the identifier 'CTxId' of byte 5 and 6.
By the command $85 the available data of the memory cell selected by the sub commands is overwritten or the controller ports are set.

Sub command 1 By the parameter sub command 1 the port group is selected.

Byte 2	Port group
$00	P0.0 ... P0.7
$01	P1.0 ... P1.7
$02	P2.0 ... P2.7
$03	P3.0 ... P3.7
$04	P4.0 ... P4.7
$05	P5.0 ... P5.7
$06...$FF	Reserved

Table 3.6.2: Selection of the port group by sub command 1 (byte 2)

Sub command 2 By byte 3 the desired memory type which should be accessed or the port group is selected:

Byte 3	Memory type
$00	Internal RAM of the 8xC592
$01	Internal XRAM of the 8xC592
$02...$09	I²C EEPROM
$0A...$6F	Reserved
$7E	Internal I/O register $80...$FF (refer tocontroller data sheet)
$7F	Access to CAN controller ports
$80...$FF	Reserved

Table 3.6.3: Selection of the memory type by sub command 2 (byte 3)

Parameter 1 and 2... By these parameters it is reported to the module at a request command on which CAN Id (CTxId) it should transmit the requested reply.
The module transmits only once on this identifier. The identifier is not stored on the module. If another transmission is wanted, another INIT Id with the corresponding parameters has to be transmitted to the module.

At a set command the date is interchanged to the module by parameter 1 with which the corresponding memory cell should be overwritten.

If ports shall be set or read, the level of the ports has to be transferred in parameter 1 as follows:

Bits of parameter 1->	D7	D6	D5	D4	D3	D2	D1	D0
Port bits	Px.7	Px.6	Px.5	Px.4	Px.3	Px.2	Px.1	Px.0

(x = 0, 1, 2, ... ,5)

Table 3.6.4: Assignment of the parameter bits to the controller ports

Reply of the modules to the command 'request memory data':

The return of the memory data depends on the value of the received sub commands which contain information about the memory type and the address of the desired memory cell or the port group.

The following table shows the information which the module transmits onto the CAN.

The reply does not contain information about the selected memory type.

Sub command 1	Memory address	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	$00	$05	$00	Mem data 00	-	-	-	-	-
$01	$01	$05	$01	Mem data 01	-	-	-	-	-
...	...	...	...	...	-	-	-	-	-
$FF	$FF	$05	$FF	Mem data 255	-	-	-	-	-

(-) Byte is not transmitted

Table 3.6.5: Module transmits memory data

Sub command 1	Port group	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	P0.x	$05	$00	Ports P0.0 ... P0.7	-	-	-	-	-
$01	P1.x	$05	$01	Ports P1.0 ... P1.7	-	-	-	-	-
...	...	...	...	...	-	-	-	-	-
$FF	P5.x	$05	$FF	Ports P5.0 ... P1.7	-	-	-	-	-

(-) Byte is not transmitted
x = 0, 1, 2, ... ,5

Table 3.6.6: Module transmits controller ports status

Explanation of the bytes transmitted by the module:

Byte 1... The first byte returns the contents of the received command byte (here always $05).

Byte 2... The second byte returns the contents of the received sub command byte (sub command 1). The sub command designates the memory address.

Byte 3:
Mem data... In case of memory cell request this cell contains the actual date of the selected memory.

Byte 3:
Ports... In case of controller port request this cell contains the actual state of the port bits. The assignment of the ports to the parameter bits is shown at the previous page.

3.6.2 External Memory

By this command it is possible to access possibly available memory components of the module. The command is designed for programmers.

The user should therefore only access these memory cells reading!

At writing accesses to the memory the lower address bits are interchanged by the sub command 1, the upper address bits by sub command 2 and the data by parameter 1.
The request of data from the memory occurs like the setting of the data with the difference that the Tx identifier on which the module should transmit is interchanged in the parameters 1 and 2.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command 1	Sub command 2	Module no.	Parameter 1	Parameter 2
Value	Request: $09	$00...$FF memory address 'LOW'	$00...$FF memory address 'HIGH'	Selected module no. $01...$FF	CTxId $0000...$07FF	
	Set: $89 **do not use**				data $00...$FF	Not used

Table 3.6.7: Bytes of the command set/request external memory

Command... By the command $09 the memory data are requested by the module. After this request the module transmits the information on the identifier 'CTxId' of byte 5 and 6.
By the command $89 the available data of the memory cell selected by the sub commands are overwritten.

Sub command 1 By the parameter sub command 1 the lower address bits of the desired memory cell are selected. (A0...A7)

Sub command 2 By the parameter sub command 2 the upper address bits of the desired memory cell are selected. (A8...A15)

Parameter 1 and 2... By these parameters it is reported to the module at a request command on which CAN Id (CTxId) it should transmit the requested reply.
The module transmits only once on this identifier. The identifier is not stored on the module. If another transmission is desired, another INIT Id with the corresponding parameters has to be transmitted to the module again.

At a set command the date is interchanged to the module by parameter 1 with which the corresponding memory cell should be overwritten.

Reply of the modules to the command 'request external memory':

The return of the memory data depends on the value of the received sub commands which contain information about the address of the desired memory cell. The following table shows the information which is transmitted to the CAN by the module.

Sub command 1	Sub command 2	Memory address	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	$00	$0000	$09	$00	Mem data 00	-	-	-	-	-
$01	$00	$0001	$09	$01	Mem data 01	-	-	-	-	-
...	...	...	...	...	...	-	-	-	-	-
$FF	$FF	$FFFF	$09	$FF	Mem data 65535	-	-	-	-	-

(-) Byte is not transmitted

Table 3.6.8: Module transmits memory data of the 'external memory'

Explanation of the bytes transmitted by the module:

Byte 1... The first byte returns the contents of the received command byte (here always $09).

Byte 2... The second byte returns the contents of the received sub command byte (sub command 1). The sub command designates the lower bits of the memory address.

Byte 3:
Mem data... In this cell the actual date of the memory is returned.

3.6.3 Extended Memory

By this command it is possible to access further memory circuits (if available) at the module. Compared to command $89 this command will transmit up to four data bytes in one frame. The command is designed for programmers only.

The user shall only *read* from these memory cells, to avoid malfunction of the module!

If write accesses shall be executed to the memory, the lower address bits are set by sub command 1, the upper address bits are set by sub command 2 and the data bytes are set by parameter 1 ...4 (bytes 5...8).
The request of data from the memory is done like writing data with the difference, that in parameter 1 and 2 the returning Tx identifier is set.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 5	Byte 6
Function	Command	Sub Command 1	Sub Command 2	Module no.	Parameter 1	Parameter 2	Parameter 3	Parameter 4
Value	request: $0A	$00...$FF memory address 'LOW'	$00...$FF memory address 'HIGH'	Selected module no. $01...$FF	CTxId $0000...$07FF		not used	
	set: $8A **do not use !**				data (addr) $00...$FF	data (addr+1) $00...$FF	data (addr+2) $00...$FF	data (addr+3) $00...$FF

Table 3.6.9: Byte of the command set/request extended memory

Command... By the command $0A the memory data are requested by the module. Always 4 data bytes will be returned. The module transmits the data on the identifier 'CTxId' of byte 5 and 6.
By the command $8A the available data of the memory cells selected by the sub commands are overwritten.

Sub command 1... By the parameter sub command 1 the lower address bits of the desired memory cells are selected. (A0...A7)

Sub command 2... By the parameter sub command 2 the upper address bits of the desired memory cell are selected. (A8...A15)

Parameter 1..2... By these parameters it is reported to the module at a request command on which CAN Id (CTxId) it should transmit the requested reply.
The module transmits only once on this identifier. The identifier is not stored on the module. If another transmission is desired, another INIT Id with the corresponding parameters has to be transmitted to the module again.

At a set command the date is interchanged to the module by parameter 1 to 4 with which the corresponding memory cell should be overwritten.

The number of data bytes that shall be transmitted is coded by the length of the telegram.

Length of telegram	the following bytes will be send:
5	parameter 1
6	parameter 1, parameter 2
7	parameter 1, parameter 2, parameter 3
8	parameter 1, parameter 2, parameter 3, parameter 4

Table 3.6.10: Definition of the number of transmitted data bytes

The data will be stored in the memory as follows:

Address (Sub command 1 and 2)	Data bytes of
memory address +0	parameter 1
memory address +1	parameter 2
memory address +2	parameter 3
memory address +3	parameter 4

Table 3.6.11: Storing the data bytes in the memory

Reply of the modules to the command 'request external memory':

The return of the memory data depends on the value of the received sub commands which contain information about the address of the desired memory cell. The module returns always 4 data bytes. The following table shows the information which is transmitted to the CAN by the module.

Sub command 1	Sub command 2	Memory address	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	$00	$0000	$0A	$00	data 00	data 01	data 02	data 03	-	-
$04	$00	$0004	$0A	$01	data 04	data 05	data 06	data 07	-	-
...	...	...	...	...	...	...	...	...	-	-
$FC	$FF	$FFFC	$0A	$FC	data 65532	data 65533	data 65534	data 65535	-	-

(-) Byte is not transmitted.

Table 3.6.12: Module sends memory data of extended memory (Example: Addresses incremented by '4'.)

Explanation of the bytes transmitted by the module:

Byte 1... The first byte returns the contents of the received command byte (here always $0A).

Byte 2... The second byte returns the contents of the received sub command byte (sub command 1). The sub command designates the lower bits of the memory address.

Byte 3:
data n... In this cell the actual date of the memory is returned.

3.6.4 Program Code

By this command program code can be requested from the module.

When requesting data from the memory, the lower address bits has to be set by sub command 1 and the upper address bits has to be set by sub command 2. In parameter 1 and 2 the returning Tx identifier has to be set.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 5	Byte 6
Function	Command	Sub command 1	Sub command 2	Module no.	Parameter 1	Parameter 2	Parameter 3	Parameter 4
Value	request: $0B	$00...$FF memory address 'LOW'	$00...$FF memory address 'HIGH'	Selected module no. $01...$FF	CTxId $0000...$07FF		not used	

Table 3.6.13: Bytes of the command set/request program code

Command... By the command $0B the program code is requested from the module. Always 4 code bytes will be returned. The module transmits the data on the identifier 'CTxId' of byte 5 and 6.

Sub command 1... By the parameter sub command 1 the lower address bits of the desired memory cells of the program code are selected. (A0...A7)

Sub command 2... By the parameter sub command 2 the upper address bits of the desired memory cells of the program code are selected. (A8...A15)

Parameter 1 and 2... By these parameters it is reported to the module at a request command on which CAN Id (CTxId) it should transmit the requested reply.
The module transmits only once on this identifier. The identifier is not stored on the module. If another transmission is desired, another INIT Id with the corresponding parameters has to be transmitted to the module again.

Reply of the modules to the command 'request external memory':

The return of the memory data depends on the value of the received sub commands which contain information about the address of the desired memory cell. The module returns always 4 code bytes. The following table shows the information which is transmitted to the CAN by the module.

Sub command 1	Sub command 2	Memory address	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	$00	$0000	$0B	$00	code 00	code 01	code 02	code 03	-	-
$04	$00	$0004	$0B	$04	code 04	code 05	code 06	code 07	-	-
...	...	...	...	...	...	...	...	...	-	-
$FC	$FF	$FFFC	$0B	$FC	code 65532	code 65533	code 65534	code 65535	-	-

(-) Byte is not transmitted.

Table 3.6.14: Module returns program code
(Example: Addresses incremented by '4'.)

Explanation of the bytes transmitted by the module:

Byte 1... The first byte retunes the contents of the received command byte (here always $0B).

Byte 2... The second byte returns the contents of the received sub command byte (sub command 1). The sub command designates the lower bits of the memory address.

Byte 3:
code n... In this cell the actual program code of the module is returned.

3.7 Process User Parameters

The user parameters are designed for module-specific applications. By this sub command it is possible to process up to 127 parameters with 16 bit width.

The assignment of the user parameters can be taken from the module-specific software.

By the command 'set user parameters' the parameters on the module are set. The command 'request user parameters' makes the module return the parameter contents on the Tx identifier CTxId which had been interchanged in the request.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command	Not used	Module no.	Parameter 1	Parameter 2
Value	Request: $06	$00...$7F	Always allocate with $00	Selected module no. $01...$FF	CTxId $0000...$07FF	
	Set: $86				Para $0000...$FFFF	

Table 3.7.1: Bytes of the command set/request user parameters

Command... By the command $06 the parameter data are requested by the module. After this request the module transmits the information on the identifier 'CTxId' of byte 5 and 6.
By the command $86 the parameters are set.

Sub command... By the sub command the desired parameter is selected.

Parameter 1 and 2... By these parameters it is reported to the module at a request command onto which CAN Id (CTxId) it should transmit the requested reply.
The module transmits only once on this identifier. The identifier is not stored on the module. If another transmission is desired, another INIT Id with the corresponding parameters has to be transmitted to the module again.

At a set command these two bytes contain the 16 bits of the parameter which should be interchanged. The possible parameters have got numbers which correspond to the value of the corresponding sub command. A maximum of 127 ($7F) parameters is possible.

Reply of the modules to the command 'request user parameters':

The parameter returned by the module is selected by the corresponding sub command.

The following table shows the information which is transmitted to the CAN by the module.

Sub command	Parameter	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	1	$06	$00	Para0		-	-	-	-
$01	2	$06	$01	Para1		-	-	-	-
...	...	...	...	...	-	-	-	-	-
$7F	127	$06	$7F	Para7F		-	-	-	-

(-) Byte is not transmitted

Table 3.7.2: Module transmits parameter contents

Explanation of the bytes transmitted by the module:

Byte 1... The first byte returns the contents of the received command byte (here always $06).

Byte 2... The second byte returns the contents of the received sub command byte.

Byte 3,4:
Para... In these cells the actual parameter contents are returned:

Output	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Bits of the parameter	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Allocation of the parameter to the bytes 5 and 6	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Byte 5								Byte 6							

Table 3.7.3: Allocation of the parameter bits to the outputs

3.8 Process Rx Mode

By the command 'Rx block mode' an own Rx identifier is allocated to each output bit, byte or word of the selected module (depending on the module type).

If an output should be set in 'normal' Rx mode, because only successive complete bytes can be transmitted, the bytes (or bits) which should keep their value have always to be set again, too.

If, e.g., only the level of a bit should be changed, the other seven bits have to be overwritten with their previous value. This requires the knowledge of the condition of all bits at the time of transmission.
In a multi tasking or a multi master system this might lead to problems, because a second program or a second master could have changed the output bits independently and unrecognized by the first.

To prevent that wrong values can be allocated to the output bits in this way, it is possible to set individual bits in a frame specifically by the Rx block mode.

By the command 'set Rx block mode' the blocks are defined by successive Rx identifiers on which the module is able to receive data.

The command 'request Rx block mode' makes the module return a message on the Tx identifier (CTxId), interchanged in the request, in which it says if the Rx mode has been activated or not.

<table>
<tr><td></td><td>Byte 1</td><td>Byte 2</td><td>Byte 3</td><td>Byte 4</td><td>Byte 5</td><td>Byte 6</td></tr>
<tr><td>Function</td><td>Command</td><td>Sub command</td><td>Not used</td><td>Module no.</td><td>Parameter 1</td><td>Parameter 2</td></tr>
<tr><td rowspan="2">Value</td><td>Request: $07</td><td rowspan="2">$00...$03</td><td rowspan="2">Always allocate with $00</td><td rowspan="2">Selected module no.
$01...$FF</td><td colspan="2">CTxId
$0000...$07FF</td></tr>
<tr><td>Set: $87</td><td>rxmode
$00...$01</td><td>Not used</td></tr>
</table>

Table 3.8.1: Bytes of the command set/request Rx block mode

Command... By the command $07 it is requested if the module is in block mode. After this request the module transmits the information on the identifier 'CTxId' of byte 5 and 6.
By the command $86 the Rx block mode is activated for the Rx identifier selected by the sub command.

Sub command... By the sub command the Rx identifier is selected for which an Rx block should be created.

If a module has got various identifiers those Rx identifiers to which Rx blocks should be allocated have to be selected with a sufficient offset to each other and to other identifiers (also to TxIds!), so that the developing identifier areas do not intersect each other!

This is especially important if the module is still operated by the default parameters, because here the identifiers normally succeed very close. The reprogramming of identifiers is often unavoidable here!

A maximum of so many blocks is possible as Rx identifiers are available for setting the outputs of the selected module (in 'normal' Rx mode). The length of the blocks depends on the module type. A module can contain blocks with different lengths.

The Rx identifiers of the blocks are created in ascending series by the local software. The first identifier of an Rx block does not have to be identical with the actual Rx identifier for which the Rx block should be used, because depending on the block length (which depends again on the module type), the lower bits of the first Rx block identifier are set to '0'.

Block length (= number of Rx identifiers)	Number of low value bits set to '0'
2	1
4	2
8	3
16	4
32	5

Table 3.8.2: Number of identifier bits set to '0' i the Rx block mode

Example: Two blocks with each 8 Rx identifiers can be allocated to a module. The two 'standard' identifiers RxId1 and RxId2 are adjusted to $403 and $419.
At the setting of the block mode the identifiers of the two blocks are determined by the local software as follows:

Block 1: RxId-B11 = $400
RxId-B12 = $401
....
RxId-B18 = $407

Block 2: RxId-B21 = $418
RxId-B22 = $419
....
RxId-B28 = $41F

If the block mode has been selected, after an RxId request command the first Rx identifier and the last Rx identifier of the block are returned.

After resetting the Rx block mode the Rx identifier originally entered, for which this block stood, is taken over again. Related to the example above these would be the Ids $403 or $419.

Parameter 1 and 2... By these two parameters it is reported to the module at a request command to which CAN Id (CTxId) it should transmit the requested reply.
The module transmits only once on this identifier. The identifier is not stored on the module. If another transmission is desired, another INIT Id with the corresponding parameters has to be transmitted to the module again.

By a set command the Rx block mode is activated or deactivated by parameter 1 (rxmode).

Parameter (rxmode)	Function
$00	Normal Rx mode
$01	Rx block mode activated
$02 ... $FF	No function

Table 3.8.3: Setting the block mode by parameter 1

Reply of the modules to the command 'request Rx block mode':

The parameter returned by the module is selected by the corresponding sub command.

The following table shows the information which the module transmits to the CAN.

Sub command	Rx block for RxId	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	RxId 1	$07	$00	rxmode1	-	-	-	-	-
$01	RxId 2	$07	$01	rxmode2	-	-	-	-	-
$02	RxId 3	$07	$02	rxmode3	-	-	-	-	-
$03	RxId 4	$07	$03	rxmode4	-	-	-	-	-

(-) Byte is not transmitted

Table 3.8.4: Module transmits Rx block mode status

Explanation of the bytes transmitted by the module:

Byte 1... The first byte returns the contents of the received command byte (here always $07).

Byte 2... The second byte returns the contents of the received sub command.

Byte 3:
rxmode... In these cells the module returns if the block mode has been selected for the corresponding Rx identifier and which length the block has got. The parameter can take over following values:

rxmode (Byte 3)	Block length
$00	Block mode switched off
$02	Block length = 2 RxIds
$04	" = 4 RxIds
$08	" = 8 RxIds
$0F	" = 16 RxIds
$20	" = 32 RxIds

Table 3.8.5: Block length in parameter 'rxmode'

3.9 Allocation of Pin Names

The allocation of names to the individual I/O pins or channels has been developed as a user specific function which should give the CAN master another opportunity to identify the modules. The reading of the pin names of a module and their check by the previously entered 'set names' should secure that the module is addressed correctly.

This function is only implemented if the module has got an EEPROM which has got a memory capacity of more than 128 bytes, because the pin names have been filed in the EEPROM.

The user can find out if the function is implemented by inquiring the fourth bit ('EEPROM size') of the CAN-status byte 'cstat'. The description of the inquiry can be found in the previous chapter 'system parameters'.

The CAN master can allocate a name in ASCII code of up to 24 bytes long to each I/O pin of a module. The pins and the bytes of the pin names are selected by the sub commands.

The return of the Pin names also occurs byte by byte.

<table>
<tr><th></th><th>Byte 1</th><th>Byte 2</th><th>Byte 3</th><th>Byte 4</th><th>Byte 5</th><th>Byte 6</th></tr>
<tr><td>Function</td><td>Command</td><td>Sub command 1</td><td>Sub command 2</td><td>Module no.</td><td>Parameter 1</td><td>Parameter 2</td></tr>
<tr><td rowspan="2">Value</td><td>Request: $08</td><td rowspan="2">Pin number

$00...$FF (module dependent)</td><td rowspan="2">Number of the interchanged byte
$00...$17</td><td rowspan="2">Selected module no.

$01...$FF</td><td colspan="2">CTxId
$0000...$07FF</td></tr>
<tr><td>Set: $88</td><td>Byte name
$00...$FF
(ASCII)</td><td>Not used</td></tr>
</table>

Table 3.9.1: Bytes of the command set/request pin name

Command... By the command $88 the individual bytes of the pin names are requested. The module transmits the information of this inquiry on the identifier 'CTxId' of byte 5 and 6.
By the command $89 the pin names are set.

Sub command 1 By the sub command the pin is selected whose name should be processed. The number of pins depends on the module type (e.g.: CDO16 - 16 pins).
The new pin name is only saved in the EEPROM by the firmware if the 24th byte (byte no. 23) of the name had been processed! Therefore it is only possible to process the bytes of one pin until the last byte (no.23) is processed!

Sub command 2

In byte 3 of the INIT Id the number of the byte is entered which should be changed in the pin name. A pin name is 24 bytes long (byte 0..byte 23).

The transmitted bytes of a pin name are only filed in the EEPROM, if the byte no. 23 of a pin name had been transmitted.

The bytes are not filed like other parameters by the command 'save parameters' in the EEPROM, but only by setting the byte no. 23!

Parameter 1 and 2...

By these parameters it is reported to the module at a request command to which CAN Id (CTxId) it should transmit the requested reply.
The module transmits only once on this identifier. The identifier is not stored by the module. If another transmission is desired, another INIT Id with the corresponding parameters has to be transmitted to the module.

At a set command parameter 1 contains the 8 bits of the byte of a pin name which should be interchanged.

Reply of the modules to the command 'request pin name':

The parameter returned by the module is selected by the corresponding sub commands.

The following table shows the information which is transmitted to the CAN by the module. The reply does not contain information about the requested byte number (sub command 2).

Sub command 1	Pin/Channel	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
$00	Pin 1	$08	$00	byte name	-	-	-	-	-
$01	Pin 2	$08	$01	byte name	-	-	-	-	-
...	...	$08	...	...	-	-	-	-	-
$FF	Pin 256	$08	$FF	byte name	-	-	-	-	-

(-) Byte is not transmitted

Table 3.9.2: Module transmits Rx block mode status

Explanation of the bytes transmitted by the module:

Byte 1... The first byte returns the contents of the received command byte (here always $08).

Byte 2... The second byte returns the contents of the received sub command byte (sub command 1 =< pin number).

Byte 3... In byte 3 the contents of the byte which has been selected in the request is returned.

3.10 Service Request

By this command it is possible to inquire the error condition of the *esd*-CAN modules. It is possible to make various or individual modules return a transmission if they show the error status 'error on CAN' or the status bit 'new on bus' is active.
The message consists of a Tx frame which has got no data.

The parameters of the modules remain unchanged when this command is requested.

The command can be used to find out which modules operate faultless on the bus and which modules have got transmission problems.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command 1	Sub command 2	Not used	Parameter 1	Parameter 2
Value	$7F	Module no_LOW $00...$FF	Module no_HIGH $00...$FF	Always allocate with $00	CTxId $0000...$07FF	

Table 3.10.1: Bytes of the command service request

Explanation of the bytes transmitted to the module:

Command... This command has got the value $7F.

Sub command1,
Sub command2... By the sub commands the modules are selected which should be checked. The modules are addressed by their module numbers.
To select an area with various modules, in sub command 1 the lowest and in sub command 2 the highest module no. of the desired area has to be entered. The limit values are included. If only one module should transmit a status message, the same module no. has to be entered for both sub commands.

Byte 4... In contrast to most of the other commands, here byte 4 and not byte 3 should be allocated with '$00'.

Parameter 1,
Parameter 2... In byte 5 and byte 6 the Tx identifier is interchanged on which the module should transmit a reply.

Reply of the module to the command 'service request':

If a module receives this command, and if a short term CAN error existed (bit 'error on CAN' = 1) or/and if the bit 'new on bus' is active, the module transmits a message with the length 0 on the received Tx identifier. No bytes are transmitted.

TxId	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
CTxId	-	-	-	-	-	-	-	-

(-) Byte is not transmitted

Table 3.10.2: Reply by CTxId

3.11 Setting the Absolute Module-Time and Synchronisation of the Modules

As described in the chapter 'Request Configuration' (refer sub command $04), each module (from software rev. 17.7) is equipped with an own 32-bits counter that works as a 24-hours clock with a resolution of 1 ms.

With the command $FD the absolute module time is set. The command can be called after a system start to synchro the module time with the CAN master time. Additionally the command sets the counter overflow value from $FFFFFFFF to $05265BFF (24 hours).

The command can be called for separate modules (module no. P 0), but should be used with the address 'module no. = 0' to access all connected esd CAN modules with one call.

Normally the call is only necessary for one time. The new module time is adapted by all modules that never have adapt the absolute time before ('New_on_ Bus').

After the new time value is received, the ‘sync controller’ of the module is started and waits for ‘sync’ messages in (if possible) periodical time stamps (T_{SYNC_PER} . 10 s...100 s). The command $FE is used for the synchronisation of the module clock. The ‘sync’ controller of the module need the time difference between the master time and the time of the local synch call as an input value.
The following figure shall show the functionality:

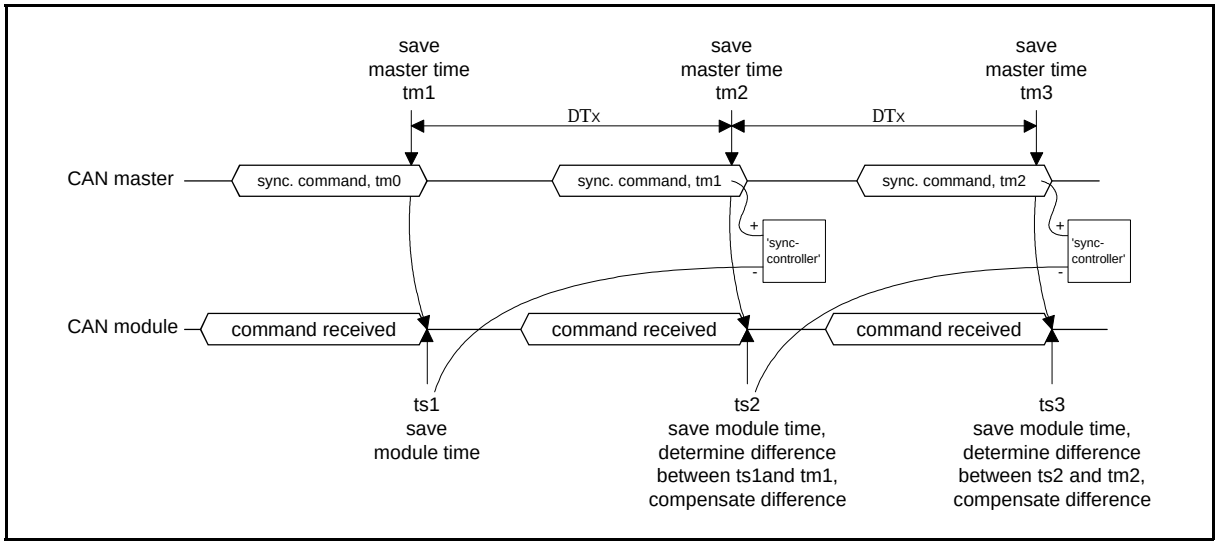


Fig. 3.11.1: Time synchronisation

Time

tm1, ts1: The CAN master has send the command $FE and stores his actual time (tm1). The module receives the command and stores his actual time (ts1) too. -<

tm2, ts2: When transmitting the next synchronisation command the master sends tm1 and stores the actual time as tm2. The slave receives tm1 and determines his difference value from ts1 and tm1.

tm3, ts3: The sequence of tm2/ts2 is repeated with every command call.

The transfer of the synchronisation command should be executed in intervals between 10 s and 2 min. Is the difference between nominal value and real value (Îtime) high, a transfer between 5...10 s is useful. The time difference Îtime can be requested by the command 'Request Configuration'.

The accuracy of the synchronisation depends on the time the CAN master needs for storing his actual master time after the synchro command is send. The shorter this time is, the more precise is the synchronisation. Additionally it is important that the master time is always stored after a constant delay time after the transfer of the command. The higher the 'jitter', the higher is the error of the synchronisation.

<table>
<tr><th></th><th>Byte 1</th><th>Byte 2</th><th>Byte 3</th><th>Byte 4</th><th>Byte 5</th><th>Byte 6</th><th>Byte 7</th><th>Byte 8</th></tr>
<tr><td>Function</td><td>Command</td><td>Sub command</td><td>not used</td><td>Module no.</td><td>Parameter 1</td><td>Parameter 2</td><td>Parameter 3</td><td>Parameter 4</td></tr>
<tr><td rowspan="2">Value</td><td>$FD- absolute_time</td><td rowspan="2">$00</td><td rowspan="2">$00</td><td rowspan="2">Selected module no. $00, $01...$FF</td><td colspan="4">absolute_time</td></tr>
<tr><td>$FE- sync_time</td><td colspan="4">sync_time_master</td></tr>
</table>

Table 3.11.1: Bytes of the commands 'setting the absolute module time' and 'synchronisation of the modules'

Explanation of the bytes transmitted to the module:

Command... These commands have got the values $7F (setting of the absolute module time) and $FE (synchronisation of the module time). With these commands no parameters can be requested. But the actual module time can be requested by the command 'Request Configuration'.

Sub command ... Has always be set to '0'.

Parameter 1 to Parameter 4 ... With the command $FD in byte 5 to byte 8 the absolute module time is set. (absolute_time...).
Value range: 0 ... 86 400 000 ms (24 h)
(0 ... $ 05 26 5B FF)

With the command $FE the synchronisation time of the master (sync_ time_master) is set (refer to description at the previous page).

3.12 Supervisor Commands

In contrast to the other commands, supervisor commands are able to address individual or all modules in the CAN net.
By the module no. $00 all modules are selected. Therefore it is not recommendable to adjust the module no. $00 on a module.
The supervisor commands are not able to request parameters from the module.

The command RESET has got the same consequences as a 'power-on RESET'. It resets all parameters which are not stored in the EEPROM. After the RESET the parameters filed in the EEPROM are active, or, if the EEPROM data are defective or the EEPROM is not available, the default parameters.

If individual or all modules should be reset in a way that they operate with the default parameters after the RESET, this can be achieved by the command default RESET.

During a local RESET the message outputs are activated.

The command Supervisor Watchdog can be called by the Supervisor, to activate the watchdog functionality (precondition is that the watchdog time and the life time factor are greater than ‘0’). After the first activation the command has to be repeated within the time 'WDtime x WDLifeTimeFactor' otherwise a local RESET is generated at the module (refer to chapter 'System Parameter').

The command suspend module causes one or all modules on the CAN to 'freeze' the actual condition of their outputs (if available) and not transmit any messages (Tx transfers) to the CAN (exception: configuration reply).

Parameters and commands are received and filed by the module, but not evaluated: It is possible therefore, e.g., to set output data on the module without changing the output conditions at once.

If the module is activated again by the command 'continue', possibly available outputs are set immediately according to the last received data and the module operates with the last received parameters.

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function	Command	Sub command	Not used	selected module no.	Parameter 1	Parameter 2
Value	$FF	$00 Trigger RESET	Always allocate with $00	$00 All modules selected $01..$FF One module selected	$AAAA - RESET	
		$01 Reserved			-	
		$02 Supervisor Watchdog			-	
		$03 Default RESET			$AAAA - Default RESET	
		$04 Suspend/continue module			$5A5A - Suspend $A5A5 - Continue	
		$05 Reset CAN-error bit			-	

Table 3.12.1: Bytes of the supervisor commands

Explanation of the bytes transmitted to the module:

Command... The supervisor commands all have got the value $FF.

Sub command... The sub command selects the corresponding supervisor command:

Sub command	Function
$00	Reset module
$01	Reserved
$02	Supervisor Watchdog
$03	Reset module and activate the default parameters
$04	Suspend module
$05	Reset CAN error bit

Table 3.12.2: Selection of the supervisor commands by the sub command

Module no. ... Here the desired actual module no. is entered. The setting of individual modules occurs by the module no. $01 to $FF.

At this command all *esd* modules connected to this CAN net are accessed at the same time by the module no. $00!

Parameter 1,.. Depending on the sub command here are parameters interchanged, which are specific for the function:

The commands RESET, default RESET, suspend/continue modules and resetting the CAN error bits are only carried out, if exactly the specified parameters are interchanged.

4. Examples for Parameterization

In this chapter the operation and the initialisation of a module should be clarified with some examples.

4.1 Setting the Tx Identifier TxId1

In this example it will be shown how the Tx identifier TxId1 is programmed on a module. The Tx identifier should get the value $1AA. The Tx identifier had not been programmed at this module so far.

Before the new identifier is set, the module should transmit a reply by the actual Tx identifier on the Tx identifier $567. The reply is requested by command $02.
As actual module no. the value $12 will be presumed here.

CAN Id	Byte 1 (command)	Byte 2 (sub command)	Byte 3 (always $00)	Byte 4 (module no.)	Byte 5 (CTxId-H)	Byte 6 (CTxId-L)
$700 =INIT Id	$02	$00	$00	$12	$05	$67

Table 4.1.1: Request of the Tx identifier

Byte 7 and 8 are not needed for this command.

After this INIT Id had been transmitted to the module, the module responds on the Tx identifier $567:

CAN Id	Byte 1 (returns command)	Byte 2 (returns sub command)	Byte 3 (returns TxId1-H)	Byte 4 (returns TxId1-L)
$567	$02	$00	$00	$92

Table 4.1.2: Reply of the Tx identifier

Byte 5 to 8 are not transmitted.

As can be seen from byte 3 and 4 the module has actually got the Tx identifier TxId1 $092.

Examples

Now the Tx identifier TxId1 (=$1AA) is allocated to the module:

CAN Id	Byte 1 (command)	Byte 2 (sub command)	Byte 3 (always $00)	Byte 4 (module no.)	Byte 5 (TxId-H)	Byte 6 (TxId-L)
$700 =INIT Id	$82	$00	$00	$12	$01	$AA

Table 4.1.3: Setting the Tx identifier TxId1

Byte 7 and 8 are not needed for this command.

The Tx identifier TxId1 of the module is now assigned with the value $1AA. The new identifier is active immediately after it has been received by the module.

4.2 Restoring the Default Parameters

This example should show how a module whose default parameters have been changed during an initialisation is put back into the original condition.

There are various ways to reactivate the default parameters.

4.2.1 ...if the actual module no. is unknown:

If only on this *esd*-CAN module the default parameters should be restored, you have to proceed as follows:

The coding switches of the module have to be set to $00 and a RESET has to be triggered.

Because the module no. is unknown, the RESET is triggered by interrupting the supply voltage of the module or the voltage at the EMERGENCY-STOP outputs or by triggering a global module RESET on the CAN (RESET all modules).

This global RESET resets all modules. But the default parameters are only restored on those modules whose coding switches are adjusted to $00.

CAN Id	Byte 1 (command)	Byte 2 (sub command)	Byte 3 (always $00)	Byte 4 (RESET type)	Byte 5	Byte 6
$700 =INIT Id	$FF	$00	$00	$00 (global)	$AA	$AA

Table 4.2.1: RESET of all *esd* modules of the CAN

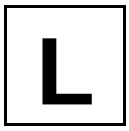
The bytes 7 and 8 are not needed for this command.

If on all *esd*-CAN modules on the CAN the default parameters should be reactivated, the global command 'default RESET' is given to the bus:

CAN Id	Byte 1 (command)	Byte 2 (sub command)	Byte 3 (always $00)	Byte 4 (RESET type)	Byte 5	Byte 6
$700 =INIT Id	$FF	$03	$00	$00 (global)	$AA	$AA

Table 4.2.2: Default RESET of all *esd* modules of the CAN

The bytes 7 and 8 are not needed for this command.
After this RESET the module starts again with the default parameters. By coding switches the desired identifier can be determined again.



Examples

4.2.2 ...if the module no. is known:

If the module no. is known it is possible to restore the default parameters by the command 'default RESET' at the desired module. The module no. of the module is presumed with $12 here, again:

CAN Id	Byte 1 (command)	Byte 2 (sub command)	Byte 3 (always $00)	Byte 4 (RESET type)	Byte 5	Byte 6
$700 =INIT Id	$FF	$03	$00	$12 (selective)	$AA	$AA

Table 4.2.3: Default RESET of an *esd* module on the CAN

The bytes 7 and 8 are not needed for this command.