CL400 / CL500

COM-E
Module Description

Edition

101

BOSCH

Automation

CL400 / CL500

COM-E
Module Description

1070 072 196-101 (00.06) GB

Contents

1   Safety Instructions

Before you start working with COM-E, we recommend that you thoroughly familiarize yourself with the contents of this manual. Keep this manual in a place where it is always accessible to all users.

1.1   Intended Use

This instruction manual presents a comprehensive set of instructions and information required for the standard operation of the described products.

The products described hereunder

- were developed, manufactured, tested and documented in accordance with the relevant safety standards. In standard operation, and provided that the specifications and safety instructions relating to the project phase, installation and correct operation of the product are followed, there should arise no risk of danger to personnel or property.
- are certified to be in full compliance with the requirements of the
  - EMC Directives (89/336/EEC 93/68/EEC, and 93/44/EEC)
  - Low-Voltage Directive (73/23/EEC)
  - Harmonized standards EN 50081-2 and EN 50082-2
- are designed for operation in an industrial environment (Class A emissions). The following restrictions apply:
  - No direct connection to the public low-voltage power supply is permitted.
  - Connection to the medium and/or high-voltage system must be provided via transformer.

The following applies for application within a personal residence, in business areas, on retail premises or in a small-industry setting:

- Installation in a control cabinet or housing with high shield attenuation.
- Cables that exit the screened area must be provided with filtering or screening measures.
- The user will be required to obtain a single operating license issued by the appropriate national authority or approval body. In Germany, this is the Federal Institute for Posts and Telecommunications, and/or its local branch offices.

☞ **This is a Class A device. In a residential area, this device may cause radio interference. In such case, the user may be required to introduce suitable countermeasures, and to bear the cost of the same.**

Proper transport, handling and storage, placement and installation of the product are indispensable prerequisites for its subsequent flawless service and safe operation.

1.2   Qualified Personnel

This instruction manual is designed for specially trained personnel. The relevant requirements are based on the job specifications as outlined by the ZVEI and VDMA professional associations in Germany. Please refer to the following German-Language publication:
Weiterbildung in der Automatisierungstechnik
Publishers: ZVEI and VDMA Maschinenbau Verlag
Postfach 71 08 64
60498 Frankfurt/Germany

This instruction manual is specifically designed for specially trained PLC technicians. They are required to have special skills and knowledge regarding programmable logic controllers.

Programming, start and operation as well as the modification of program parameters may only be executed by specially trained personnel! This personnel must be able to recognize possible hazards that might be caused by programming and program modification, and in general by mechanical, electrical or electronical equipment.

Interventions in the hardware and software of our products not described in this instruction manual may only be performed by our skilled personnel.

Unqualified interventions in the hardware or software or non-compliance with the warnings listed in this instruction manual or indicated on the product may result in serious personal injury or damage to property.

Installation and maintenance of the products described hereunder is the exclusive domain of trained electricians as per IEV 826-09-01 (modified) who are familiar with the contents of this manual.

Trained electricians are persons of whom the following is true:

- They are capable, due to their professional training, skills and expertise, and based upon their knowledge of and familiarity with applicable technical standards, of assessing the work to be carried out, and of recognizing possible dangers.

- They possess, subsequent to several years' experience in a comparable field of endeavor, a level of knowledge and skills that may be deemed commensurate with that attainable in the course of a formal professional education.

With regard to the foregoing, please read the information about our comprehensive training program. The professional staff at our training center will be pleased to provide detailed information. You may contact the center by telephone at (+49) 6062 78-258.

1.3   Safety Markings on Components

 DANGER! High voltage!

 DANGER! Corrosive battery acid!

 CAUTION! Electrostatically sensitive components!

 Disconnect mains power before opening!

 Lug for connecting PE conductor only!

 Functional earthing or low-noise earth only!

 Screened conductor only!

1.4   Safety Instructions in this Manual

DANGEROUS ELECTRICAL VOLTAGE

This symbol warns of the presence of a **dangerous electrical voltage**. Insufficient of lacking compliance with this warning can result in **personal injury.**

DANGER

This symbol is used wherever insufficient or lacking observance of this instruction can result in **personal injury.**

CAUTION

This symbol is used wherever insufficient or lacking observance of instructions can result in **damage to equipment or data files.**

☞   This symbol is used to alert the user to an item of special interest.

1.5   Safety Instructions for the Described Product

DANGER
Fatal injury hazard through ineffective Emergency-OFF devices!
Emergency-OFF safety devices must remain effective and accessible during all operating modes of the system. The release of functional locks imposed by Emergency-OFF devices must never be allowed to cause an uncontrolled system restart!
Before restoring power to the system, test the Emergency-OFF sequence!

DANGER
Danger to persons and equipment!
Test every new program before operating the system!

DANGER
Retrofits or modifications may interfere with the safety of the products described hereunder!

The consequences may be severe personal injury or damage to equipment or the environment. Therefore, any system retrofitting or modification utilizing equipment components from other manufacturers will require express approval by Bosch.

DANGEROUS ELECTRICAL VOLTAGE
Unless described otherwise, maintenance procedures must always be carried out only while the system is isolated from the power supply. During this process, the system must be blocked to prevent an unauthorized or inadvertent restart.

If measuring or testing procedures must be carried out on the active system, these must be carried out by trained electricians.

CAUTION
Danger to the module!
Do not insert or remove the module while the controller is switched ON! This may destroy the module. Prior to inserting or removing the module, switch OFF or remove the power supply module of the controller, external power supply and signal voltage!

CAUTION
Only Bosch-approved spare parts may be used!

CAUTION
Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

Observe the following protective measures for electrostatically endangered modules (EEM)!

- The Employees responsible for storage, transport and handling must be trained in ESD protection.

- EEMs must be stored and transported in the protective packaging specified.

- Out of principle, EEMs may be handled only at special ESD work stations equipped for this particular purpose.

- Employees, work surfaces and all devices and tools that could come into contact with EEMs must be on the same potential (e.g. earthed).

- An approved earthing wrist strap must be worn. It must be connected to the work surface via a cable with integrated 1 MΩ resistor.

- EEMs may under no circumstances come into contact with objects susceptible to accumulating an electrostatic charge. Most items made of plastic belong to this category.

- When installing EEMs in or removing them from an electronic device, the power supply of the device must be switched OFF.

1.6   Documentation, Software Release and Trademarks

Documentation

The present manual provides the user with comprehensive information about the COM-E module.

Overview of available manuals:

Manuals	Language	Order no.
COM-E Module Description	English	1070 072 196
R500 Computer Interface Module	English	1070 072 131

Hexadecimal numbers are represented by a sub H (FF$_H$) or they are written the same way as they must be entered (16#FFFF).

Release

☞ **This manual applies to the following versions:**
Hardware version: **1.1**
Firmware version: **starting at 1.2**
See also chapter 2.5.4.

Trademarks

All trademarks referring to software that is installed on Bosch products when shipped from the factory represent the property of their respective owners.

At the time of shipment from the factory, all installed software is protected by copyright. Software may therefore be duplicated only with the prior permission of the respective manufacturer or copyright owner.

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2 Hardware

The COM-E module is provided with a serial V.24/20 mA interface and an Ethernet interface (10Base-T) which make it possible to couple the CL400 / CL500 controllers with other Bosch controllers or other communication-capable devices.

Power Supply

The COM-E does not require an external power supply. All supply voltages are provided by the CL400 / CL500's power supply unit.

Compatibility with R500P, R500MAP, R500M-EN and COM-P

The COM-E's hard- and software concept makes it possible to operate the COM-E in combination with the COM-P, R500P, R500, R500MAP, and R500M-EN modules in the CL400 / CL500 basic device.

To address the COM-E from the PLC program, the function modules for computer interfaces are to be linked to the PLC program.

2.1   Front Panel

Status display
Channel 0

25-pin socket

V.24/20 mA
Channel 0

Reset button
Link-LED

Status display
Channel 1

Receive-LED
Transmit-LED

10Base-T
Ethernet socket
Channel 1

Version identification

Labeling field
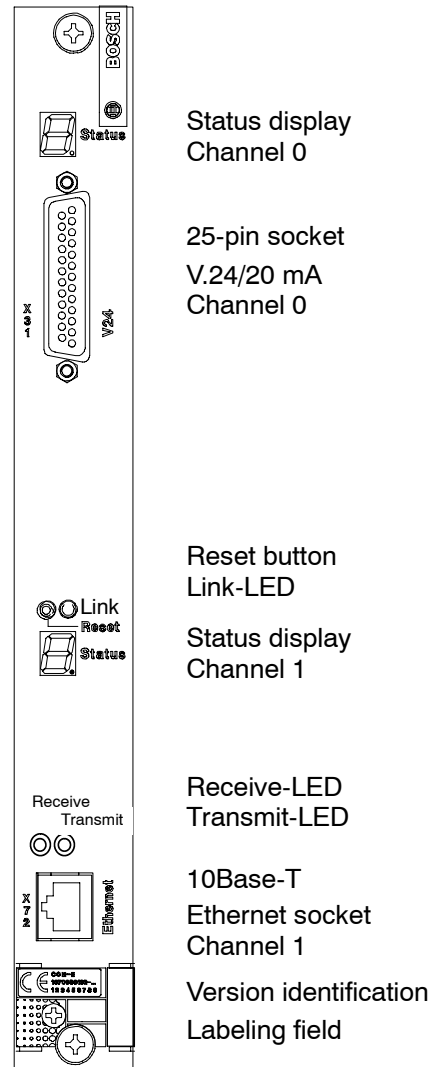
Status Display

Each of the two channels on the COM-E is provided with a status display.

● For channel 0, the upper 7-segment display is responsible.

● For channel 1, the lower 7-segment display is responsible.

Interfaces

● The X31 interface is a V.24/20 mA interface. It is used for point to point coupling to an external device or as a diagnosis/protocol monitor for the Ethernet interface, compare with Tracer for PROFIBUS-FMS.

● The 10Base-T connector is used for the connection to the Ethernet network.

Reset Button

Pressing the reset button starts reinitialization of COM-E's operating software.

- All active jobs are aborted undefined.
- All jobs are deleted from the job queue.
- STOP and CLAB requests of the module are deleted.

Link-LED

This LED indicates that the link integrity signals can be exchanged between COM-E and the coupled partner device. This way it is possible to enable a communication between both stations.

Receive/Transmit-LED

These LEDs indicate the data traffic. They are lit when messages are going out or coming in.

Identification of Version

This label identifies the revision level of the module. Changes are marked by a black point.

Labeling Field

The labeling field is for you, the user, to identify the module according to your plant's identification system. This e.g. might be the module's block address or the IP address.

2.2   Slot

A maximum of 5 COM-Es can be operated in a PLC. In server operation, even more modules can be implemented.

CL400

For the CL400, the slots 4 to 14 in the GG2 are at your free disposal.

1	2	3	4	5	6	7	8	9	10	12	12	13	14

In GG2/K, the slots 4 to 8 are freely available.

1	2	3	4	5	6	7	8

CL500

For the CL500, the slots 5 to 14 in the GG2 are at your free disposal.

1	2	3	4	5	6	7	8	9	10	12	12	13	14

In GG2/K, the slots 5 to 8 are freely available.

1	2	3	4	5	6	7	8

2.3 V.24/20 mA Interface

The V.24/20 mA interface is available at channel 0. Via this interface, devices that are equipped with a V.24/20 mA interface themselves can be connected.

The following protocols can be used:

- BUEP03E   Transmission protocol for free configuration
- BUEP19E   Protocol for secure data transmission
- BUEP64   Transmission protocol 3964R
- Tracer/Monitor

2.4   Ethernet Interface

The Ethernet is connected via a twisted pair cable with RJ45 connector. The in IEEE 802.3 defined terminal conditions for 10Base-T are applicable:

- Network topology star
- Max. transmission rate: 10 Mbit/s
- Max. segment length: 100 m
- 100 Ω twisted pair cable
- Link monitoring
- Manchester-coded data transmission
- Connector style: eight-pin RJ-45

The line should have a cross section of 0.08 mm^2 to 0.34 mm^2, 100 Ω imped-ance, and 12 to 45 transpositions per meter. For this use, special cables, called Shielded Twisted Pair (STP), are available:

- STP cable category 3
- STP cable category 4
- STP cable category 5
- STP cable category 6

Increasing category numbers correspond to better cable characteristics.

We recommend the use of STP cables category 5.

Pin Assignment

Pin No.	Explanation
1	Tx+
2	Tx–
3	Rx+
4	free
5	free
6	Rx–
7	free
8	free

2.5   Settings on the COM-E

The settings must be made prior to the COM-E's commissioning.

CAUTION
Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

DIP Switch	Explanation
S2	Setting the block address
S3	Protocol-specific setting channel 0
S4	Reserved
S5	Reserved
S6	Multiswitch

S2	S3	S4	S5	S6
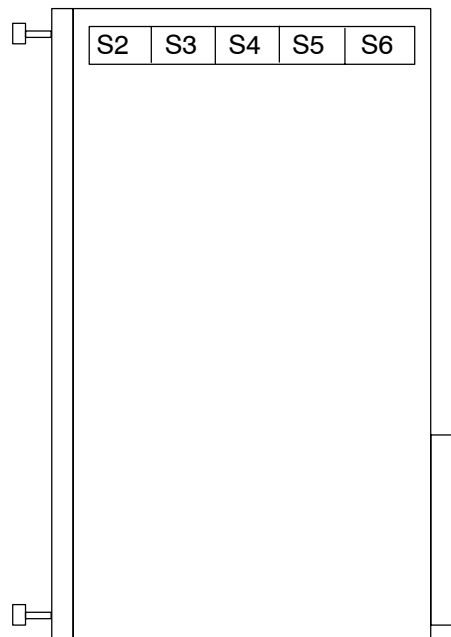
2.5.1   Block Address of COM-E

At the CL400 / CL500's system bus, the COM-E occupies a block of 256 kB or four blocks.

The block address of the COM-E is set at DIP switch S2.

The settings are made in the same way as for all other modules of the CL400 / CL500 controller series.

S2								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**System Bus Address [hex]**
off	off	off	off	off	off	off	off	00
off	off	on	off	off	off	off	off	04
off	off	off	on	off	off	off	off	08
off	off	...	...	...	...	...	...	...
off	off	off	off	off	on	off	off	20 (32)
off	off	on	off	off	on	off	off	24 (36)
off	off	off	on	off	on	off	off	28 (40)
off	off	on	on	off	on	off	off	2C (44)
off	off	off	off	on	on	off	off	30 (48)
off	off	on	off	on	on	off	off	34 (52)
..	..	..	..	..	..	..	..	..
off	off	off	on	off	on	on	on	E8 (232)
off	off	on	on	off	on	on	on	EC (236)
off	off	off	off	on	on	on	on	reserved at CL400 f0 (240)
off	off	on	off	on	on	on	on	F4 (244)
off	off	off	on	on	on	on	on	F8 (248)
off	off	on	on	on	on	on	on	FC (252)

The block address for the COM-E module must be given in quadruple steps because the module always occupies 4 blocks.

We recommend to set block addresses starting at 20_H, e.g. 20_H, 24_H, 28_H, $2C_H$, 30_H.

2.5.2 Protocol-Specific Settings

Protocol-specific settings for channel 0 are to be located at DIP switch S3 and S6. At DIP switch S6, only the switches 1 and 2 are assigned to channel 0.

The DIP switches S4, S5, and S6 with switch 3 and 8 are reserved for future extensions, and must always be switched to OFF.

2.5.3 Protocol-Specific Settings V.24/20 mA

In general, 8 information bits and 1 stop bit are transferred.

S3								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Function**
							off	Control signals are not scanned
							on	Control signals are scanned
				off	off	off		38400 baud
				on	off	off		57600 baud
				off	on	off		600 baud / 10400 baud for BUEP03E with switch S6-2 on
				on	on	off		1200 baud
				off	off	on		2400 baud
				on	off	on		4800 baud
				off	on	on		9600 baud
				on	on	on		19200 baud
			off					No parity
			on					Parity active
		off						Odd parity
		on						Even parity
off	off							No protocol (tracer/monitor)
on	off							BUEP19E
off	on							BUEP03E
on	on							BUEP64

☞ **For further information regarding BUEP03E, BUEP19E, and BUEP64, please refer to the manual: R500 Computer Interface Module; order no. 1070 072 131.**

S6								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Function**
Channel 0				reserved				
off								BUEP19E: Priority centr. jobs BUEP64: Priority centr. jobs BUEP03E: Data length 8 bit
on								BUEP19E: Priority decentr. jobs BUEP64: Priority decentr. jobs BUEP03E: Data length 7 bit
	off							BUEP64:Protocol end with DLE ETX
	on							BUEP64:Protocol end with DLE ETB BUEP03E: 10400 baud at S3 = 600 baud
		off	off	off	off	off	off	Reserved switches always OFF

V.24 Interface

The voltage levels of the signals and the assignment of the connectors are according to the guidelines "VDI Richtlinien 2880, Blatt 2" for programmable logic controllers, process and data interfaces.

Signal level, data transmission line:
- logic 1   –15 V to –3 V
- logic 0   +3 V to +15 V

Signal level, communications and control line:
- active   +3 V to +15 V
- passive   –15 V to –3 V

Explanation	Designation	Pin No.	Signal Direction
Shield	Shield	Housing	
Transmitted data PLC	TxD	2	→
Received data PLC	RxD	3	←
Reference conductor	Signal-Ground	7	
Data Set Ready	DSR	6	←
Data Terminal Ready	DTR	20	→

20 mA Interface

Signal level and assignment of the connectors comply with the guidelines: "VDI Richtlinien 2880, Blatt 2" for programmable logic controllers, process and data interfaces (limitation: max. reverse voltage 27 V). The 20 mA interfaces can be, in dependence on the pin assignment, switched to active, i.e. with source of current, or to passive.

Line Statuses
- logic 1   20 mA
- logic 0   no current

20 mA active

Explanation	Designation	Pin No.	Signal Direction
Shield	Shield	Housing	
Received data + PLC	RxD +	12	←
Received data – PLC	RxD –	24	
Transmitted data + PLC	TxD +	13	→
Transmitted data – PLC	TxD –	25	
Data Set Ready +	DSR +	14	←
Data Set Ready –	DSR –	18	
Reader Control +	RDRCTL +	16	→
Reader Control –	RDRCTL –	21	

For active operation, the connections 9 (12 V in) and 10 (12 V out) must be jumpered.

20 mA passive

Explanation	Designation	Pin No.	Signal Direction
Shield	Shield	Housing	
Received data + PLC	RxD +	22	←
Received data – PLC	RxD –	12	
Transmitted data + PLC	TxD +	23	→
Transmitted data – PLC	TxD –	13	
Data Set Ready +	DSR +	11	←
Data Set Ready –	DSR –	14	
Reader Control +	RDRCTL +	19	→
Reader Control –	RDRCTL –	16	

Length of Line

The maximum applicable length of the line is dependent on the baud rate.

For the Bosch cable 14 x 0.14 twisted, shielded, order no. 1070 910 152, the following lengths apply:

Transmission Speed [baud]	V.24 [m]	20 mA [m]
110 to 4800	15	350
9600	15	300
19200	15	150
38400	15	100
57600	15	50

It is required that the interface modules of the partner device correspond at least to those of the COM‑E.

The V.24 interface requires that there are only small differences between the potential of the transmitter and the receiver ($-2\,V < V_{diff} < +2\,V$).

☞ **The transmission cable must not be laid in parallel to directly neigh‑boring power cables.**

2.5.4   Ethernet-Specific Settings

Ethernet Address

Each module has an impressed Ethernet address. This address is unique worldwide, and should not be altered.

The Ethernet address consists of 6 address bytes and is constructed as follows:

Fixed Part [hex]			Module-Specific		
00	60	34	xx	yy	zz

Modification of the Ethernet address is possible via the configuration file. All 6 address bytes can be overwritten.

☞ **Network problems resulting from such modification through e.g. dual addressing, etc. are the responsibility of the user.**

In order to reset the settings, press the reset button during switch-on.

Internet Address

The addressing of the module via Ethernet requires an Internet address (IP address). At the moment, the Internet addresses consist of 4 bytes that are normally specified in the octet notation (e.g. 142.2.26.142).

These IP addresses are given by the network administrator. In the environment of the connected LAN, the IP address may only exist once.

Normally, the IP address is entered, by means of WinSPS, in the SK table (system coordinator table) of the SK500 and/or the ZS400, and is determined by COM-E from there. This guarantees that the IP address does not migrate when the modules are changed.

To do so, the following firm- and software editions are required:

Module	Necessary Firm-/Software Release
WinSPS	2.3 and up
SK500	206 and up
SK510	206 and up
ZS400	Software V2.5
ZS401	Software V2.5

In exceptional cases, the IP address can also be entered via a terminal at the upper interface, compare with chapter 9 Ethernet Job Listing. This address is then applicable as long as there is no suitable SK/ZS400 available.

☞ **The address setting via the system coordinator / central processing unit (SK/ZS) has priority.**

2.6 Configuration File

With the configuration file, several presettings and default values on the COM-E can be changed. The file is imported into the COM-E module using the WinSPS editor, version 2.3 and higher, submenu 'Controls', via SK, ZS or COM-E, where it is then filed in a non-volatile way.

The configuration file can be created with any kind of ASCII editor. The data is checked during loading. The entries are oriented towards keywords, the parameters are divided by TABs or spaces. The semicolon is used for designation of the start of a comment.

At the lower segment display, an "n" will appear if there is no configuration file loaded.

☞ **The COM-E module is configured in such a way that, in general, it is not necessary to load a ProjDat.eth configuration file!**

2.6.1 Keywords

Not all keywords must be specified in the configuration file. In case of missing information, the corresponding default value is valid.

Keyword	Default Value
Retransmissiontimer	200 ms
Retransmissioncounter	16
Retransmissionmode	0 ; constant repeat time
IP-Table	
IP-Lifetime	120 ; 120 seconds
Ethernet-Overwrite	0 ; no overwrite
Subnet-Mask	255.255.0.0
Default-Gateway	no default address
Password	no password

Retransmissiontimer

Default: 200 ms

This time value determines the repeat time of a message.

If, e.g., a request message is not answered with a response message, the request message is repeated after the retransmission time has elapsed.

Example for an entry in the configuration file:

Retransmissiontimer: 400   ; corresponds to 400 ms

Retransmissioncounter

Default: 16

The counter determines how often a message is repeated before an error message is sent back to the controller.

Example for an entry in the configuration file:

Retransmissioncounter: 20   ; max. 20 repeats

Retransmissionmode

Default: 0   ; constant repeat time

The retransmission mode defines if the time between the repeat messages is always the same or if the length of an interval from the previous to the next repeat message is doubled.

Example for an entry in the configuration file:

Retransmissionmode: 1   ; 0 = constant time interval
                                      ; 1 = doubling of the time intervals

IP-Table

Normally, the IP table is not necessary. In an IP table, the references between the IP address, the module name and the Ethernet address can be established; compare to routing table.

By specifying this table the message load can be reduced, the module name on COM-E can be determined, and the Ethernet address for this module can be defined anew.

The table is constructed in the following way:

IP Address	Module Name	Ethernet Address [hex]	Comment
123.20.2.123	Controller_2	00-60-34-00-80-44	; In the back of the ; hall to the left
123.20.2.165	Controller_8	00-60-34-00-81-77	; Main control

☞ **IP address, module name, and Ethernet address are divided by TABs or spaces, and entered in this notation and order!**

The Ethernet address can be followed by a comment, divided by a semicolon.

The module name may have a maximum of 31 characters. The module name is accepted as a COM-E name if the IP address of the system table matches the IP address of the IP table.

☞ **A maximum of 64 entries is permitted!**

IP-Lifetime

Default: 120   ; 120 seconds

The connection with a communication partner is set up via the IP address. The assignment between the IP and the physical Ethernet address is done via ARP messages. This assignment is not determined anew before each data exchange, but will be valid as long as the time set in the IP Lifetime. A data exchange within this timeframe retriggers this timer.

Example for an entry in the configuration file:

IP-Lifetime: 200   ; 200 seconds

Ethernet-Overwrite

Default: 0   ; no overwrite

The Ethernet overwrite function causes the acceptance of the IP table's Ethernet address in the module if the IP address given in the system table is identical with the address in the table.

Example:
- In the system table, the COM-E is listed with the IP address 142.2.40.123.
- Ethernet overwrite is set to 1.
- IP table:

IP Address	Module Name	Ethernet Address [hex]	Comment
....			
142.2.40.123	John	11-22-33-44-55-66	;to be accepted
....			

After loading the configuration file, the Ethernet address 11-22-33-44-55-66 will be taken over by the module.

Example for an entry in the configuration file:

Ethernet-Overwrite: 1   ; 0 = No overwrite (default)

                                ; 1 = Overwrite

☞ **The originally impressed Ethernet address is not overwritten. After deleting the configuration file, it will become visible again.**

Subnet-Mask

Default: 255.255.0.0

This mask is only effective in combination with the default gateway address. If a message is sent to another subnetwork, it is sent via the defined default gateway.

Example for an entry in the configuration file:

Subnet-Mask: 255.255.255.0

Default-Gateway

Default: no default address

Gateway address to a subnetwork.

Example for an entry in the configuration file:

Default-Gateway: 142.2.1.100

Password

Default: no password

A writing access to a controller with a COM-E module can be protected with a password. The password is only checked for communication with the PG (programming unit) or other external connections. During a COM-E – COM-E communication, the password is not active.

Example for an entry in the configuration file:

Password: Fred

2.6.2   Example of a Configuration File

```
; Configuration file COM-E Project XY of 6-12-98.
; ------------------------------------------------
; Comments are marked with a ';'
; Spaces and tabulators serve as delimiters.

; Communication parameters
; ------------------------
Retransmissiontimer:   500    ; Time in milliseconds (default: 200 ms)
Retransmissioncounter:  8     ; default 16
Retransmissionmode:     0     ; 0 = constant repeat time (default)
                              ; 1 = increasing repeat time (with each
                              ; repeat, the time is doubled)


; List of communicating stations
; ------------------------------
; static part of the ARP table, i.e. the list of stations
; This table has a permanently set structure with:
; Ip-Adr. <TAB/Blank> logical name <TAB/Blank> Ethernet address ;Comment
; The logical name may have a maximum of 31 characters
; During centralized programming, the controller can be selected under this
; name.

IP-Table:
142.2.20.10 ESP001  20-af-91-23-23-66 ; John
142.2.20.11 ESP002  07-71-ab-c7-12-36 ; Fred
142.2.20.12 ESP003  13-45-66-77-54-24 ; Stan
142.2.20.20 COM-E_1 00-60-34-00-20-00 ; In the back of the hall to the left
142.2.20.21 COM-E_2 00-60-34-00-20-01 ; Main control
142.2.20.22 COM-E_3 00-60-34-00-20-02 ; Output
142.2.20.43 COM-E_4 00-60-34-00-20-03 ; ..
142.2.20.44 COM-E_5 00-60-34-00-20-04 ; ..

Ethernet-Overwrite: 1         ;Overwriting of the impressed Ethernet address
                              ; with entry from the IP table

; For the dynamic part of this table, the following data can be preset:
; IP lifetime determines how long a dynamic entry in the ARP table remains valid.
; A job with this address retriggers the timer.
IP-Lifetime:           120    ; time in seconds

; Default-Routing
; ---------------
; Client commands whose target IP address is located in another subnetwork
; are generally sent to the default gateway.
Subnet-Mask:   255.255.0.0

Default-Gateway:142.2.1.100

; Login
; -----
; For a controller - controller communication, a login is not required.
; If a PC or another device is connected, this communication
; reference must be first released with a password if it is
; defined in the configuration file.
; The password can be changed from the PG (programming unit).
Password:          John
```

2.7 Status Display

Each channel of the COM-E module is provided with a status display. It shows all channel-related statuses and error messages.

These messages are assigned directly to the corresponding channel, and thus to this protocol.

Lower Display	Upper Display	Explanation
0 to 3	H	Hardware error
4	H	No Ethernet address
5	H	Reserved
0 to F	*	Faulty jobs channel 1 (Ethernet)
*	0 to F	Faulty jobs channel 0 (V.24/20 mA)
*	P	No protocol set for channel 0 (monitoring is possible)
*	'-'	Job listing (monitoring/tracer) on
*	'_'	Error listing on
*	'-.'	Data output with job listing
*	'_.'	Data output with error listing
U	*	No IP address set
n	*	No configuration file loaded
*	.	Centralized job runs at channel 0
.	*	Centralized job runs at channel 1
*	C	Software error
C	A	Wait for system logon, wrong block address, no entry of the module in the SK table
*	C	Reserved
0 to F	off	Hangman, with output of a 3-digit string

2.8   Technical Data

Technical Data	COM-E
Interfaces	• V.24/20 mA as per guideline "VDI 2880 Blatt 2" • 20mA interface is electrically isolated
Baudrates V.24/20 mA interface	600 to 57600 bd
Current uptake internally • 5V voltage supply • +12V ISO voltage supply	 500 mA typical 70 mA + 20 mA per active current loop
Resistance against conducted interferences	As per EN 61 131-2
Max. number COM-E per controller	5
Ambient temperature range	0 to +55 °C
Storage temperature range	–25 to +70 °C
Width	1 slot
Weight	300 g
Protection degree	Protection degree IP20 as per DIN VDE 0470-1, installed in housing
Place and way of installation	The COM-E can, if inserted in a card rack, be installed in a control cabinet horizontally or vertically (if the ambient temperature is reduced to 40° C).

Notes:

3   PLC Interface

The PLC interface is the access to communication, and is realized by means of the following function modules:

- R5INIT
- R5REQ
- R5CON

The PLC interface enables the user to allocate a job to the COM-E; this is also called 'client characteristics of the CL400 / CL500'.

The function modules do not offer a job monitoring function (time-out). Job monitoring is provided by the firmware of COM-E.

☞ **If COM-E is purely operated as a server, function modules are not required.**

Notes:

4 R5INIT

4.1 Characteristics

Characteristics	R5INIT
Module name	R5INIT
Number of parameters	6
Reserved markers	M230 to M254

Communication Modules

The initialization R5INIT function module creates different tables in the ZS Central Unit and on the COM-E module, and fills them out with information which is accessed during communication between these modules.

Before communication via the computer interface is possible, this module must and shall only be processed once after having switched on the controller. In general, it is therefore called up in the OM5 or OM7 startup-organization module.

☞ **In case of usage as a server only, the R5INIT module is not required.**

4.2 Parameters

The R5INIT has 5 input and one output parameter.
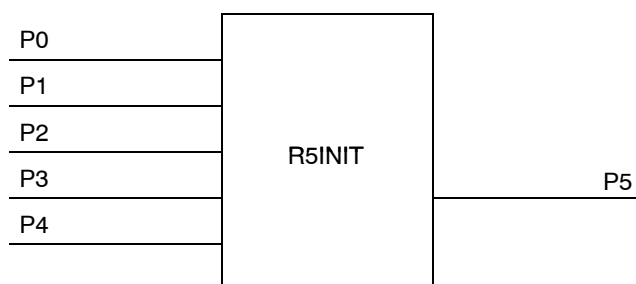
4.2.1   Input Parameters

Parameter	Attribute	Description
P0	W	Module number of computer interface 0
P1	W	Module number of computer interface 1
P2	W	Module number of computer interface 2
P3	W	Module number of computer interface 3
P4	W	Module number of computer interface 4

The module number corresponds to the line number of the entry in the system table. (This is not the block address!)

The assignment of the computer interface number (RSS no.) to the module number can be chosen freely.

If the module number is passed to the parameter P2 e.g., the RSS no. is = 2.

If the module numbers of the computer interfaces are changed in the SK table, the parameters of the R5INIT must be adjusted accordingly. For those modules that are not available in the system, the value 16#FFFF must be passed as a parameter.

Because this module may be called up only once in any ZS Central Unit, one call initializes all communication modules (R500, R500P, COM-P, COM-E, R500MAP and R500M-EN) that are supposed to execute the data communication jobs of the corresponding ZS.

4.2.2   Output Parameters

Parameter	Attribute	Description
P5	W	Result

This parameter transmits the result of the initialization to the PLC program and signalizes errors that have come up.

Code [hex]	Explanation
0000	Initialization finished without errors
0001	No RSS according to parameter 0 available
0002	No RSS according to parameter 1 available
0004	No RSS according to parameter 2 available
0008	No RSS according to parameter 3 available
0010	No RSS according to parameter 4 available
0020	No free memory area available for memory management list
0021	No data field addresses in the memory management list
0030	Communication error on the RSS
0031	Communication error on the ZS

Notes:

5   R5REQ

5.1   Characteristics

Characteristics	R5REQ
Module name	R5REQ
Number of parameters	6
Reserved markers	M230 to M254
Processing time	0.2 ms + 3 ms for each job to be transmitted with ZS500

With the request module, the user passes the parameters which are necessary for the execution of the protocol activity to the corresponding communication task.

The request enters the job in the request job queue where a parameter structure is used together with the output data as a transfer parameter.

The request module writes a command into the communication module's job queue, which contains the information where the parameters for a communication job can be found. Afterwards, the communication module takes the relevant communication job from the ZS400 or ZS500 or any other control processor, which it then starts to execute.

5.2   Parameters

The function module R5REQ has four input and two output parameters.

```
P0 ─────────┌──────────┐
P1 ─────────│          │
P2 ─────────│  R5REQ   ├───────── P4
P3 ─────────│          ├───────── P5
            └──────────┘
```
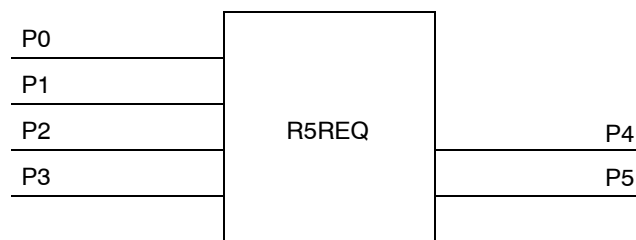
5.2.1   Input Parameters

P0

Parameter	Attribute	Description
P0	W	Data type

This parameter determines the type of a data area. Here, for each job, a data storage area of 16 words is reserved for the protocol-specific parameters.

Possible data storage areas are:

- Data module 44_H
- Data buffer 64_H
- Data field 43_H

The user must always reserve 16 words per job for job-specific parameters.

P1

Parameter	Attribute	Description
P1	W	Data type attribute

If a data module is determined by P0 as a data storage area, P1 indicates the data module number. In other cases, P1 is meaningless, and should be reserved with 16#FFFF.

Applicable values are:

- 0 to 511
- 16#FFFF

P2

Parameter	Attribute	Description
P2	W	Byte offset

This is the location where the start address for the job parameters in the selected data storage area is determined.

P3

Parameter	Attribute	Description
P3	W	Job bit bar ABL

Each of the 16 bits of this parameter represents a reference to a block of job parameters located in the data storage area determined by P0 to P2. Bit 0 of P3 thus refers to the 0. job parameter block, and bit 15 refers to the 15. job parameter block in the determined data storage area.

Setting a bit in P3 initiates the start of the job which is described in the corresponding job parameter block. If several bits are set contemporarily, the corresponding jobs are passed to the COM-E in the same cycle.

One single execution of the R5REQ with set job bits already starts all those selected jobs. The job bits must then be reset using the application program.

5.2.2   Output Parameters

P4

Parameter	Attribute	Description
P4	W	Error message

This is where basic status and error codes that are recognized by the R5REQ during job allocation are entered:

- The low byte of P4 then contains the status or error code;
- The high byte contains a coded recommendation for a reaction hereto.

High Byte		Low Byte	
Code [hex]	PLC Reaction	Code [hex]	Error Code
00	No error, correct call	00	No error, correct call
01	Repeat R5REQ call	01	The parameter P3 ABL (Job bit bar) is zero
02	Change PLC program	02	The declared data module is not available
03	Change protocol parameter	03	The declared data module is too short
04	The function module R5INIT must be executed again	04	The declared byte offset is not valid
05	The function module R5REQ must be executed again		
06	The function module R5CON must be executed again	06	Wrong memory management list, ZS version not suitable
07	Reload protocol	07	The COM-E is not listed in the SK table
		08	Wrong block address of COM-E

☞ **Further error messages that are recognized by the R5REQ during the start of the job are put into the first word of the corresponding job block.**

P5

Parameter	Attribute	Description
P5	W	Result bit bar EBL

This is where the user is informed about whether errors have been recognized during job allocation. Each result bit has been assigned a job. The assignment corresponds to the one of the P3 input parameter. A set result bit indicates that the job which has been addressed with the same bit number in P3 could not be allocated. In addition, a detailed error code is output in the first word of the relevant job block.

5.3   Meaning of the Parameters in the Data Storage Area

For each job, a parameter field of 16 words must be reserved in the data field (DF), the data buffer (DB), or the data module (DM).

The address and the offset of this data storage area is determined with the parameters P0 to P2 of the R5REQ.

Each parameter field will be assigned a bit in the ABL job bit bar and a bit in the EBL result bit bar, starting at bit 0.

Below, you find an example of the corresponding data storage area if the parameter P2 (offset) has the value 0:

Job Bit of the ABL	Corresponding Data Storage Area	Byte Addresses
0	DW0 to DW15	0 to 31
1	DW16 to DW31	32 to 63
2	DW32 to DW47	64 to 95
3	DW48 to DW63	96 to 127
4	DW64 to DW79	128 to 159
5	DW80 to DW95	160 to 191
6	DW96 to DW111	192 to 223
7	DW112 to DW127	224 to 255
8	DW128 to DW143	256 to 287
9	DW144 to DW159	288 to 319
10	DW160 to DW175	320 to 351
11	DW176 to DW191	352 to 383
12	DW192 to DW207	384 to 415
13	DW208 to DW223	416 to 447
14	DW224 to DW239	448 to 479
15	DW240 to DW255	480 to 511

The maximally 16 job parameters are distinguished in two groups:

● Protocol-independent parameters

Their contents are always the same, no matter which protocol or which service is addressed with the subsequent parameters.

● Protocol-dependent parameters

These parameters are different in all protocols or services.

5.3.1   Protocol-Independent Parameters

Data Word	Contents	
	High Byte	**Low Byte**
DW0	PLC reaction	Error code
DW1	RSS number	Channel number
DW2	Job number	

DW0

The data word 0 sends the result of the job back. This is where the result of the job is passed over after each R5REQ module call.

The result word differs between high byte (PLC reaction) and low byte (error code).

High Byte		Low Byte	
Code [hex]	PLC Reaction	Code [hex]	Error Code
00	Job has been passed to RSS without error	00	Job has been passed to RSS without error
01	Call R5REQ again	01	Job is already being processed
02	Change PLC program	02	Job is in queue
03	Change protocol parameter	03	Job is acknowledged but not yet confirmed
04	Execute R5INIT again	04	Wrong channel number
05	Execute R5REQ again	05	Wrong RSS number
06	Execute R5CON again	06	Wrong job number
07		07	Abortion of job not possible
08	Check system configuration	08	No free job number on the RSS
		10	RSS 0 not initialized
		11	RSS 1 not initialized
		12	RSS 2 not initialized
		13	RSS 3 not initialized
		14	RSS 4 not initialized
		20	RSS 0 not listed in SK table
		21	RSS 1 not listed in SK table
		22	RSS 2 not listed in SK table
		23	RSS 3 not listed in SK table
		24	RSS 4 not listed in SK table
		30	Communication error on the RSS
		31	Communication error on the ZS
		92	Invalid command parameter
		D0	No protocol for channel 0 or channel 1 loaded
		D1	Job queue is full
		D4	R5INIT not called

DW1

In this word it is specified on which COM-E and via which channel this job should be processed.

The RSS number is entered in the high byte of this word. The RSS number is determined with the R5INIT module.

The channel number indicates via which interface of the module the job is supposed to be processed.

DW2

The computer interfaces of the CL400/CL500 make a parallel start of up to 16 jobs possible. By indicating the job number, the jobs can be distinguished. Another job with the same job number can only be started when the old one is finished. Such an attempt during a running job will be rejected by the R5REQ with an error message.

Starting more than one centralized job with different job numbers in a PLC cycle though is possible.

The COM-E can process up to 16 jobs at the same time. To do so, the COM-E is provided with 16 job channels. The job numbers 0 to 15 are assigned directly to the job channels. Jobs with bigger job numbers seek the next free job channel on the COM-E. This is the reason why the numbers 0 to 15 should not be mixed with higher job numbers because jobs could be rejected in spite of free channels.

The job numbers can accept a value ranging from 16#0000 to 16#7FFF.

The 16. bit of the job number has the purpose to delete those jobs from the job queue that have been passed to the computer interface where they are pending for processing.

The job numbers 12 to 15 are reserved for high-priority jobs. Such an indication on the parameter has the effect that this parameter is given high priority and that it is processed accordingly.

The following processing is executed sequentially according to priority.

☞ **Jobs cannot be sent in parallel to a communication partner!**

5.3.2   Protocol-Dependent Parameters

The protocol-dependent parameters are described in the following chapters.

Notes:

6   R5CON

6.1   Characteristics

Characteristics	R5CON
Module name	R5CON
Number of parameters	5
Reserved markers	M230 to M254
Processing time	0.5 ms with ZS500

The function module R5CON controls centralized jobs. It is its task to send information back to the user during processing as well as after the finished job. To do so, it takes the status and the error word from the job table and outputs this information to the address that the user has indicated as the parameter.

With R5CON only one job per call or all error-free and one faulty job can be acknowledged. The R5CON forwards the status and the error word from the job table to the PLC program. If all error-free jobs are acknowledged, the status and the error word only contain the information about the one applicable faulty job.

The R5CON must acknowledge all jobs that have been allocated by the R5REQ and the results of the single jobs are read out. For unconfirmed services, a local acknowledgement is generated.

Only after the acknowledgement is read out, a new job can be started with this job number.

6.2   Parameters

The function module R5CON is provided with two input and three output parameters.
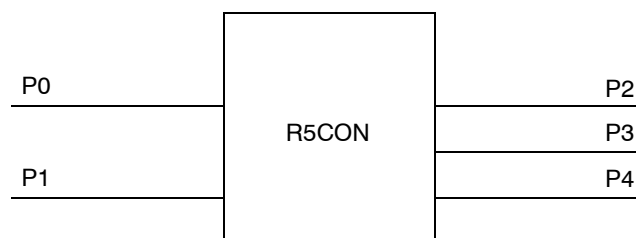
6.2.1   Input Parameters

P0

Parameter	Attribute	Description
P0	W	RSS and channel number

At this parameter, the RSS and the channel number on which the corresponding job was executed, are set.

P1

Parameter	Attribute	Description
P1	W	Job number (16#0000 to 16#7FFF, 16#FFFE or 16#FFFF)

Valid entries are:

- Job numbers from 16#0000 to 16#7FFF or
- the wildcards 16#FFFF and 16#FFFE

By indicating a job number 16#0000 to 16#7FFF, the user selects a specific job for which he wants to get an acknowledgement. This way, a specific job can be controlled.

The given job number is mirrored in the P2 output parameter.

If the 16#FFFE wildcard is specified as a job number, the R5CON function module acknowledges all jobs of the interface named by P0 that have been finished without any error up to this moment.

If additional jobs have been finished with errors, the R5CON acknowledges the faulty job with the highest job number and sends its status and error codes in the output parameters back. Other possible faulty jobs are not acknowledged by this R5CON call.

If no job is finished, the value 16#FFFF is returned to the output parameter P2.

If only error-free jobs are finished, all of them are acknowledged and the value 16#FFFE is returned to the output parameter P2.

If the wildcard 16#FFFF is given in the P1 parameter, the R5CON acknowledges the job that has been processed by the communication module, but whose acknowledgement has not yet been received. If this is applicable to more than one job, the one with the highest job number will be acknowledged. Its job number will then be entered in the output parameter P2. All other jobs will not be acknowledged.

6.2.2　　Output Parameters

P2

Parameter	Attribute	Description
P2	W	Job number

Into this parameter, R5CON writes the number of that job whose status and error codes are available in the P3 and P4 output parameters.

If an explicit job number has been specified in P1, it will be mirrored in P2.

If after the parameterization with P1 = 16#FFFF no job is finished, the value 16#FFFF will be returned to P2 as a job number.

If after the parameterization of P1 = 16#FFFE no faulty job, but one or more jobs without error message are finished, the value 16#FFFE will be returned to P2.

P3

Parameter	Attribute	Description
P3	W	Status / PLC reaction

In this word, the current job status is output with each execution of R5CON. The current job status is indicated in the high byte of this word.

The low byte of P3 provides a code that recommends to the user a suitable measure in case of an error (PLC reaction). This code becomes valid after the job has been finished.

High Byte		Low Byte	
Code [hex]	Job Status	Code [hex]	PLC Reaction
00	Job is finished (terminated) without error	00	Error-free operation
01	Job on the RSS is being processed	01	Repeat call of the R5CON function module
02	Job is in the queue of the RSS	02	Change PLC program
03	Job is finished with error	03	Check and change job parameter
04	No job with this job number is being processed	04	Execute R5INIT function module again
		05	Execute R5REQ function module again
		06	Execute R5CON function module again
		50	Undefined error code, no reaction possible

P4

Parameter	Attribute	Description
P4	W	Error message

In case of an error, i.e. high byte of P3 = 03$_H$, the detailed error code is located in P4. In general, the evaluation of this code is only required during commissioning or in case of service.

The error message is available for one PLC cycle only.

Detailed error descriptions are available:
- for BUEP03E and BUEP64 in the R500 manual, order no. 1070 072 131
- for BUEP-E and BUEP19E in chapter 7.3.3

7　General Information Regarding BUEP-E and BUEP19E

BUEP-E is the name for a communication protocol via Ethernet-LANs that, with regard to the user interface and with the exception of the IP address and the error codes, is identical to the BUEP19E protocol.

The BUEP-E protocol can be processed with the COM-E module on channel 1. It transmits data between a COM-E module and another network node. The other node is determined by its internet address.

The parameters of the function modules are equal for all communication modules (R500, R500P, COM-P, COM-E). They are available in the R500 description.

The protocol parameters of BUEP19E and BUEP-E are different from each other only with regard to the parameter words PW14 and PW15 where the internet address of the communication partner must be specified.

The abbreviations AST and PST that will appear in this description more often have the following meaning:

● AST

　Requesting Station, Client. It describes the communication partner that starts the protocol job.

● PST

　Peripheral Station, Server. It describes the communication partner that reacts to a received protocol job.

7.1   Parameters BUEP-E / BUEP19E

The job parameters correspond to the parameters as they are defined for BUEP19E. In addition to this structure, the internet address of the PST module is entered in the PW14 and PW15 parameter.

Parameter Word	Contents	
	High Byte	**Low Byte**
PW1	PLC reaction	Error code
PW2	RSS number	Channel number
PW3	Job number	
PW4	Type of command: E/A	Type of operand: Byte/Word
PW5	Command code: AST	Command code: PST
PW6	Command attribute AST	
PW7	Address AST high part (ZS block address)	
PW8	Address AST low part	
PW9	Command attribute PST	
PW10	Address PST high part (ZS block address)	
PW11	Address PST low part	
PW12	Amount of data corresponds to type of operand	
PW13	Process coordination point	Field coordination point
PW14	Internet address high part	
PW15	Internet address low part	
PW16	Reserved	

7.1.1   Protocol-Independent Parameters

Job activation of the protocol-independent parameter is done via the R5REQ module.

PW1

Parameter Word	Attribute	Description
PW1	W	Result of the job

This is where after each module call the error message is passed over. The low byte contains the error code and the high byte the proposed PLC reaction.

High Byte		Low Byte	
Code [hex]	PLC reaction	Code [hex]	Error code
00	Job has been passed to RSS without error	00	Job has been passed to RSS without error
01	Call R5REQ again	01	Job is already being processed
02	Change PLC program	02	Job is in queue
03	Change protocol parameter	03	Job is acknowledged, but not yet confirmed
04	Execute R5INIT again	04	Wrong channel number
05	Execute R5REQ again	05	Wrong RSS number
06	Execute R5CON again	06	Wrong job number
07	Reload V.24 protocol	07	Abortion of job not possible
08	Check system configuration	08	No free job number on the RSS
		10	RSS 0 not initialized
		11	RSS 1 not initialized
		12	RSS 2 not initialized
		13	RSS 3 not initialized
		14	RSS 4 not initialized
		20	RSS 0 not listed in SK table
		21	RSS 1 not listed in SK table
		22	RSS 2 not listed in SK table
		23	RSS 3 not listed in SK table
		24	RSS 4 not listed in SK table
		30	Communication error on the RSS
		31	Communication error on the ZS
		92	Invalid command parameter
		D0	No protocol for channel 0 (V24 channel) loaded
		D1	Job queue is full

PW2

Parameter Word	Attribute	Description
PW2	W	RSS and channel number

This word contains the information on which COM-E and via which channel this job is supposed to be processed.

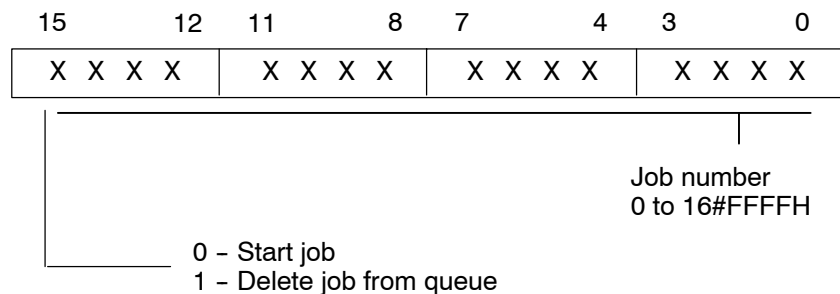| High Byte	Low Byte
RSS number	Channel number

PW3

Parameter Word	Attribute	Description
PW3	W	Job number

At the computer interfaces of the CL400 / CL500, it is possible to start up to 16 jobs in parallel. By indicating the job number, the jobs can be distinguished. Another job with the same job number can only be started when the old one is finished. Such an attempt during a running job will be rejected by the R5REQ with an error message.

Starting more than one centralized job with different job numbers in a PLC cycle though is possible.

15	12	11	8	7	4	3	0
X X X X		X X X X		X X X X		X X X X	

Job number
0 to 16#FFFFH

0 – Start job
1 – Delete job from queue

The job numbers 12 to 15 are reserved for high-priority jobs. Such an indication on the parameter has the effect that this parameter is given high priority and that it is processed accordingly.

7.1.2   Protocol-Specific Parameters

The protocol-specific parameters parameterize the data traffic through BUEP-E for AST and PST. Below, the parameters are going to be explained separately.

Type of Command / Type of Operand

Parameter Word	Contents	
	High Byte	**Low Byte**
PW4	Type of command	Type of operand
Example	41_H	01_H
	Output	Word

Type of Command

This parameter determines the command type of the job. Two types can be distinguished:

- E (45_H) Input in the AST
- A (41_H) Output from the AST

The direction of the jobs always refers to the AST, so that an output job $(41_H \rightarrow A)$ transmits data from the AST to the PST and an input job $(45_H \rightarrow E)$ transmits data from the PST to the AST.

A job which is started with a differing command type results in the abortion of the job with a corresponding error message.

Type of Operand

The low byte of the parameter describes the type of operand of the job. According to which AST command code is applicable, eight different operand types can be used:

Code [hex]	Data Type	Number in Bytes
00	Byte	1
01	Word	2
02	Double word	4
03	Quad word	8
04	Byte mask	2
05	Word mask	4
06	Double word mask	8
07	Quad word mask	16

When selecting the operands, please check if they are supported by the PST.

Command Codes AST / PST

Parameter Word	Contents	
	High Byte	**Low Byte**
PW5	Command code AST	Command code PST
Example	44$_H$	44$_H$
	Data module	Data module

The command code (Hex-code of the command) of the AST is specified in the high byte of this parameter, and the command code of the PST is specified in its low byte.

Command Attribute AST

Parameter Word	Contents
PW6	Command attribute AST
Example	17$_H$
	Data module 23

Address AST High Part

Parameter Word	Contents
PW7	Address AST high part
Example	10$_H$
	ZS 2

In the PW7 parameter word, the block address of the module, to which the AST command is referred, is specified.

Address AST Low Part

Parameter Word	Contents
PW8	Address AST low part
Example	32$_H$
	50 bytes

In the low part of the AST address, the byte address (offset) of the used command is specified.

Command Attribute PST

Parameter Word	Contents
PW9	Command attribute PST
Example	A$_H$
	Data module 10

Address PST High Part

Parameter Word	Contents
PW10	Address PST high part
Example	F0$_H$
	ZS400

In this parameter, the block address of the module to which the PST command is referred, is specified.

Address PST Low Part

Parameter Word	Contents
PW11	Address PST low part
Example	46$_H$
	70 bytes

In the low part of the PST address, the byte address (offset) of the used command is specified.

Amount of Data

Parameter Word	Contents
PW12	Amount of data (in data types) according to type of operand
Example	28$_H$
	Amount = 40

In this parameter, it is specified how much data – in relation to the operand type – has to be transferred.

If the operand type 'mask' is used, the amount of data must be set to 1. Then, the double length (setting mask and resetting mask) of the type that is specified in the mask identifier (e.g. the word mask) is always transmitted in the following order: low part, high part.

Example:

Parameter Word	PW11	Number in Bytes
Byte	3	3
Word	7	14
Double word	2	8
Quad word	5	40
Byte mask	1	2
Word mask	1	4
Double word mask	1	8
Quad word mask	1	16

Coordination

Parameter Word	Contents	
	High Byte	**Low Byte**
PW13	Process coordination point	Field coordination marker
Example	02_H	FF_H
	I/O status	No coordination marker

The parameter coordination is composed of a field coordination marker (low byte) and a process coordination point (high byte).

It is the coordination markers' task to coordinate the execution of an instruction on the PST. It is executed only if the corresponding coordination event is 'true'; for the CL500, this means, that you must be in the process coordination point or that the field coordination marker must be set to 1; the same is applicable to other controllers.

Controller Type CL500 as PST

The command 'control central unit' in the CL500 system uses two kinds of coordination markers:

- Process coordination marker (AKM) and
- for ZS501 and up: Field coordination marker (FKM)

The AKMs are set as follows:
- 00_H System STOP status
- 01_H System RUN status
- 02_H I/O status
- 03_H I/O status or STOP
- 04_H EP
- 05_H EP or STOP
- 06_H OM1
- 07_H OM1 or STOP
- FF_H No process coordination

The FKMs in the special marker area are determined as follows:
- SM16.0 to SM17.7: one-time FKMs

  These FKMs are reset by the system after execution of the coordinated command.

- SM18.0 to SM19.7: permanent FKMs

  These FKMs are not reset by the system after execution of the coordinated command.

The FKMs are coded as follows:
- SM16.0 to SM 17.7:   FKMs 0_H to F_H
- SM18.0 to SM 19.7:   FKMs 10_H to $1F_H$
- No field coordination: FKMs FF_H

Internet Address High Part

Parameter Word	Contents	
	High Byte	**Low Byte**
PW14	Byte 1	Byte 2
Example	2_H	$8E_H$
	2.	142.

In this parameter, the high part of the PST's Internet address is specified. This parameter must be considered with parameter PW15.

Internet Address Low Part

Parameter Word	Contents	
	High Byte	**Low Byte**
PW15	Byte 1	Byte 2
Example	80_H	$1A_H$
	128.	26.

In this parameter, the low part of the PST's Internet address is specified. This parameter must be observed with parameter PW14.

Example: Internet address 142.2.26.128 $\rightarrow$ $8E021A80_H$

The addresses are divided into classes: Class A, Class B, Class C, Class D, and Class E. These addresses always form a 32 bit value which must be filed on these parameter bytes using the 'big-endian' format.

☞ **Please use the 'ISTRING' format for address input in the data module!**

ISTRING 142.2.28.17

7.2   Command Description for Central Units

It is distinguished between field commands and special commands.

7.2.1   Field Commands

Data Field 43$_H$

Command	Data Field
Command code	43$_H$
Command attribute	FFFFH
Address high part	Block address
Address low part	Byte address 0 to 24k
Type of operand	all

Data Module without Header 44$_H$

Command	Data Module without Header
Command code	44$_H$
Command attribute	DM number 0 to 255 (511)[1]
Address high part	Block address
Address low part	Byte address 0 to 511
Type of operand	all

1) with relevant ZS configuration, starting at RAM module 256 kB.

Marker 4D$_H$

Command	Marker
Command code	4D$_H$
Command attribute	0
Address high part	Block address
Address low part	Byte address 0 to 255
Type of operand	all

Data Buffer 64$_H$

Command	Data Buffer
Command code	64$_H$
Command attribute	0
Address high part	Block address
Address low part	Byte address 0 to 511
Type of operand	all

7.2.2   Special Commands

Identification Command 76$_H$

Command	Identification Command
Command code	76$_H$
Command attribute	Control code
Address high part	Block address
Address low part	0
Type of operand	0

Description of the control codes:

High Byte								Low Byte
7	6	5	4	3	2	1	0	Identification number

Identification number other than FF$_H$

Bit 0	0	Without identification code
	1	With identification code
Bit 3	0	Without protocol priority
	1	With protocol priority
Bit 4	0	Take over identification number
	1	Do not take over identification number
Bit 5 to 7	0	Reserved

Description of the identification codes:

Device identification	Word	CL500	16#0000
Type identification	Word	COM-E	16#3084
SW version	Byte	Binary code	
HW version	Byte	Binary code	
Module block address	Word		

Read PLC Operating Mode 7A_H

Command	Identification Command
Type of command	E
Command code	7A_H
Command attribute	0
Address high part	ZS/SK block address
Address low part	0
Type of operand	0

The command provides 1 word (= 2 bytes) status code.

☞ **Only permitted as PST command!**

Description of the status code:

High Byte	Low Byte							
0	7	6	5	4	3	2	1	0

Status code of SK500: (Block address = 0xff)

Bit 0	0	CLAB active
	1	CLAB not active
Bit 1 to 3	x	Reserved
Bit 4	0	System in RUN
	1	System in STOP
Bit 5 to 7	x	Reserved

Status code of ZS500/ZS400:

Bit 0	0	Module in RUN
	1	Module in STOP
Bit 1	x	Reserved
Bit 2	0	Outputs disabled
	1	Outputs enabled
Bit 3 to 7	x	Reserved

7.3   Error Messages

The BUEP-E protocol creates error information that is divided into three areas:

- PLC reaction (byte)
- Error class (byte)
- Error code (byte)

The error information is filed in the feedback parameter of the R5CON in the following order:

7.3.1   Parameter 3, Status / PLC Reaction R5CON

High Byte		Low Byte	
Code [hex]	**Job Status**	**Code [hex]**	**PLC Reaction**
00	Job is finished (completed) without error	00	Operation without error
01	Job on the RSS is being processed	01	Repeat call of FM R5CON
02	Job in queue of RSS	02	Change PLC program
03	Job is finished with error	03	Check and change job parameter
04	No job with this job number is being processed	04	Process FM R5INIT again
		05	Process FM R5REQ again
		06	Process FM R5CON again
		50	Undefined error code, reaction not possible

7.3.2   Parameter 4, Error Messages R5CON

High Byte	Low Byte
Error class	Error code

The error class provides a notice regarding the generation point of the error information. The following declarations have been made:

Error Class [hex]	Explanation
00	Error-free
30	System bus communication between ZS and COM-E
33	Job execution AST (= on the COM-E)
34	Protocol processing on the COM-E
40	Job execution PST (error byte 1)
41	Job execution PST (error byte 2; module-specific)
FF	Error message of the function modules

7.3.3 Catalogue of Errors

The PW column contains the parameter which has probably caused the error.

Error Information [hex]				Explanation
Reaction	Class	Code	PW	
00	00	00		Error-free job

Error during command execution on one's own AST module

Error Information [hex]				Explanation
Reaction	Class	Code	PW	
01	30	21		RUN error. The module is in the RUN state. The specified command cannot be executed, AST
01	30	22		Change of operating mode not possible, AST
03	30	23	4, 5	AST field access not permitted; the desired access (read/write/bit) is not applicable for this field.
01	30	24		AST field protection active; at the moment, the desired field is reserved by another position
01	30	25		Timer disabled; actual time values can only be changed when time is running
03	30	26	6	AST module number too large; larger than the allowed maximum value
03	30	27	6	AST data module not available, in the application program
03	30	28	8, 12	AST data module too small, in the application program
03	30	2B	Data	Error during writing to the system clock
01	30	E0 to FF		Reserved for system bus error
01	33	02		Memory access error
03	33	03	4	Wrong memory type; e.g. writing on EPROM memory
03	33	10	7	No module exists for the specified AST block address
03	33	18	5	Unsupported command code; unequal to D/DB/DF/M
03	33	19	4	Type of command neither E nor A
03	33	20	5	AST command code undefined
03	33	3A	4, 8	Wrong address orientation, e.g. writing a word on odd addresses
03	33	3B	8	Invalid address range
03	33	3C	e.g. 6	Invalid parameter
03	33	3D		Invalid type of operand
03	33	63		Buffer overflow, amount of data too much
01	34	05		Server does not respond; Time-out
01	34	06		Server not found; no ARP
03	34	07	14, 15	No server found for specified IP address
01	34	08		No IP address entered on the module

Error during command execution on the partner module PST

Error Information [hex]				Explanation
Reaction	**Class**	**Code**	**PW**	
01	40	02		Memory access error
03	40	03	4	Wrong memory type, e.g. write access on EPROM
01	40	05		Internal error during processing of the command on the PST
03	40	10	10	No module exists for the specified PST block address
03	40	20	5	PST command code unknown
03	40	23	13	Invalid coordination marker on the PST
03	40	26	12	Block length error
03	40	3A	4, 11	Wrong address orientation, e.g. writing a word on odd addresses
03	40	3B	11	Invalid address range
03	40	3C	9	Invalid parameter
03	40	3D	4	Invalid type of operand
03	40	63		Buffer overflow; data length is greater than the available memory of 200_H bytes.
03	40	D2	13	Coordination marker disabled.
01	40	xy		Module-specific error.
01	41	20		STOP error; the module is in the STOP state. The specified command cannot be executed.
01	41	21		RUN error; command cannot be executed in RUN.
03	41	23	4, 5	Field access not allowed; the desired access (read/write/bit) is not applicable for this field.
01	41	24		Field protection active; at the moment, the desired field is reserved by another position.
01	41	25		Timer disabled; actual time values can only be changed when time is running.
03	41	26	9	Module number too high; higher than the allowed maximum value.
03	41	27	9	Data module not available, in the PST.
03	41	28	11	Data module too small, in the PST.
03	41	2B	Data	Error during writing on the system clock.
01	41	xy		Module-specific error.

7.4 Password

BUEP-E enables several clients to access the controller via the COM-E module. This can be preferred in many cases, but it can also lead to problems. Therefore, a password function is provided for protection.

☞ **The default password is: BoschPlcSystems**

The PG knows this password and tries to log in automatically. If the password has not been altered, the programmer will not even notice that a password exists. If the password has been changed, communication with the controller in the PG is only possible after correct password confirmation. The password can be altered via the configuration file or the programming unit.

The password verification is only active for writing commands and/or outputs (A) into the controller.

☞ **A password can only be reset if the reset button on the relevant COM-E module is pushed during switch-on.**

Notes:

8   TFTP Protocol

In addition to the BUEP-E communication protocol, the TFTP protocol (Trivial File Transfer Protocol) is realized on the module, specification according to RFC 782 of 1992.

It provides a PC or a Unix computer with a simple possibility of communicating with the controller. The controller can read data fields of up to 510 bytes. Bigger fields are not supported. Writing into the data fields is not allowed either because of data security reasons.

The controller and the corresponding data fields are interpreted as a file system and can be read out by the COM-E module under the corresponding file name.

Addressing of Operands / File system

<Type of Controller> <Type of Operand> <Operand Offset> <Amount of Operands>

Type of Controller:

- CL50   CL500 ZS0
- CL51   CL500 ZS1
- CL52   CL500 ZS2
- CL53   CL500 ZS3
- CL4   CL400

Type of Operand:

- I   Input
- O   Output
- M   Marker
- D   Data word
- DF   Data field
- DM   Data module

Operand Offset:

- From this decimal number on, the data is read in.

Amount of Operands:

- L   Initial identifier of amount of operands

Decimal number with the data amount 0 to 510.

Special case:

- In case of data words, the data module must be specified after the type of the controller.

Examples:

- CL4M6L20   CL400, starting at marker 6, 20 bytes
- CL51DF100L200   CL500/ZS1, starting at data field 100, 200 bytes
- CL4DM0D0L510   CL400, data module 0, starting at data word 0, 510 bytes

Call from the PC

TFTP <Host> GET <Source> [<Destination>]

Example:

TFTP 142.24.26.129 GET CL4DM0D0L510 DBAU0

The DBAU0 file is where the contents of the data module 0 are filed.

Error Messages

Illegal TFTP commands produce the error string:
- Illegal TFTP operation

Wrong source operands/source file coding produces:
- File not found

On the protocol level, these errors are signaled by ICMP messages.

A wrong host address or a COM-E module that is momentarily not address-able produces, after 26 seconds, the error string:
- Time-out

In addition, the error listing of the COM-E module provides the following error codes:
- Err1:   42   Identification TFTP error
- Err2:   01   Illegal TFTP opcode
           02   Illegal controller
           03   Illegal operand
           04   Illegal length

9   Ethernet Job Listing

The job listing is a local bus monitor which displays all protocol activities as well as all received and sent commands.

The Ethernet job listing is enabled via the connected terminal at the upper interface.

For protocol selection for the upper interface, the setting 'no protocol' must be switched on via the DIP switch S3.

The following keyboard entries are important:

Key	Function
T	Switch on/off job listing
E	Switch on/off error listing, only possible if job listing is switched off.
D	Display format of Hex/String switch-over for string output
H, ?	Display of allowed key inputs
K, C	Display of the communicating stations, with AST commands
B	Display of the bus parameters and statistics
P	Display of the system modules
I	Input of the Internet address, e.g. 142.2.26.128
N	Input of the module name, string max. 31 characters
M	Display of the message that was output last

If listing is enabled, then the channel 0 for the V.24/20mA protocols BUEP19E, BUEP64, and BUEP03E is disabled.

Via this interface, the Ethernet protocol software then outputs test messages. Thus, the user can follow the communication process by connecting a terminal or a printer, which is a useful tool in the commissioning phase.

☞ **The job listing function is only intended for usage during commissioning because it slows down the data traffic on the Ethernet interface significantly.**

☞ **As error messages, mostly Error Class and Error Code are output. The error and/or the cause of the error can be localized via the error message lists in the description of the R5CON module.**

Numbers are mostly output in the hexadecimal number system.

Job Listing

Job listing is switched on and off with the T-button.

During switch-on and switch-off, error listing, too, is switched on and off with the T-button. If job listing is enabled, the middle segment at the upper segment display is activated.

Error Listing

Error listing is switched on and off with the E-button.

Error listing can only be switched on if job listing is switched off. If error listing is enabled, the lower segment at the upper segment display is activated.

Message Data Output

With job listing, only client and server commands are output. In addition, the O-button is used for switching on and off the output of the message data.

The message data output is only effective if job listing is switched on.

List of Communicating Stations

Via the K- or the C-button, the list of communicating stations is output. This list contains the assignment of the Ethernet address to the IP address.

In addition, the list of communicating stations contains information about whether the list entry is free or reserved and for how long the entry is still going to be valid. The timer is set to the value of the retransmission timer by client jobs.

If an external communication station uses a password, 'attached' is displayed.

Example:

act. Serverlist

```
Ethadr: 00-60-34-00-08-1F IP-Adr: 142.2.26.144 Timer: 0  static
Ethadr: 00-60-34-00-08-0B IP-Adr: 142.2.26.146 Timer: 0  static attached
Ethadr: 00-60-34-00-08-0A IP-Adr: 142.2.26.145 Timer: 0  static
Ethadr: AA-00-04-00-02-40 IP-Adr: 142.2.1.100  Timer: 52 used attached
Ethadr: 00-00-0C-4E-58-0D IP-Adr: 142.2.1.102  Timer: 59 used
...
```

This list also shows the static part of the ARP table which is preset by the configuration file.

Bus Parameters

Via the B-button, the set bus parameters and an overview of the handled data traffic are displayed.

Example:

COM-E name: Control_1
Ethernet address: 00-60-34-00-08-0B
Internet address: 142.2.26.146
Retransmission counter: 16
Retr.Timer: 200   Constant retransmission

Subnet mask: 255.255.0.0   Default gateway 0.0.0.0

AstKmd: 00000527
Rep-AstKmd: 00000050
Arp: 00000009
Icmp: 00000001
IP: 001FE135
Rep-Ip: 0000002E
OverrunCnt: 00000000

AstKmd: Number of executed client jobs
Rep-AstKmd: Number of message repeats with these client jobs
Arp: Number of received ARP request messages
Icmp: Number of received ICMP requests (Ping)
IP: Number of received client jobs
Rep-Ip: Number of message repeats with the received client jobs
OverrunCnt: Overruns in the Ethernet controller

Backplane Module Display

Via the P-button, the modules that have been recognized in the card rack are displayed.

Example:

VFD 0:   ZS400   BlkAdr: 00F0   0000   Version   0025   stat   0410
VFD 9:   COM-E   BlkAdr: 0024   0000   Version   0011   stat   0000

VFD 0 to 9   Module number in the SK table
Module type
BlkAdr   Set block address of the module
Version   High byte = hardware version / Low byte = software version

Internet Address

Normally, the internet address is entered in the SK table of the controller. Older versions of the SK500 or the ZS400 though do not support this entry. If these modules are used, the IP address can be specified via the terminal.

The address must be entered in the following form:
number.numbers.numbers.numbers

Editor utilities are:

- Delete   deletes the last entry
- Return   finishes the entry
- Escape   aborts the entry without storing the entered data

Retransmission Timer / Retransmission Counter

These two values are normally specified by the configuration file. For commissioning or when working without the configuration file, the default values can be changed via a terminal.

Editor utilities are:

- Delete   deletes the last entry
- Return   finishes the entry
- Escape   aborts the entry without storing the entered data

Module Name

The input of the module name is initialized with the N-button. The module name can have a maximum of 31 characters.

As characters, the ASCII characters >0x20 and < 0x7f are applicable.

Editor utilities are:

- Delete   deletes the last entry
- Return   finishes the entry
- Escape   aborts the entry without storing the entered data

External ARP Table

The external ARP table can be output via the A-button. The Ethernet addresses of the network nodes that have established a connection with the COM-E module are stored in this ring memory with 64 entries.

Example:

ARP requests:

IP: 142.2.42.96, Eth: 00–60–08–44–74–11
IP: 142.2.36.86, Eth: 00–60–08–34–91–30

9.1   Client Command

The command is activated through the PLC program. R5INIT is executed during startup. A command is activated with the R5REQ module.

Example:

Job 32, data module 14, read with 512 bytes; Communication partner is CL400.

Display:

1. Id: 0020, Rd-Kmd: 44, High: 00F0, Low: 0000, len: 200, Erg: 000E

2. TX IP-Rq

3. Receive-Data:

4. 34 45 56 ....

5. Command finished

Reg. 1.:
- Id: 0020   Job number 32
- Rd-Kmd: 44   Read command data module
                    43 = DF, 44 = DM, etc.
- High: 00F0   Address high part (PST)
                    Block address
- Low: 0000   Address low part (PST)
                    Byte address, offset
- len: 200   Number of bytes
                    is calculated with data type and amount
- Erg: 000E   Command attribute (PST)
                    Data module number

Reg. 2.:
- TX IP-Rq   Transmit IP request
                    Command is sent via the bus

Reg. 3.:
- Receive-Data   Receive response message

Reg. 4.:
- 34 45 ...   Received data

Reg. 5.:
- Command finished Command has been executed and completed.

9.2   Server Command

A bus node requests data from the module or writes data. In the PLC program, this does not require a communication function module.

Example:

Data module 10, read with 512 bytes, read from ZS0.

Display:

1. Rx-Rd-Kmd: 44, High: 0000, Low: 0000, len: 200, Erg: 000A

2. Tx 0200 Byte

Reg. 1.:

- Rx-Rd-Kmd: 44   Received command
                          Read command data module
                          43 = DF, 44 = DM, etc.

- High: 0000   Address high part
                          Block address

- Low: 0000   Address low part
                          Byte address, offset

- len: 200   Number of bytes
                          is calculated with data type and amount

- Erg: 000A   Command attribute
                          Data module number

Reg. 2.:

- TX 0200   Transmit number of traffic channel bytes
                          512 bytes user data are sent

9.3   Error Messages

9.3.1   Client Error Messages

Error-free client commands are finished by:

● Command finished

Faulty commands are finished by:

● Command aborted Errorcode: 3363; Buffer overflow, amount of data too large
● Rx IP-Rs BUEP-Error: Err1: 10, Err2: 00

Err1 corresponds to the error code in the error table.

Err1: 10 Err2: 0 = PST block address wrong

9.3.2   Server Error Messages

Error-free server commands display the received command only.

Errors that appear during the execution of the received command are output with the message:

● BUEP: Err1: 10, Err2: 00

This error message is also sent to the client.

Err1 corresponds to the error code in the error table.

Err1: 10 Err2: 0 = PST block address wrong

9.3.3   ICMP Error Messages

The ICMP signals (Internet Control Message Protocol) are generated by ICMP messages on the Ethernet.

Messages that are directly processed on the module:

● ECHO REPLY
● ECHO REQUEST
● REDIREKT

The other messages are indicated in the error output.

Errors that usually lead to a job abortion:

● DESTINATION UNREACHABLE
● TIME EXCEEDED
● PARAMETER PROBLEM

Type	Code	Explanation
3		destination unreachable
	0	network unreachable
	1	host unreachable
	2	protocol unreachable
	3	port unreachable
	4	fragmentation needed but don't-fragment bit set
	5	source route failed
	6	destination network unknown
	7	destination host unknown
	8	source host isolated
	9	destination network administratively prohibited
	10	destination host administratively prohibited
	11	network unreachable for TOS (Type of Service)
	12	host unreachable for TOS
	13	communication administratively prohibited by filtering
	14	host precedence violation
	15	precedence cutoff in effect
4	0	source quench
9	0	router advertisement
10	0	router solicitation
11		time exceed
	0	time-to-live equals 0 during transit
	1	time-to-live equals 0 during reassembly
12		parameter problem
	0	IP header bad
	1	required option missing
13	0	timestamp request
14	0	timestamp reply
15	0	information request
16	0	information reply
17	0	address mask request
18	0	address mask reply

10   Time Characteristics

The two diagrams below demonstrate the time characteristics and the bus load in dependence of the number of clients.

The measurements were done with an Ethernet bus analyzer. The analyzer calculates the average bus load and the number of messages of the server. The two diagrams that follow are the result of both measuring examples.

Example 1

Measuring System	Module	Number of COM-E Modules	Cycle Time
Server configuration	ZS400	1	min. 65 ms, max. 75 ms
Client controller 1	SK500 ZS500	5	Approx. 10 ms
Client controller 2	ZS400	5	Approx. 10 ms
Client controller 3	SK500 ZS501	5	Approx. 10 ms

All clients read a data module with 512 bytes from the server. The commands are STOP- or EP-coordinated.

Example 2

Measuring System	Module	Number of COM-E Modules	Cycle Time
Server controller 1	SK500 ZS500	5	
Client configuration	ZS400	1	Approx.10 ms

The client continuously requests a data module with 512 byte. The server controller is in the STOP state.

A reading command, 512 byte, lasts approximately 41 ms.

A writing command, 512 byte, lasts approximately 41 ms as well.

Bus Load (Number of Clients)

Bus Load [%]

Number of Clients

Bus Load (max.) [%]
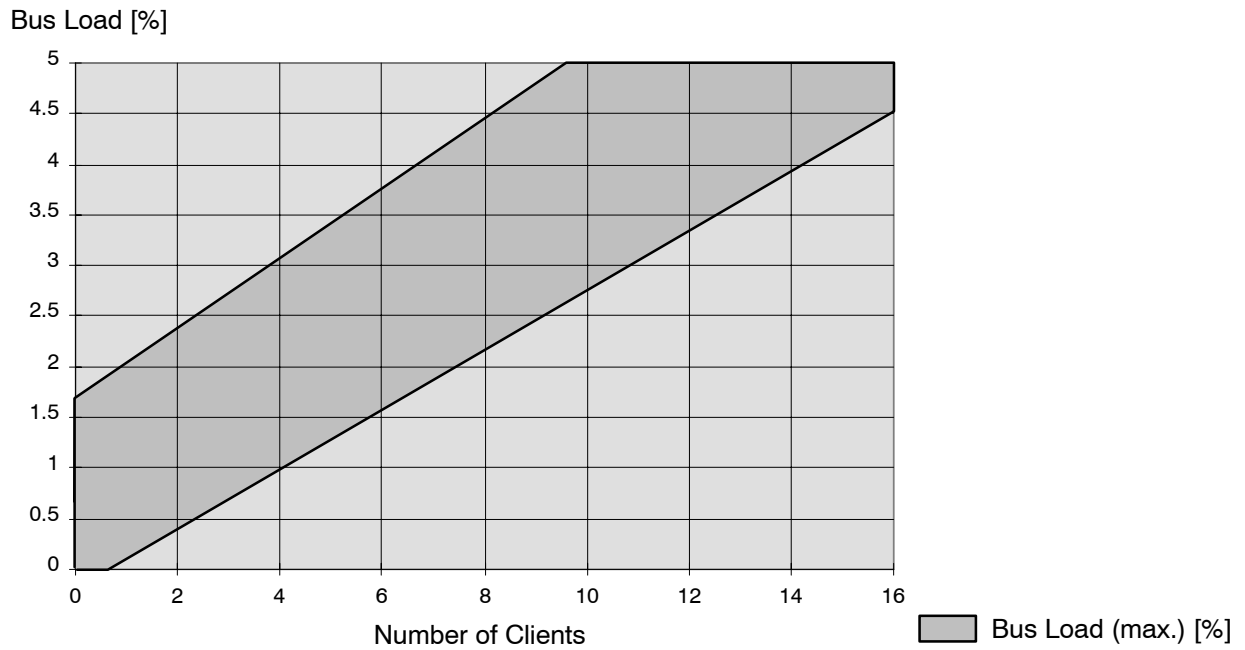
Time of Transmission (Number of Clients)

[ms]

Number of Clients

Time of Transmission
[ms]
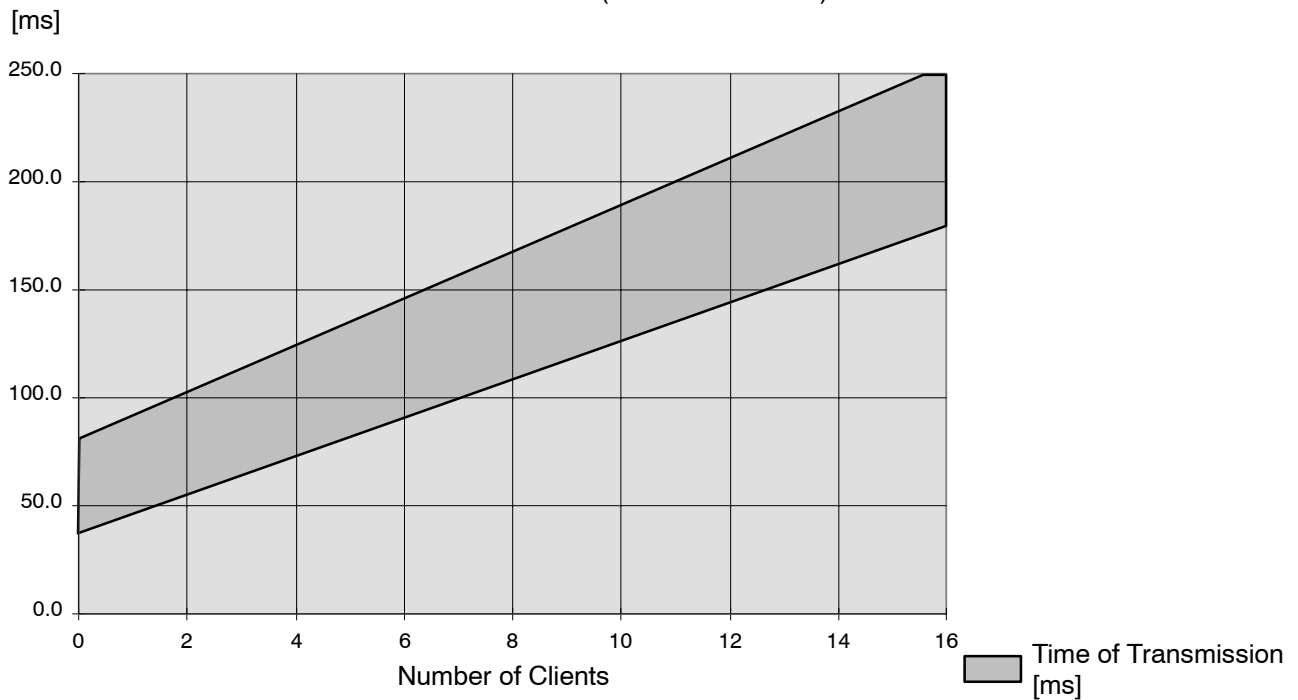
11   PLC Program Examples

11.1   Function Module

Below you find an example of a function module for reading out via Ethernet a data module from another controller. The parameters are generated dynamically in a DM. All auxiliary variables are located in this DM as well. After the DM has been read in, a counter variable is incremented and a new reading job is started.

```
; -----------------------------------------------------------------------------
; Reading a DM via Ethernet
; Parameter handling in a work DM
; -----------------------------------------------------------------------------
; Call parameters of the module
;P0   RssNr WORD VAR_INPUT      RSSNo. (RSS No. in the high byte)
;P1   DB_NR WORD VAR_INPUT      Data module to command handling (min. 60 words)
;P2   STATUSWORD VAR_IN_OUT     Statuses of the command (0:New  1:Run  2:O.K.
;                               otherwise error)
;P3   DBNrPSTWORD VAR_INPUT     DM number on the PST
;P4   BlkAdrPSTWORD VAR_INPUT   Block address PST
;P5   DBNrASTWORD VAR_INPUT     DM number on the AST
;P6   BlkAdrASTWORD VAR_INPUT   Block address AST
;P7   Anzahl WORD VAR_INPUT     Amount of data to be read (in words)
;P8   Offset WORD VAR_INPUT     Offset in the DMs
;P9   IPAdr_LWORD VAR_INPUT     Low part Internet address
;P10  IPAdr_HWORD VAR_INPUT     High part Internet address
;P11  CNT WORD VAR_IN_OUT       Command counter

;Usage of the scratch DM
;DM 0 to 31 CommandParameter
;DM 32 to 37 Error
DEF      D38,-ErgMerk          ;Marker for module result
DEF      D40,-ErrMerk          ;Marker for module error
DEF      D42,-DBnr
DEF      D44,-Para1            ;Call parameters Req and Con
DEF      D46,-Para2
DEF      D48,-Para3

L    W   -DB_Nr,A              ;Activating the work data module
CM       [A]
T    W   A,-DBnr

L    W   -Status,A            ;Evaluation of current command status
CPLA W   0,A
JPZ      initdata             ;At 0: new command
CPLA W   1,A
JPZ      execute              ;At 1: poll command
CPLA W   2,A
JPZ      vonvorn              ;At 2: trigger new command
fehler:                       ;otherwise: error
EM
```

```
;Initialization and composition of the command

vonvorn:                        ;Trigger command again
L    W    -CNT,A                 ;Increment counter by 1
INC  W    A,1
T    W    A,-CNT
L    W    0,A                    ;Status on Start
T    W    A,-Status

initdata:                       ;Start command: at first, prepare parameter

L    W    16#0800,A             ;Basic address active DM DW0 for indirect
                                ;addressing to A
L    W    A,B                    ;and to B
L    W    19,C                   ;Length in C = 16 + 3 words
L    W    0,D                    ;Value 0 to D

il_1:                           ;Delete entire block
T    W    D,[B]                  ;Value on address
INC  W    B,2                    ;Increment (byte) address
DEC  W    C,1                    ;Decrease length
JPN       il_1                   ;to length = 0

INC  W    A,2
L    W    -RssNr,D               ;Number of RSS (R5INIT)
O    W    16#0001,D              ;and of channel 1
T    W    D,[A]                  ;Write into DM

INC  W    A,2
L    W    -DB_Nr,D               ;Generate job number from the
                                ;DM no. + 0x100

ADD  W    16#100,D
T    W    D,[A]

INC  W    A,2
L    W    16#4501,D              ;Data type Word (= 01); 45 corresponds to reading 'E'

T    W    D,[A]

INC  W    A,2
L    W    16#4444,D              ;Command code PST and AST = 'D'
T    W    D,[A]

INC  W    A,2
L    W    -DBNrAST,D             ;Command attribute AST
T    W    D,[A]

INC  W    A,2
L    W    -BlkAdrAST,D           ;Block address AST (CL400 = 0xf0)
T    W    D,[A]

INC  W    A,2
L    W    -Offset,D              ;Address AST low part
T    W    D,[A]

INC  W    A,2
L    W    -DBNrPST,D             ;Command attribute PST
T    W    D,[A]
```

```
INC   W   A,2
L     W   -BlkAdrPST,D       ;ZS block address PST
T     W   D,[A]

INC   W   A,2
L     W   -Offset,D          ;Address PST low part
T     W   D,[A]

INC   W   A,2
L     W   -Anzahl,D          ;Amount of words to be read
T     W   D,[A]

INC   W   A,2
L     W   16#7F7F,D          ;e.g. without coordination marker
T     W   D,[A]

INC   W   A,2
L     W   -IPAdr_H,D         ;Internet address high word
T     W   D,[A]

INC   W   A,2
L     W   -IPAdr_L,D         ;Internet address low word
T     W   D,[A]

;Command execution

Request:                     ; Transmit request

CM        -R5REQ,6
P0    W   16#44              ; <  Data range for protocol parameters
P1    W   -DBnr              ; <  Data module number
P2    W   0                  ; <  Offset
P3    W   16#0001            ; <  Job bit bar
P4    W   -ErrMerk           ;  > Error message of the FM
P5    W   -ErgMerk           ;  > Result bit bar

L     W   -ErgMerk,B
L     W   -ErrMerk,A
CPLA  W   0,A                ;if no error: continue
JPZ       weiter
L     W   3,A                ;error during request
T     W   A,-Status

EM

weiter:
L     W   1,A                ; Set status to 1 (= Running)
T     W   A,-Status

execute:                     ; Polling of command

waitCon:                     ; Wait for confirmation

L     W   16#0800,A          ; Basic address for indirect addressing act. DM
INC   W   A,2                ; Address on DW1
L     W   [A],B              ; Take RSS no. from DW1
T     W   B,-Para1

INC   W   A,2                ; Address on DW2
L     W   [A],B              ; Take job number from DW2
T     W   B,-Para2
```

```
;Confirmation module
CM      -R5CON,5                ;
P0  W   -Para1                  ;RSS
P1  W   -Para2                  ;Job number
P2  W   -Para3                  ;Result bit bar
P3  W   -ErgMerk                ;Result
P4  B   -ErrMerk                ;Error identifier

L   W   -Para3,B
L   W   -ErrMerk,C
L   W   -ErgMerk,A

U   W   16#FF00,A               ;Mask low byte
CPLA W  16#200,A
JPZ     inBearb                 ;High byte 02: being processed
CPLA W  16#100,A
JPZ     inBearb                 ;High byte 01: being processed
CPLA W  16#000,A
JPZ     ende                    ;High byte 00: Command completed

fehler:                         ;Otherwise error evaluation
L   W   3,A                     ;Status on error
T   W   A,-Status
L   W   -ErrMerk,B
JP      kmdende

ende:                           ;Command completed
L   W   2,A                     ;Status on o.k.
T   W   A,-Status
JP      kmdende

inBearb:
JP      kmdende

kmdende:
L   W   -Status,A
CPLA W  2,A
JPAG    errbeha                 ;Jump arithmetically higher to error handling
EM

errbeha:

;here, a special treatment for specific errors can be introduced
;L   W   -ErrMerk,A
;CPLA W  16#F003,A
;JPZ     noerror

;Storing the errors
L   W   16#0820,A               ; Offset for error in DM
L   W   -ErrMerk,B
T   W   B,[A]
INC W   A,2
L   W   -ErgMerk,B
T   W   B,[A]

EM
```

```
;noerror:
;L   W   0,A
;T   W   A,-ErrMerk
;L   W   2,A
;T   W   A,-Status
;EM
```

```
;noerror:
;L   W   0,A
```

11.2   Job Parameters in the Data Module

Two parameter fields for one reading and one writing job of a data module. These parameters are added to the request module R5REQ as job parameters.

```
; -------------------------------------------------------------------
; Data Module File
; -------------------------------------------------------------------
LENGTH=512                      ;Length of the data module in bytes

                                ;***** Read-DM12 to DM11 command *****
                                ;DW0
     0  UINT      16#0000
                                ;RSS and channel number
     2  UINT      16#0001
                                ;Job number (0x60)
     4  UINT      16#0060
                                ;P3 type of command (45=E)/ type of operand (00=Byte)
     6  UINT      16#4500
                                ;P4 command code AST (44=DM) / Com. PST (44=DM)
     8  UINT      16#4444
                                ;P5 command attribute AST (DM no./data field no.)
    10  UINT           11
                                ;P6 block address AST (AST=CL400)
    12  UINT      16#00f0
                                ;P7 byte offset AST
    14  UINT      16#0000
                                ;P8 command attribute PST (DM no./DF no.)
    16  UINT           12
                                ;P9 block address PST (PST=CL400)
    18  UINT      16#00f0
                                ;P10 Byte offset PST
    20  UINT      16#0000
                                ;P11 amount of data according to type of data
    22  UINT          512
                                ;P12 process coordination point /
                                ;field coordination marker 05 = EP or Stop /
                                ;7F = without field coordination marker
    24  UINT      16#057f
                                ;IP address of the communication partner 142.2.26.136
                                ;(different representation:
                                ;OSTRING(4) <8e><02><1a><88>)
    26  ISTRING "142.2.26.136"
    30  UINT            0
```

```
                        ;***** Read-DM13 to DM11 command *****
                        ;DW0
   32 UINT        16#0
                        ;RSS and channel number
   34 UINT      16#0101
                        ;Job number (0x61)
   36 UINT        16#61
                        ;P3 type of command (41=A)/ type of operand (00=Byte)
   38 UINT      16#4500
                        ;P4 command code AST (44=DM) / Com. PST (44=DM)
   40 UINT      16#4444
                        ;P5 command attribute AST (DM no./data field no.)
   42 UINT          11
                        ;P6 block address AST (AST=CL400)
   44 UINT      16#00f0
                        ;P7 byte offset AST
   46 UINT      16#0000
                        ;P8 command attribute PST (DM no./DF no.)
   48 UINT          13
                        ;P9 block address PST (PST=CL400)
   50 UINT      16#00f0
                        ;P10 byte offset PST
   52 UINT      16#0000
                        ;P11 amount of data according to type of data
   54 UINT         512
                        ;P12 Process coordination point /
                        ;field coordination marker 05 = EP or Stop /
                        ;7F = without field coordination marker
   56 UINT      16#057F
                        ;IP address of the communication partner 142.2.26.129
                        ;(different representation:
                        ;OSTRING(4) <8e><02><1a><81>)
   58 ISTRING "142.2.26.129"
   62 UINT           0
```

Notizen:

A   Appendix

A.1   Abbreviations

Abbreviation	Explanation
ABL	Job bit bar
AKM	Process coordination marker
AST	Requesting station (Client)
BUEP	Bosch transmission protocol
BUEP-E	Protocol for secure data transmission
BUEP03E	Freely configurable transmission protocol
BUEP19E	Protocol for secure data transmission
BUEP64	Transmission protocol 3964R
DB	Daten buffer
DF	Data field
DM	Data module
DW	Data word
EBL	Result bit bar
EEM	Electrostatically endangered modules
EP	End of program
ESD	Electrostatic discharge Abbreviation for all terms that concern electrostatic discharges; e.g. ESD protection, ESD danger
FKM	Field coordination marker
FKM	Field coordination marker
FM	Function module
ICMP	Internet Control Message Protocol
OM	Organization module
PE	Protective Earth
PLC	Programmable Logic Controller
PST	Peripheral station (Server)
PW	Parameter word
R5CON	Function module for communication of the PLC interface access (for controlling centralized jobs)
R5INIT	Function module for communication of the PLC interface access (creates information tables)
R5REQ	Function module for communication of the PLC interface access (activates a command)
RSS	Computer interface
SK	System Coordinator, CL500
STP	Shielded Twisted Pair
TFTP	Trivial File Transfer Protocol (simple communication possibility for PC or UNIX computer with the controller)
ZS	Central unit

A.2   Index

Notes:

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