

**SIEMENS**

**Cerberus® MK7022  
Communication Unit**

Interface Description  
SW Version 10

**do not copy**

Copy no. \_\_\_\_\_

**Fire & Security Products**

Siemens Building Technologies Group

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**Note:**

The system owner should be aware that the connection to (or the interaction with) other systems may impair the functionality and reliability of the fire detection and / or security and protection system.

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# 1 Introduction

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The MK7022 communication unit is the published interface between a CERBERUS DMS7000 network and a remote system provided by a third party. In the point-to-point serial connection, change-of-state telegrams are transmitted to the remote system and command telegrams may be transmitted from the remote system to a DMS7000 control unit. In accordance with mutually agreed transparency restrictions, certain telegrams may not be transmitted.

The communication protocol is based on elements of the ISO 1745 standard.

To ensure that the data link between the MK7022 and the connected remote system functions correctly, conventions at the following level are required:

- Physical layer
  - V.24 standard signals
  - Signal level, distance
  - Data transmission rate
  - Transmission format
- Data link layer
  - Control characters
  - Transmission blocks
  - Error checking procedures
  - Protocol sequences, timings and counters
- Application layer
  - Telegram buffering
  - Telegram filter
  - Equipment monitoring by MK7022
  - Procedure for initializing the process image in the remote computer

## 2 Physical layer

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The physical interface basically conforms to the EIA RS232C standard which in turn is based on the CCITT V.24 and V.28 standards. The deviations from these standards are described below.

### 2.1 Signals of the V.24 standard

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From the standardized V.24 signals only the following are used:

- **TD** Transmit Data
- **RD** Receive Data
- **GND** Signal Ground

### 2.2 Signal levels

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The levels of the signals conform to the V.28 standard.

Logical 0: +3 Volt ... +15 Volt

Logical 1: -3 Volt ... -15 Volt

### 2.3 Transmission distance

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The high quality of the voltage converters of the MK7022 allows transmission distances far greater than the 30 metres specified in the RS232C standard. For distances > 30 metres the installation of intermediate repeaters is recommended.

### 2.4 Data transmission rate

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A transmission rate of 1200 or 2400 Baud can be selected.

### 2.5 Transmission format

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The data transmission is bit serial in asynchronous, half-duplex mode. The characters to be transmitted comprise 1 start bit, 7 data bits, 1 parity bit (even parity) and 2 stop bits.

## 3 Data link layer

The data link layer ensures error-free message transmission between the MK7022 and the remote system by means of a protocol derived from the ISO1745 standard.

The protocol is basically symmetrical. An exception is the re-establishment of the data link, which is initiated by the MK7022 ( Master-Station).

### 3.1 Control characters

The control characters are based on the ASCII character set according to ISO 646.

Control character	Hex value	Function
EOT	04	Re-establishment of the data link End of telegram transmission
ACK	06	Positive acknowledgment
NAK	15	Negative acknowledgment
ENQ	05	Request for telegram transmission
SOH	01	Start of message header
STX	02	Start of message
ETX	03	End of message

### 3.2 Transmission blocks

Two different transmission blocks are used within the protocol:

- line monitoring (UBL)
- data telegram (UBT)

#### 3.2.1 Transmission block: Line monitoring

The transmission block *line monitoring* (UBL) is an empty message which is used for monitoring the data link. UBLs are exchanged whenever there are no data telegrams to be transmitted.

**Structure of UBL:**

SOH	"L"	"0"	STX	ETX	BCC
\$01	\$4C	\$30	\$02	\$03	\$7D
< relevant character sequence for the BCC >					

#### 3.2.2 Transmission block: Data telegram

The transmission block *data telegram* (UBT) is used for transmitting change-of-state and command telegrams.

**Structure of UBT:**

SOH	"T"	"1"	STX	DMS7000 TELEGRAM	ETX	BCC
\$01	\$54	\$31	\$02	13 ASCII characters	\$03	<bcc>
< relevant character sequence for the BCC >						

The structure of the DMS7000 telegram is described in document No. e1461.

### 3.3 Procedure for calculating the block check character BCC

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For checking the integrity of the transmitted message, block checking according to ISO 1155 is used. In this process the longitudinal parity is formed across the transmission block and the result is stored in an additional character, the Block Check Character (BCC). The following rules apply:

- The longitudinal parity is calculated as modulo-2 sums (XOR) across the bits of the corresponding columns in the transmission block.
- The calculation begins after the SOH character and ends with (including) the ETX character.

#### 3.3.1 Example for calculating the BCC

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**BCC calculation for the telegram W111A109M8501:**

Character	Hex	Binary	Operation
SOH	01	0000 0001	---
"T"	54	0101 0100	---
"1"	31	0011 0001	XOR
STX	02	0000 0010	XOR
"W"	57	0101 0111	XOR
"1"	31	0011 0001	XOR
"1"	31	0011 0001	XOR
"1"	31	0011 0001	XOR
"A"	41	0100 0001	XOR
"1"	31	0011 0001	XOR
"0"	30	0011 0000	XOR
"9"	39	0011 1001	XOR
"M"	4D	0100 1101	XOR
"8"	38	0011 1000	XOR
"5"	35	0011 0101	XOR
"0"	30	0011 0000	XOR
"1"	31	0011 0001	XOR
ETX	03	0000 0011	XOR
<BCC>	<b>3A</b>	<b>0011 1010</b>	<b>Result</b>

## 3.4 Transmission procedures

Transmission procedures are rules for exchanging control characters and transmission blocks between the stations.

### 3.4.1 Protocol phases

Phase	Service	Control character of initiating station	Control character of responding station
PHW	Establishing data link	EOT	ACK
PHX	Line monitoring	UBL	UBL
PH2	Request for telegram transmission	ENQ	ACK, NAK
PH3	Telegram transmission	UBT	ACK, NAK
PH4	End of telegram transmission	EOT	ACK, NAK, ENQ

### 3.4.2 Protocol timers

Time	Function	Nominal value (sec.)
TA1, TB1	Response monitoring	15
TA2, TB2	Transmission delay PHX	0.25
TA3, TB3	Transmission delay PH2,PH3,PH4	0
TW4	Transmission delay PHW	1

### 3.4.3 Protocol counters

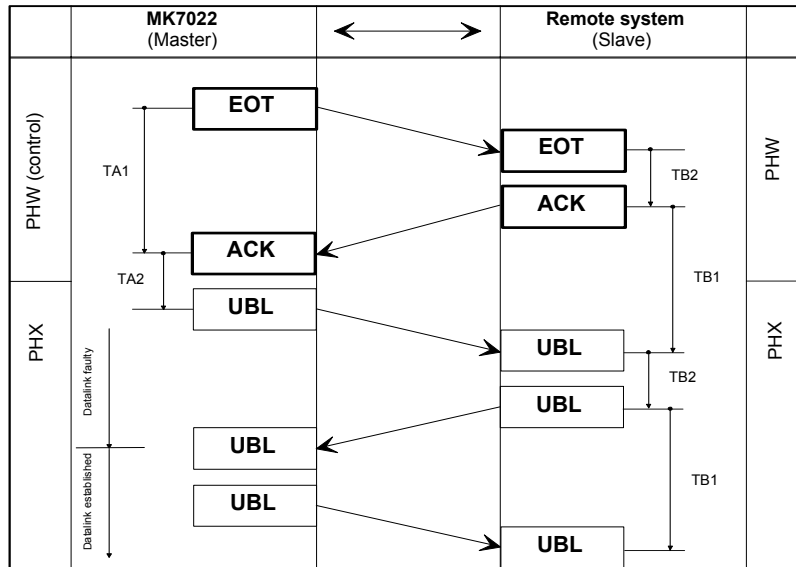
Time	Function	Nominal value (sec.)
W3	Repetitions outside PHW	3
W4	Repetitions within PHW	$\infty$



### 3.4.4 Protocol sequence diagrams

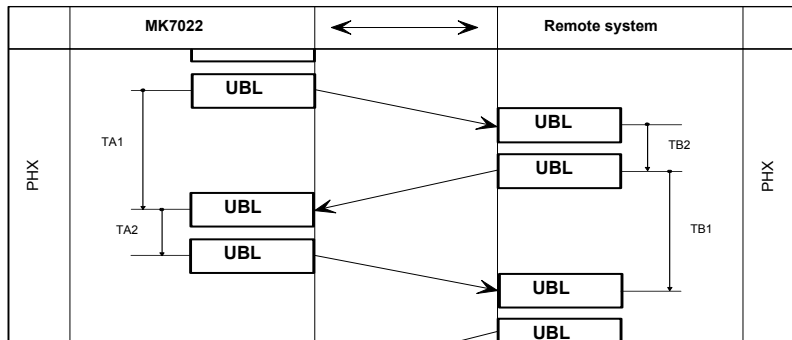
#### Phase PHW: Establishing data link

Data link recovery is initiated by transmitting an EOT. If the remote system replies with ACK then phase PHX is activated. The data link is considered to be established when one UBL has been successfully transmitted in both directions.

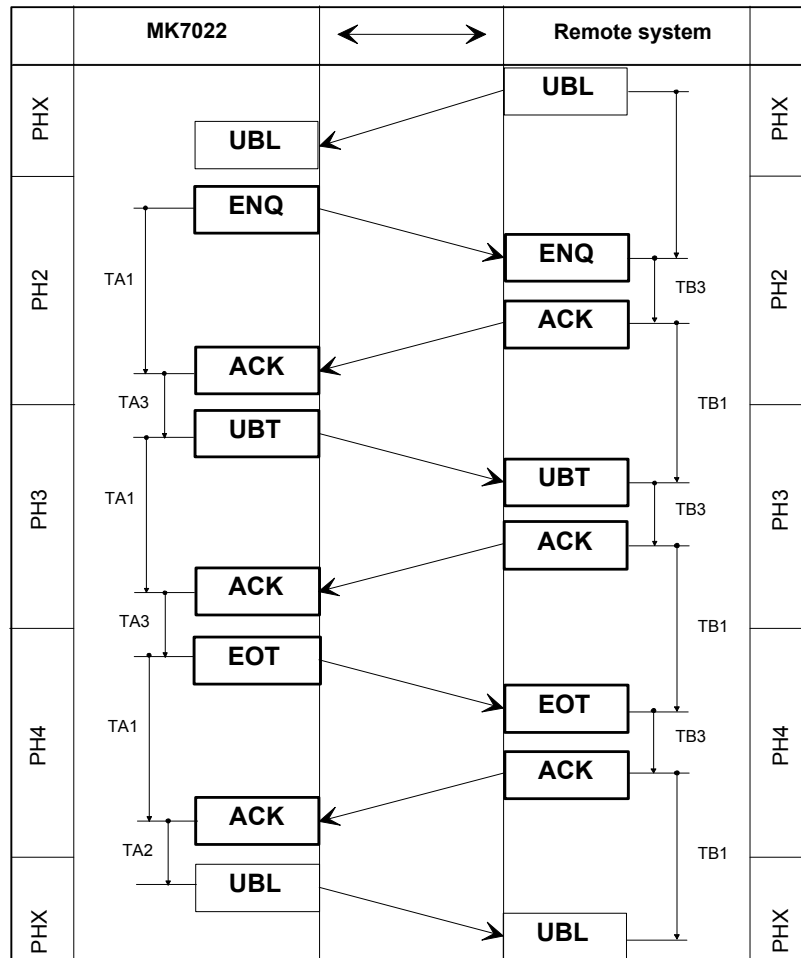


#### Phase PHX: Line monitoring

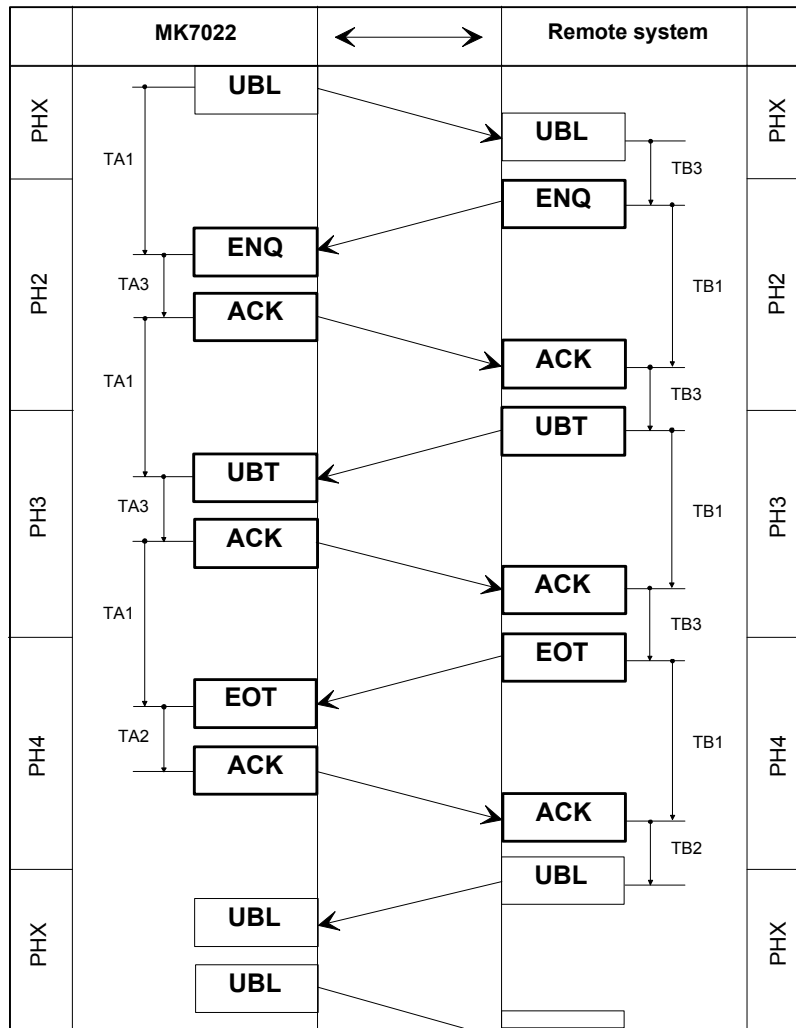
If neither of the stations has any data to transmit then an empty message is exchanged for line monitoring purposes.



PH2 .. PH4: Data telegram transmission from the MK7022 to the remote system



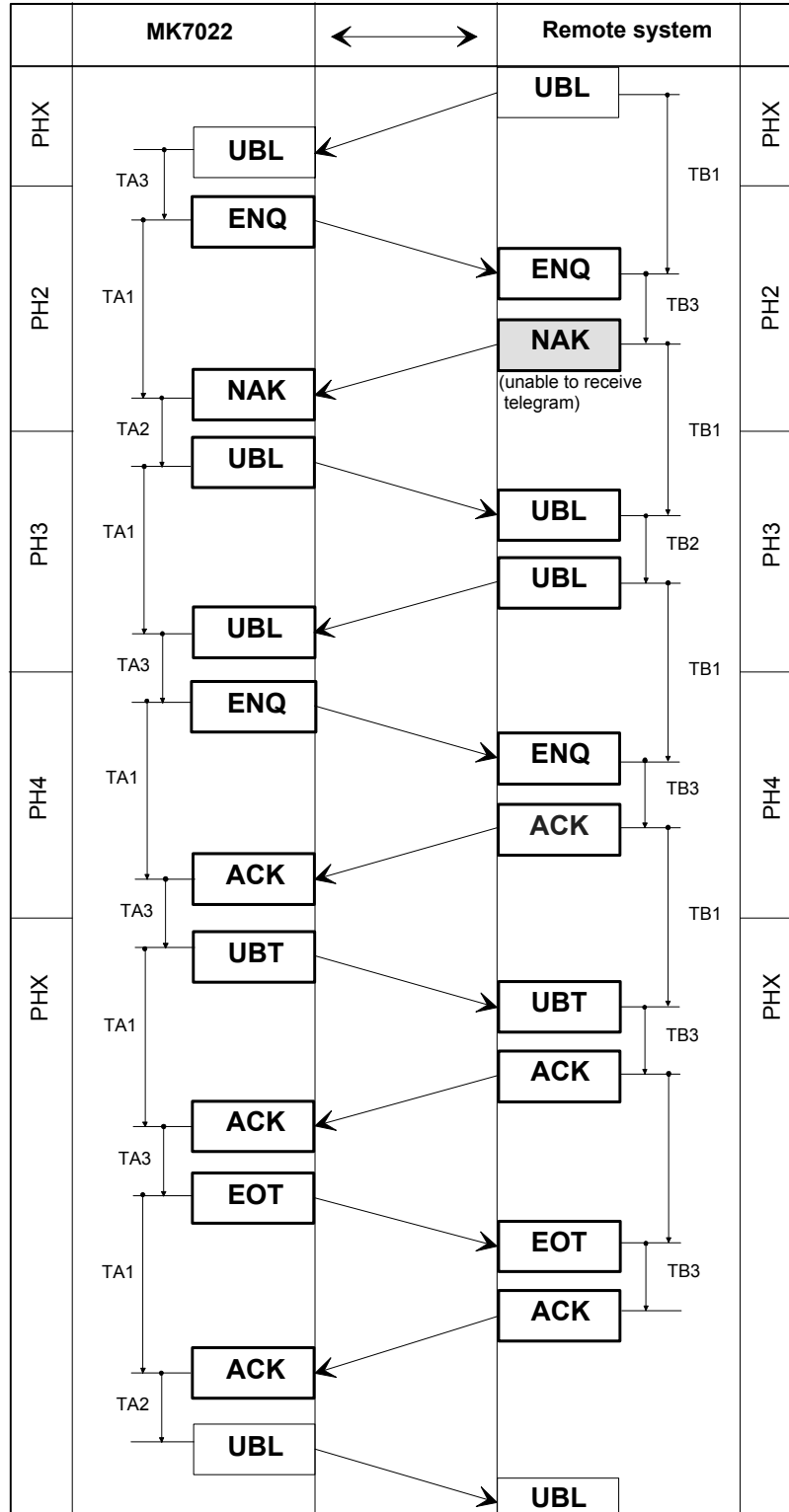
PH2 .. PH4: Data telegram transmission from the remote system to the MK7022





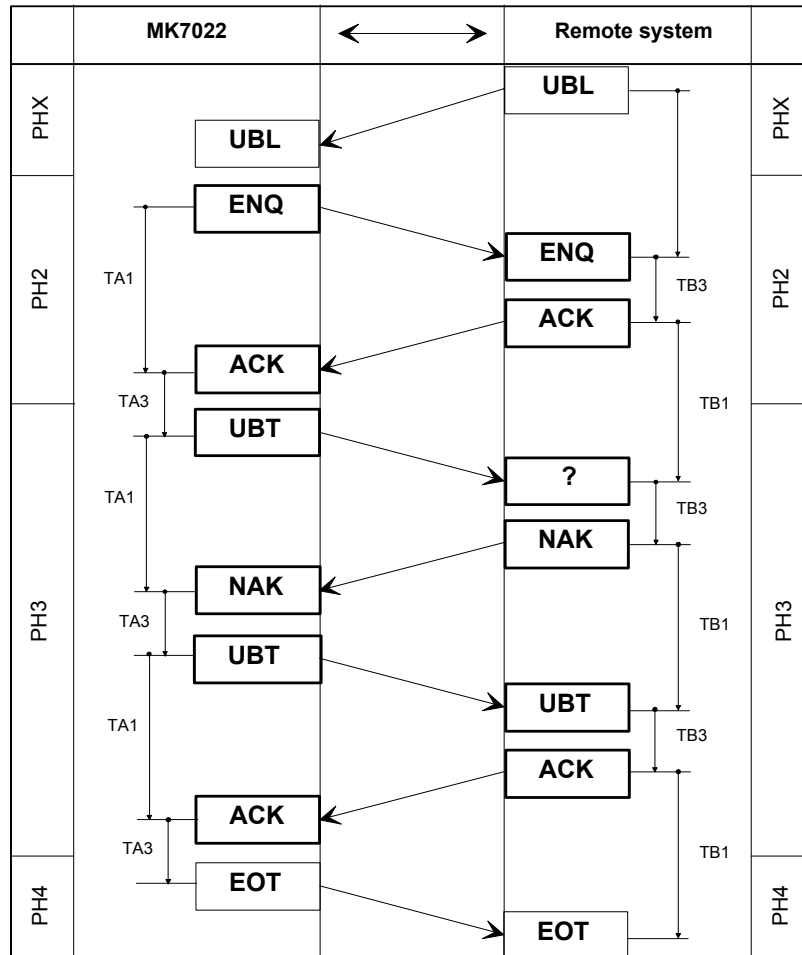
### Denial of transmission right

If a station is momentarily unable to receive a telegram, it can answer an ENQ with NAK. In this case a UBL must be exchanged before transmission can again be requested.



## Repetition of an erroneous transmission block

A UBT (or UBL) which has been transmitted with an error is repeated up to 3 times (counter W3) before the data link is declared as interrupted. In this case the data link must be re-established via the PHW phase.





## 3.5 Application layer

### 3.5.1 Telegram buffering

For bridging short-time communications bottlenecks the MK7022 contains telegram buffers for both directions. The capacity of these buffers is as follows:

MK7022 → remote system: 100 telegrams

Remote system → MK7022: 30 telegrams

When the buffer is full the oldest telegram is overwritten by the newest. This prevents a telegram backlog in the DMS7000 network. After a data link interruption the buffers are cleared.

### 3.5.2 Telegram filter

In the MK7022 there are project-specific telegram filters for both directions. In this way unwanted or illegal telegrams can be filtered out.

### 3.5.3 Handling of interface faults

#### Interface to the DMS7000 network

All status changes of the interface to the DMS7000 network are signaled to the remote system by means of a telegram.

#### 1. Event: Data link interrupted on DMS7000 side

The data link between the MK7022 and the DMS7000 network is lost due to a fault. No further messages can be transmitted to/from the DMS7000 network.

#### Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<MKadr>	00	00	M	44	46	Data line	Faulty
Z	<MKadr>	00	00	R	00	86	Message	Fault acknowledgment
Z	<MKadr>	00	00	M	00	88	Message	Acknowledged

#### Procedure (Assumption: DMS address MK7022 = 800)

MK7022	Telegram	Remote system
Event: Data link to DMS7000 network is lost	Z8000000M4446 →	
	← Z8000000R0086	Event: The fault message is recognized and acknowledged.
Event: Acknowledgment is received and confirmed	Z8000000M0088 →	



Note: Fault acknowledgment by the remote system is not mandatory.



## 2. Event: Data link re-established on DMS7000 side

The cause for the interruption of the data link between the MK7022 and the DMS7000 network has been remedied. The connection to the DMS7000 network has been re-established. The process image of the remote computer must be updated with the aid of the polling procedure.

### Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<MKaddr>	00	00	M	44	3C	Data line	normal

### Procedure (Assumption: DMS address MK7022 = 800)

MK7022	Telegram	Remote system
Event: Data link to the DMS7000 Network re-established	Z8000000M443C →	



Note: Acknowledgment of the normal operation message is not necessary.

## 3. Event: Data line to the DMS 7000 interrupted (CERLOOP only)

The MK7022 in a DMS7000/CERLOOP network has lost the connection to one of its neighboring stations. Communication with the equipment in the DMS7000 network is still possible via the second data line.

### Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<MKaddr>	00	00	M	38	46	Data network	Faulty
Z	<MKaddr>	00	00	R	00	86	Message	Fault acknowledgment
Z	<MKaddr>	00	00	M	00	88	Message	Acknowledged

### Procedure (Assumption: DMS address MK7022 = 800)

MK7022	Telegram	Remote system
Event: CERLOOP data line is interrupted	Z8000000M3846 →	
	← Z8000000R0086	Event: fault message is recognized and acknowledged
Event: Acknowledgment is received and confirmed	Z8000000M0088 →	



Note: Fault acknowledgment by the remote system is not mandatory.

#### 4. Event: Data line to the DMS7000 network is re-established (CERLOOP only)

The cause for the interruption in the CERLOOP data line in the DMS7000 network has been remedied. Since the connection between the MK7022 and the control units in the DMS7000 was never completely interrupted, it is not necessary to update the process image in the remote computer.

##### Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<MKaddr>	00	00	M	38	3C	Data network	normal

##### Procedure (Assumption: DMS address MK7022 = 800)

MK7022	Telegram	Remote system
Event: Problem on the CERLOOP data line segment remedied	Z8000000M383C →	

#### Interface to the remote system

Any status change of the interface to the remote system is transmitted via telegrams to any other evaluation units in the DMS7000 network. For the remote system these telegrams are only relevant if more than one MK7022 exists in the DMS7000 network.

#### 1. Event: Data link to the remote system interrupted

The data link between the MK7022 and the remote system is lost due to a fault. No further messages can be transmitted by the DMS7000 network.

##### Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<MKadr>	00	00	M	45	46	Remote system	Faulty
Z	<MKadr>	00	00	R	00	86	Message	Fault acknowledgment
Z	<MKadr>	00	00	M	00	88	Message	Acknowledged

##### Procedure (Assumption: DMS address MK7022 = 800)

MK7022	Telegram	DMS7000 evaluation unit
Event: Data link to the remote system is lost	Z8000000M4546 →	
	← Z8000000R0086	Event: The fault message is recognized and acknowledged
Event: Acknowledgment is received and confirmed	Z8000000M0088 →	

#### 2. Event: Data link to the remote system is re-established

The cause for the interruption has been remedied. Since the connection between the MK7022 and the control units in the DMS7000 was interrupted, it is now necessary to update the process image in the remote computer.

##### Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<MKaddr>	00	00	M	45	3C	Remote system	normal

##### Procedure (Assumption: DMS address MK7022 = 800)

MK7022	Telegram	Remote system
Event: Problem on the data link remedied	Z8000000M453C →	

### 3.5.4 Monitoring the equipment in the DMS7000 network

Before communication with any DMS7000 unit is possible, a check must be made whether or not these units are present (ON-LINE) on the network. A unit signals its availability by cyclically transmitting a presence telegram (interval 30 sec.). The advantages of this method are topology independence and true end-to-end monitoring. A disadvantage is the resulting overhead load on the network.

The MK7022 performs the presence check for the remote system. The units to be monitored must be configured in the system data of the MK7022. Presence changes of these units are spontaneously communicated to the remote system via telegrams.

When polling the status of the MK7022 the remote system also receives a report of all control units which are OFF-LINE.

#### Connection failure to a DMS7000 unit

If no presence telegram is received from a DMS7000 control unit within the defined monitoring time (configurable between 50 and 90 seconds) it is considered as OFF-LINE and is indicated to the remote system by a "Data line faulty" telegram.

##### Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<DMSadr>	00	00	M	44	46	Data line	Faulty

##### Procedure (Assumption: Control unit with DMS address = 111)

MK7022	Telegram	Remote system
Event: No presence telegrams from control unit 111 within time-out.	Z1110000M4446 →	

#### Re-establishing the connection to a DMS7000 unit

When presence telegrams are again received from a DMS7000 unit it is considered as ON-LINE. This is indicated to the remote system by a "Data line normal" telegram.

##### Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<DMSadr>	00	00	M	44	3C	Data line	normal

##### Procedure (Assumption: Control unit with DMS address = 111)

MK7022	Telegram	Remote system
Event: start receiving presence telegrams from control unit 111	Z1110000M443C →	

### 3.5.5 Polling of the MK7022

The MK7022 can be requested to transmit certain abnormal states by means of defined command telegrams. Abnormal states are:

- Faulty data link to the DMS7000 network
- Faulty data link segment in DMS7000 (CERLOOP, neighboring segments only)
- OFF-LINE state of a monitored DMS7000 unit

Available telegrams

Sector	DMS Adr	ADF1	ADF2	Sep	Data A	Data B	Text A	Text B
Z	<MKadr>	00	00	R	53	55	Polling	on
Z	<MKadr>	00	00	R	53	52	Polling	execute
Z	<MKadr>	00	00	M	53	3A	Polling	Begin
Z	<MKadr>	00	00	M	53	3B	Polling	End

#### Procedure

Assumptions: DMS address MK7022 = 800 status: CERLOOP data link segment faulty

DMS address control unit 1 = 111 status: ONLINE

DMS address control unit 2 = 112 status: OFFLINE

MK7022	Telegram	Remote system
	← Z8000000R5355 ← Z8000000R5352	Event: Data link to the MK7022 normal. Remote system starts polling the MK7022.
Event: Polling command received. Transmit abnormal states.	Z8000000M533A → Z8000000M3846 → Z1120000M4446 → Z8000000M533B →	

### 3.5.6 Example of a complete polling procedure

#### System configuration

This example is based on a CERLOOP network comprising:

- Fire detection control unit CZ10 (DMS address 111) configured sectors: BASIC, FIRE and EXTINGUISHING
- Intrusion control unit CZ12 (DMS address 121) configured sectors: BASIC, INTRUSION and PLANT MONITORING
- Communications unit MK7022 (DMS address 800) configured units: 111 and 112.

#### Procedure

	MK7022	Telegram	Remote system
	Event: Data link to remote system is normal		Event: Data link to the MK7022 is normal.
		← Z8000000R5355 ← Z8000000R5352	Event: Remote system starts polling the MK7022.
	Event: Polling command received. Transmission of the abnormal states	Z8000000M533A → Z8000000M3846 → Z1110000M4446 → Z8000000M533B →	
		← Z1210000R5355 ← Z1210000R5352	Event: The CZ10 has been reported as OFF-LINE. For this reason polling begins with the CZ12. Start polling of basic sector.
Event CZ12: Polling command for basic sector received. Transmission of abnormal states.		Z1210000N533A → <telegram> → : <telegram> → Z1210000N533B →	
		← S1210000R5355 ← S1210000R5352	Event: Polling of basic sector completed. Start polling of intrusion sector.
Event CZ12: Polling command for intrusion sector received. Transmission of abnormal states.		S1210000N533A → <telegram> → : <telegram> → S1210000N533B →	
		← P1210000R5355 ← P1210000R5352	Event: Polling of intrusion sector completed. Start polling of plant monitoring sector.
Event CZ12: Polling command for plant monitoring sector received. Transmission of abnormal states.		P1210000N533A → <telegram> → : <telegram> → P1210000N533B →	
			Polling of CZ12 completed.
Event CZ10: Control unit begins to transmit presence telegrams	Event: CZ10 (111) Status changes from OFF-LINE to ONLINE	Z1110000M443C →	
		← Z1110000R5355 ← Z1110000R5352	Event: The CZ10 is reported as ONLINE. Polling starts with the basic sector.
Event CZ10: Polling command for basic sector received. Transmission of abnormal states.		Z1110000N533A → <telegram> → : <telegram> → Z1110000N533B →	
		← W1110000R5355 ← W1110000R5352	Event: Polling of basic sector completed. Start polling of fire sector.

	<b>MK7022</b>	<b>Telegram</b>	<b>Remote system</b>
Event CZ10: Polling command for fire sector received. Transmission of abnormal states.		W1110000N533A → <telegram> → : <telegram> → W1110000N533B →	
		← L1110000R5355 ← L1110000R5352	Event: Polling of fire sector completed. Start polling of extinguishing sector.
Event CZ10: Polling command for extinguishing sector received. Transmission of abnormal states		L1110000N533A → <telegram> → : <telegram> → L1110000N533B →	
			Polling of CZ10 completed. The process image of the remote system is completely up-to-date.



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