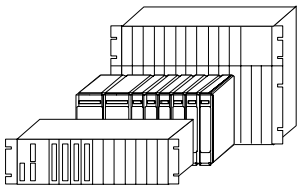
Ax 1703



Firmware Description

UMPM02

IEC 870-5-101 Multi-Point Traffic MASTER

HW-Type: 2541 / FW-Type: 2531

This document is applicable to the following product(s):

UMPM02 Rev. 01 and higher

Version	Revision	Date	Change
A, 1	00	15.01.02	first issue
A, 1	01	14.07.03	parameter documentation reworked
A, 1	02		this revision was not issued
A, 1	03	02.08.04	chap. 2.8.1. PST control message (main and stand-by transmission line) chap. 2.10. stand-by transmission line concept with GSM modem chap. 2.10.4. parameter setting of the modems (AT commands modem upon master station) chap. 2.11. control location selection (new) appendix A: diagnoses and appendix B: parameter documentation revised

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15.01.02	SW-AUT/POM	02.08.04	SW-AUT/POM	02.08.04	SW-AUT/POM

Table of Contents

1. System Overview

1.1. Short Description

The UMPM02 firmware is used for the serial coupling of two Ax 1703 components in accordance with IEC 870-5-101.

The functions supported by IEC 870-5-101 are laid down in the interoperability list of Ax 1703.

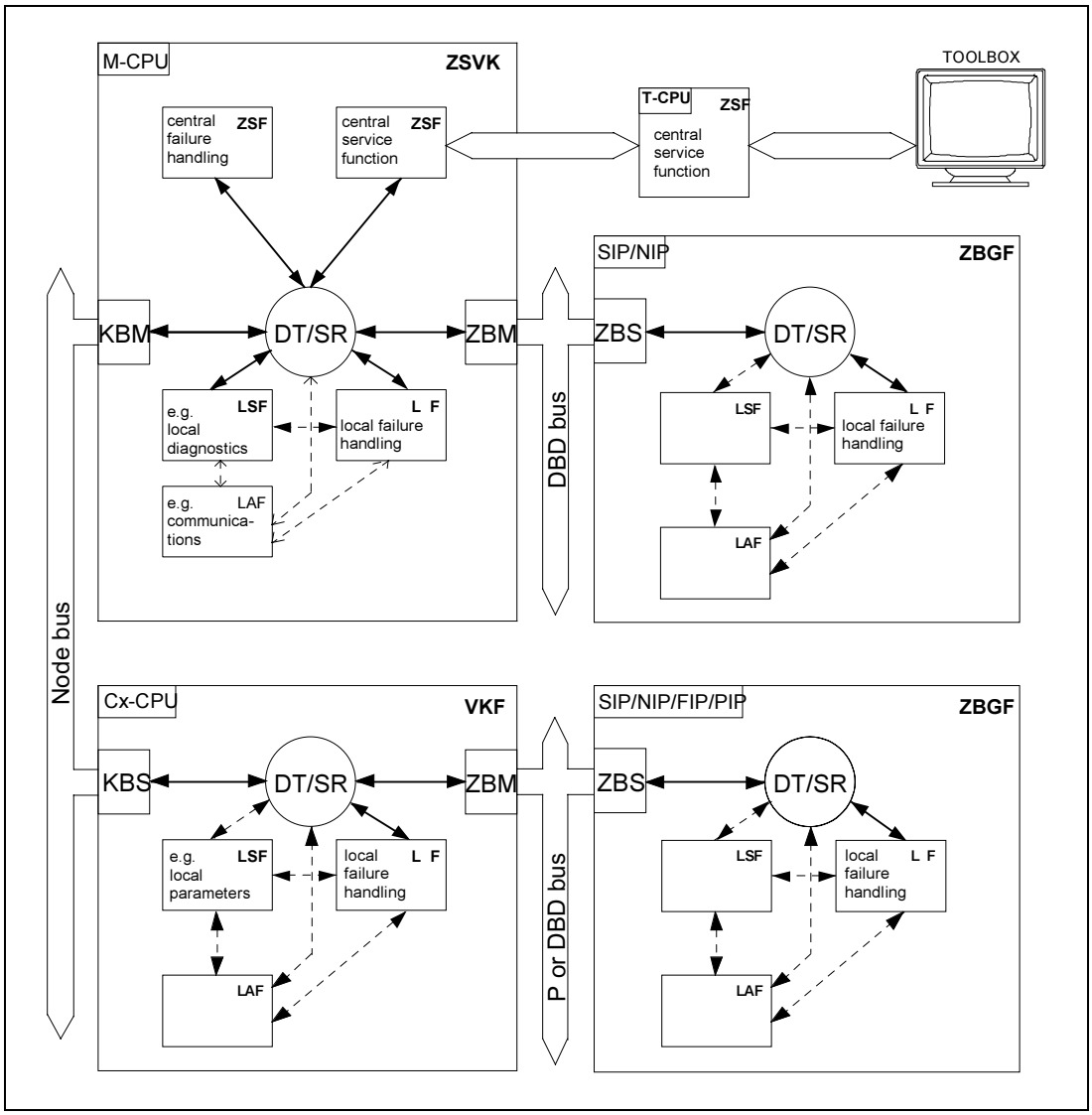
The message formats used correspond to the IEC 870-5-101 standard and the Ax 1703 Data Formats description.

The data communication control used for this firmware is an unbalanced primary multi-point traffic master.

1.2. Interfaces

The data exchange to the KOM is done via messages in the Ax 1703 format.

1.3. Embedding in the Environment



2. Protocol-specific Functions

2.1. Interface Fault

After an interface fault has been detected, a communications fault is signalled (if parameterized) and all further data for this station are disabled on the BSE.

2.2. Master/Standby Function

The Master/Standby function is done by the redundancy function in Ax 1703. If the firmware is in standby operation it does not send any messages. In contrast to this, however, all received messages are forwarded to the superordinate BSE. In order to synchronize the firmware - which is in standby operation - to the same FCB (Frame Count Bit) as the active one, the current FCB is either taken from the monitored Reset of Remote Link or from a valid long message.

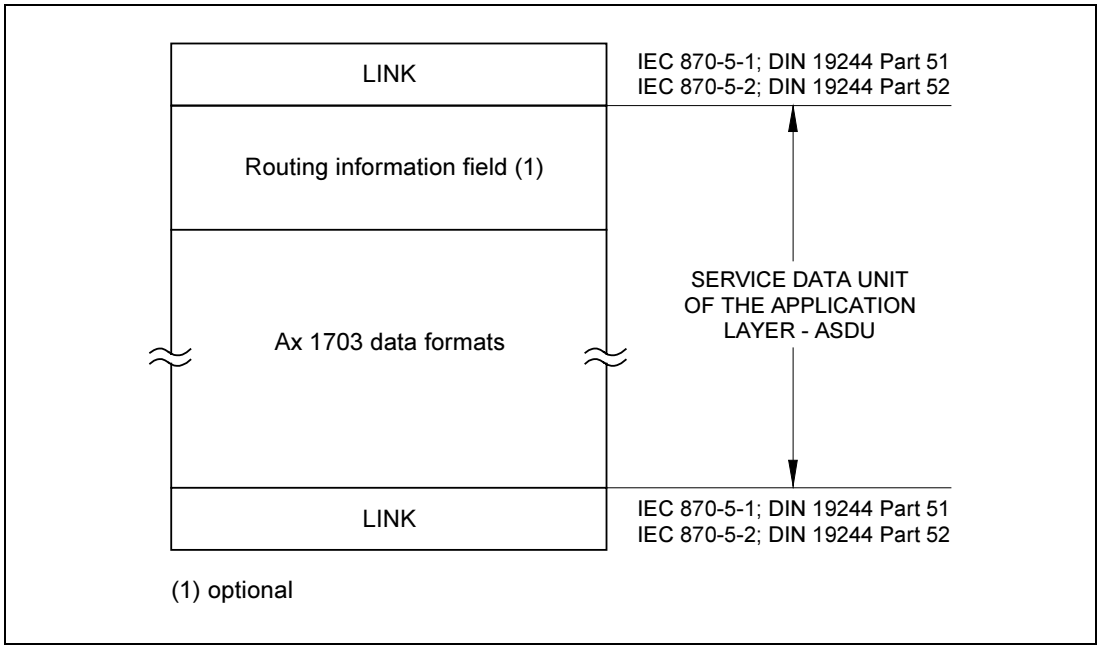
2.3. Routing (Repeater Functionality)

2.3.1. Basic Structure of the Application Data

In the "Ax-1703 Data Block Formats" document the structures of the application data (data model) which are needed for the telecontrol technology are extensively described.
Within the area of freedom of the protocol, selections must be made from this description for the application case at hand.
Over and above this, these selections must be made more precise by means of definitions in order to produce the compatibility.

In a compatible message (Link Protocol Data Unit: LPDU) basically only one PROTOCOL DATA UNIT OF THE APPLICATION LAYER (Application Protocol Data Unit: APDU) is transmitted.

A SERVICE DATA UNIT OF THE APPLICATION LAYER (ASDU) consists of the ROUTING INFORMATION (optional) and one or more data block formats which are external to Ax 1703.



Structure of a service data unit of the application layer - ASDU

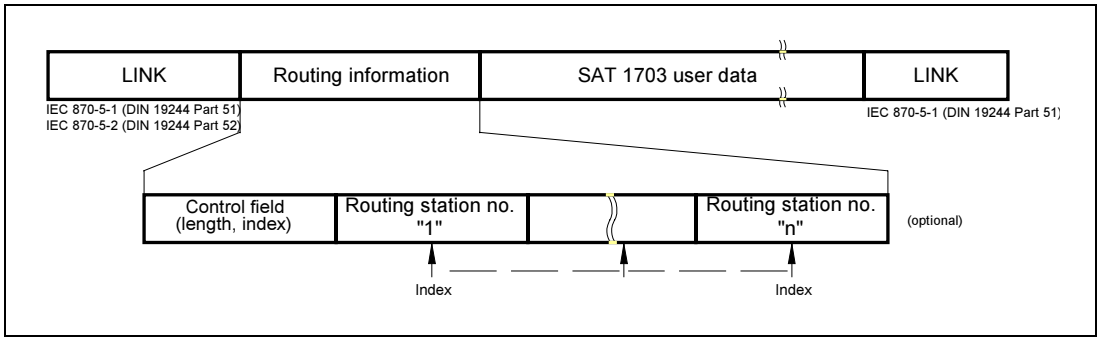
2.3.2. Description of the Routing Method

RTUs which cannot be directly reached by the central station due to the geographical conditions or the too low maximum possible transmission power of the radio equipment are interfaced via so-called "data relay stations" (routing stations).

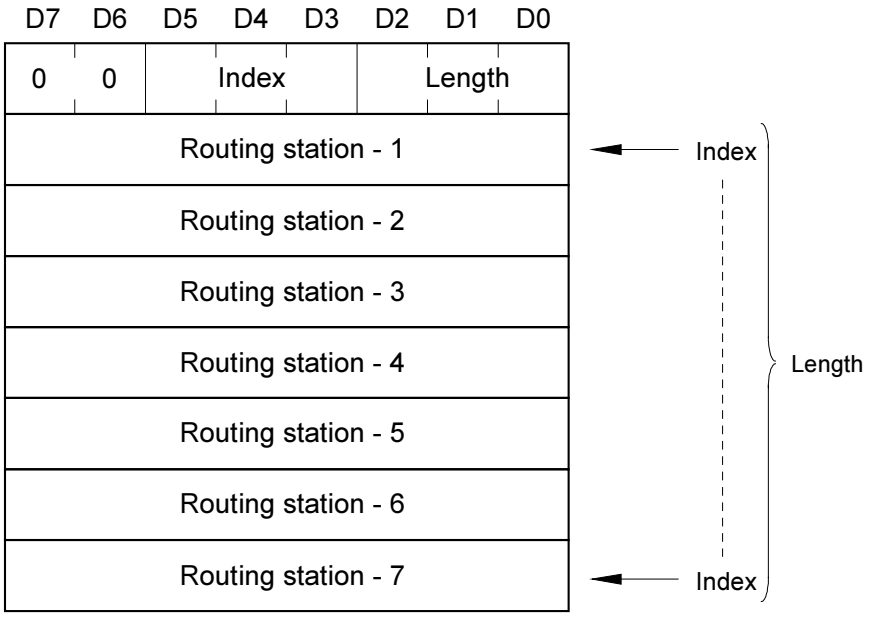
"Data relay stations" are stations which are used only for communications in repeater operation and which are not equipped with any local peripherals. For this, normal RTUs can likewise serve as "data relay stations".

"Data relay stations " can likewise be retrofitted with local peripherals and thus be used as normal RTUs if required.

The routing information describes the route via which "data relay stations" (intermediate stations) the RTU can be reached by the central station.
The routing information is co-transmitted for each message addressed to a selected station which cannot be reached directly by the central station. The destination station number is transmitted in the "LINK" (IEC 870-5-2).



Routing information in the message



Length ... Number of routing stations entered
- With the "optimized routing procedure" the length of the routing field is managed dynamically, i.e. only those routing stations which are actually needed are entered into the routing field.
- With the "non-optimized routing procedure" the routing field is always transmitted with the maximum length (8 bytes).
  However, only the actual number of fields used for routing stations is to be entered into the routing field. The unused routing fields are initialized with "FF".

Index ... Details about the routing fields which have already been dealt with.

Routing information field

Received messages are - after complete receipt - immediately sent out again by "data relay stations" if - based on the "routing information" (in the message) - they are intended for transmission onwards.

Messages received from stations which are not intended as the "final location" (= addressed RTU) or "data relay station" (station is not - or not yet - provided for in the routing information of the message) are not handled further.

The received routing information for the reply message which is to be sent out is entered in reverse order by the addressed "final location". In this way, the reply message is transmitted across the network via the route preset by the central station.

In repeater operation, stations can be reached by the "routing method" used via a maximum of 7 "data relay stations" (routing stations).

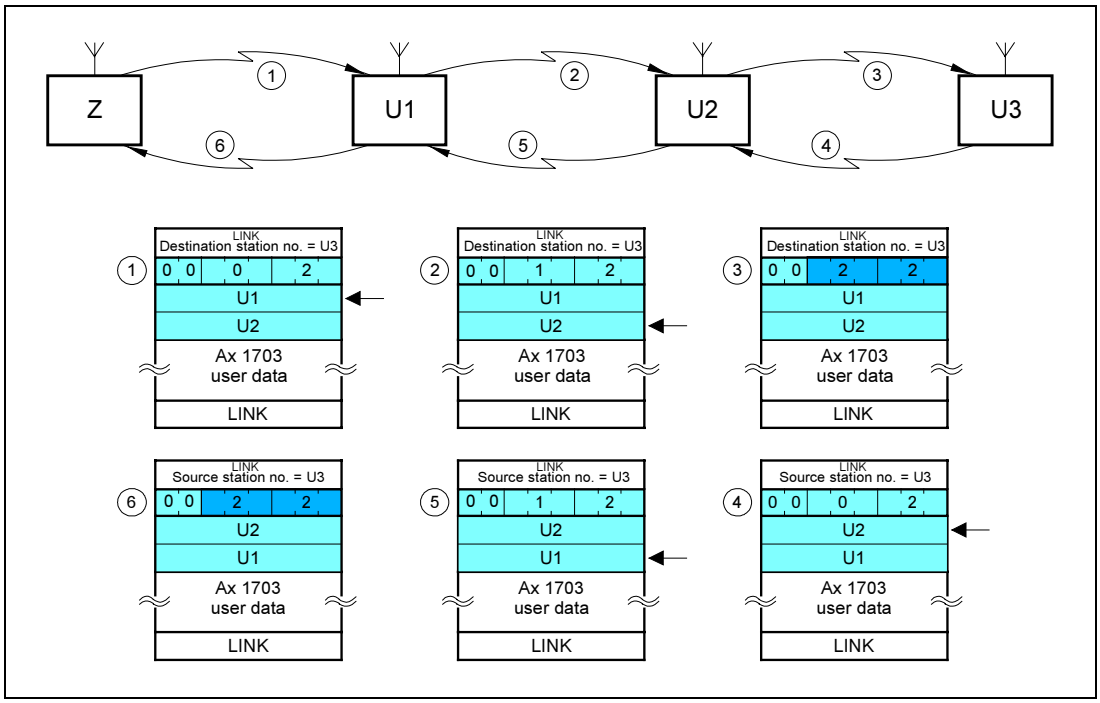
The configuration of routing information is not necessary for stations which can be reached directly by the central station.

Optimized Routing Method:

With the "optimized routing method for repeater operation" the routing information is managed "dynamically" in messages.

Calls to stations which can be directly reached by the central station do not contain *any* routing information (= Message format with fixed block length). Such stations - if no data are to be transmitted - reply with a single character or a short acknowledgement (no routing information in the message). User data are transmitted with the "message format variable block length" and a "0 routing information".

Calls to stations which cannot be reached directly by the central station only contain the necessary routing information (message format with variable block length). Such stations - if no data are to be transmitted - reply with an acknowledgement message and the required routing information (message format with variable block length). User data are generally transmitted with the "message format with variable block length" and the required routing information.

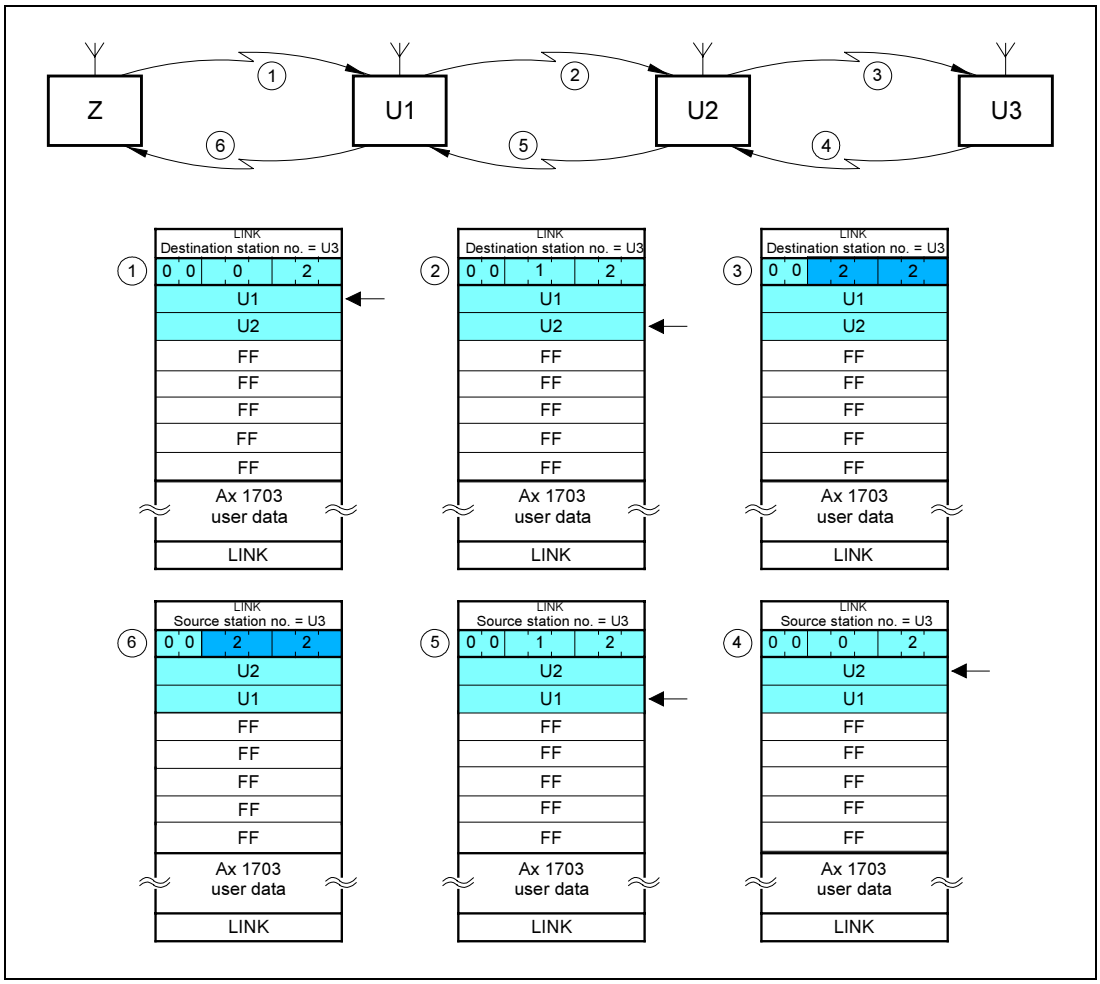


Example of the management of the routing information for 2 intermediate stations (routing stations) "Optimized routing method "

Non-optimized Routing Method:

With the "non-optimized routing method" the routing information in the messages is managed "statically".

In messages with a fixed block length, the routing information is always present at its maximum length in messages with fixed/variable block length.
I.e. Calls/acknowledgements are generally transmitted with the "message format with fixed block length" and user data with the "message format with variable block length".
Single characters are not used.



Example of the management of the routing information for 2 intermediate stations (routing stations) "Non-optimized routing method "

2.3.3. Main/Standby Route

For each station a "main route" can be configured. The "main route" is the necessary routing information via which a station can be reached by the central station over the shortest route. In addition, for each station a "standby route" can be configured. The "standby route" represents that routing information via which a station can likewise be reached by the central station.

In the non-faulty interrogation cycle, all stations are interrogated directly or via the configured "main route".

If stations cannot be reached by the central station via the "main route", communication is tried via the configured "standby route". If stations can only be reached via the "standby route", the "main route" is tested in the background.

The "main route" can, for example, be faulty due to the failure of a "data relay station" (routing station).

Configured "standby routes" are tested in the background at configurable intervals. With non-faulty communication (for unchanged default parameters) a standby route which has been configured for a station is tested after every 20 station interrogations (messages to a station, station interrogations or data messages).
When the main route is faulty, it is tested after every 10 station interrogations when a standby route is configured.

For stations which can be reached directly by the central station, configuration of the routing information ("main route / standby route") is not necessary.

With a faulty main/standby route, if at least one non-faulty route is available for communication, a warning in the form of "Selective station binary information items" is generated by the central station.

2.3.4. Quality Assessment of Main/Standby Routes

A "quality assessment" is carried out for each path. The "quality of a route" is derived from the required message repetitions. If the "quality of a route" is no longer given a "warning" is likewise derived by the central station.

For the quality assessment, the last 16 messages are assessed for each route. If from the last 16 messages more than a configured number have not been acknowledged, a warning is given out.

2.3.5. Radio Circuit Identification

When using the same radio frequencies in different, locally and geographically separate regions, due to "overreachings in radio traffic", an RTU could receive station interrogations or even commands from a "foreign" central station.

Similarly with several central stations, undesired plant behaviour caused by overreachings can be excluded by the use of different radio frequencies or a unique station number allocation

If unique station number allocation is not possible, a unique allocation (within the framework of the configuration possibilities) of all stations to their respective "own central station" can be achieved with the help of the "radio circuit identifier".

The radio circuit identifier (1 - 254) can be configured in the central station and in the RTUs.

All messages which contain routing information are sent out from the central station with the configured radio circuit identifier.

Messages are then only assessed by the routing RTUs if the radio circuit identifier contained in the message agrees with the configured one.
In this way, messages from "foreign central stations" which are received due to "overreachings in radio traffic" are not assessed.
In addition, messages received by the central station from "other radio regions" are likewise not assessed.

2.4. Station Interrogation

The transmission of the data from the RTUs to the central station is done only on station-selective station interrogation (polling). Spontaneous transmission of the data from the RTU is, therefore, not possible. Altered data remain stored in the RTU and, on a station interrogation of this station, are transmitted to the central station.

The connected data relay stations or RTUs are interrogated by the central station in a configurable interrogation cycle. Stations with important data can thus be called several times in one interrogation cycle.

"Relay stations " (stations without local peripherals which are used purely for communication in repeater operation) are treated in the interrogation cycle like normal RTUs.

Stations which have a large amount of data to be transmitted can be interrogated by the central station several times immediately one after the other before a station change is made.

Data from the central station to the RTU are spontaneously transmitted after the end of the running message transmission of the interrogation cycle. Following this, the interrupted interrogation cycle is continued.

The interrogation cycle can be made either continuously or just on request. The interrogation cycle counts as having ended if the configured number of station calls has been executed for the last station.

The station interrogation does not automatically guarantee that the entire amount of data which is initiated for transmission is transmitted in one interrogation cycle.

By configuration of the station interrogation in the central station (Number of calls until station change), "getting stuck" at a station with continuously changing data can be prevented.

Stations which have not stored any data for the transmission are not removed from the interrogation cycle. To optimize the interrogation cycle, for such stations (independent of the "Number of station calls until station change" configuration) a station change is carried out immediately after one call.

Faulty stations likewise continue to be interrogated in the interrogation cycle but for such stations no message repeating (retries) is carried out during the station interrogation.

2.5. Acknowledgement Behaviour

If the acknowledgement for a message which was sent out from the central station does not appear, this message is repeated n times (n = configurable number). After the configured number of message retries, before expiry of the number of retries, a switchover is made to the configured standby route (if present). If, after these retries, positive acknowledgement has still not been received, the interface is marked as faulty and the interface failure is also displayed visually.

CAUTION:

The acknowledgement expectation time is calculated per level. In this way, the idle cycle in the event of faulty stations is also speeded up.

$$t_{ack} = t_{call} * no_{level} + t_{reply} * (no_{level} + 1) (t_p + t_v + t_{sign} + t_{signal} * (no_{level} * 2 + 1))$$

t_{Call} = Message runtime of the call message
t_{Reply} = Message runtime of the reply message (max. 255 data bytes)

t_{Call} and t_{Reply} = f (Baud rate + Routing method)

$No._{level}$ = Via how many repeater stations the RTU is to be reached (Possible: 0 - 7)

t_p = Pause time

t_v = Setup time

t_{Delay} = Transmission delay

t_{Signal} = Signal runtime of the message (= Correction factor)

⇒ SIP parameters

2.6. Failure Monitoring

2.6.1. Transmission Time Limitation

In order that RTUs or radio devices which are impaired in their function do not lead to a "blocking of the transmission section", the radio devices employed are fitted with a maximum transmission time limiter. This device switches the radio device off after a settable maximum time. After this protection device has been triggered in a fault event, the interrogation cycle to the remaining stations can be continued by the central station.

2.6.2. Failure Monitoring in the Central Station

The failure of RTUs is detected by the central station in the normal interrogation cycle. Failed stations continue to be interrogated in the interrogation cycle but for such stations no message repeating (retries) is carried out during the station interrogation.

2.6.3. Failure Monitoring in Redundant Central stations

In redundant STANDBY central stations (inactive central stations), station-selective failure monitoring is carried out (as from Rev. 06).

The failure of the interface is detected by the STANDBY central station by monitoring for cycle message receipt. On "Receive timeout" (= active central station or radio device of the central station has failed) the interface is signalled as failed.

With station-selective failure handling, it is now possible for the passive master to detect a failure.

Guide value (period until error detection):

Error detection = 1 second * Enabled station

In the worst-case event, it can take a very long time until a failure is detected because, otherwise, the data flow would be greatly slowed down.
The station-selective failure handling is activated by entering a value on "receive timeout". If the last station fails, the global receive timeout is effective, otherwise the time is produced as described above.

Existing station-selective faults are reset in redundant STANDBY central stations if an error-free message is "heard" by these stations.

2.7. Time Synchronization

Due to the restrictions in the available radio frequencies and the employment often of several intermediately connected intelligent relay stations, significantly longer total transmission times partly result. The disadvantage which results from the heavily delayed arrival of information for the logging and fault analysis should be compensated for by the time tagging of the events in the medium voltage substation (= RTU). The keeping of a realtime clock which is required in each case for time tagging must often - for cost reasons and often bad receiving locations - be done without a decentralized DCF77 time character receiver. With this there is, above all, a control technology problem because, regarding one RTU there are at least two parallel paths each with up to 6 control circuits which are connected one after the other whose deviations compensate or total differently dynamically and so diverge from one another. In connection with continuous switching between the redundant transmission routes which is desirable for monitoring reasons, with regard to the synchronization of these RTUs, contradictory inputs arise about in which the direction the clock should be moved. Hard setting to the last time in each case is not possible as, due to such time jumpbacks, the sequence of the acquired events is confused and a precise analysis of the course of the process can be made impossible.

2.7.1. Time Setting

In the start-up, the timesetting is discarded by the UMPM02 firmware until its own protocol element is time set so that the current ms can be correctly entered into the timesetting message.

It is generally the case that a time setting of the RTU is always received in the same minute in which the message was sent out by the central station. During a time setting procedure, binary information changes in the RTU are forwarded to the central station for several minutes with the "old time".

The time setting message is also used for time synchronizing.

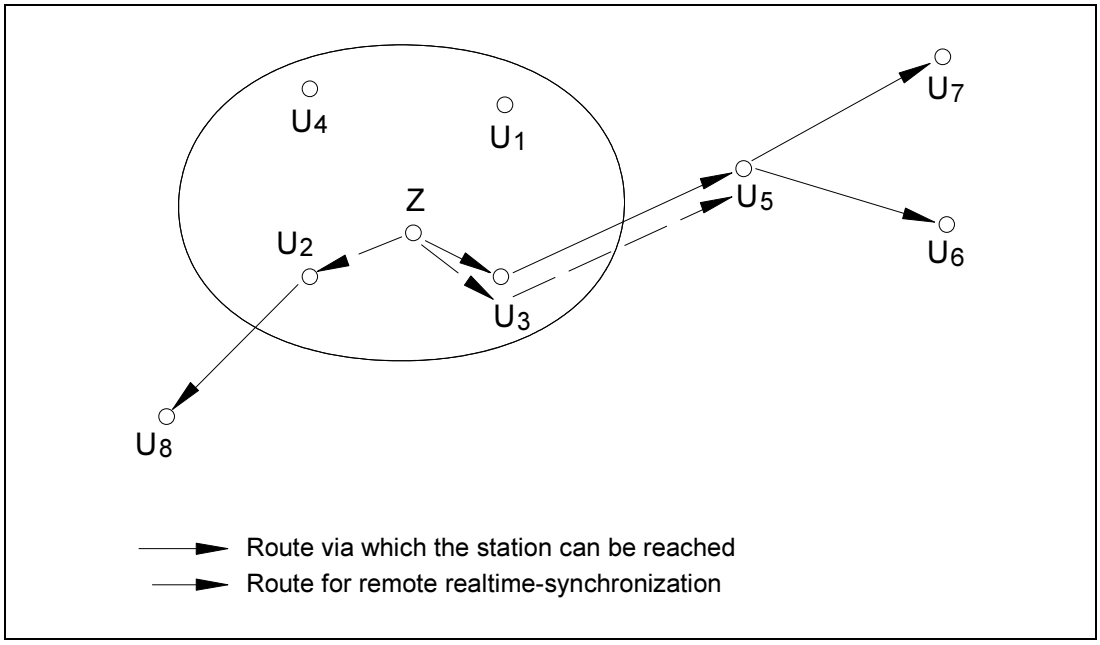
If lower precision of the realtime data is sufficient, the synchronization of the RTUs can also take place via the serial communications line.
Due to the method used for time synchronization, a precision of $\pm$ 10 ms is achieved for the RTUs of the 1st hierarchy level - these are all those stations which can be reached directly by the central station. For RTUs which can only be reached via relay stations, a maximum precision of only $\pm$ 20 ms and an additional 10 ms for each intermediate relay station is achieved.

Due to the quartz clocks which are used (Accuracy: 10^{-4}) there is a maximum deviation of 360 ms/h or 6 ms/min.

The resulting maximum deviations arise due to the "minute time synchronization" which cannot be guaranteed to be carried out chronologically.
With an average number of stations and corresponding configuration, at baud rates above 600 Bd a remote synchronization can be carried out about every 2 - 3 minutes.

So that, for a time synchronization, the station interrogation and the time synchronization can be carried out in an appropriate period of time, an optimised time synchronization cycle has been included.
In this cycle, a processing list is created in the start-up phase by the SIP which contains every station with which the entire network can be remotely realtime-synchronized.

E.g.



In this special case, a time synchronization is sent to stations U_6 and U_8.
Stations U_6 and U_7 can be reached via U_3 and U_5.

The time synchronization message contains the station number for BROADCAST (= 255). In this way, each station which receives the message receives the data which is contained in it. The EZF5 to stations U_6 and U_7 contains the route via U_3 and U_5. As a result, the stations U_1, U_2, U_3, U_4, U_5, U_6 and U_7 are automatically remotely synchronized.

Initiation time: If there is more than one station in the processing list, the initiation time is defined fixed at 15 seconds.
For only one station or no stations (there are no stations outside the first hierarchy level) the initiation time is calculated on the SIP so as to be as accurate as possible for the minutes pulse.

For the time synchronization, on transmission each data relay station corrects the time information by the times which it knows (e.g. set-up time, message run time, internal processing times).
In addition, a global parameter "Signal runtime per radio device (radio transmitter/receiver)" can be configured in the central station. This correction factor is likewise co-transmitted during the remote realtime-synchronization and is used for correcting the time information on re-transmittal.
By this method, all stations which serve as a "relay station" in a station interrogation are likewise time synchronized.

For the "fine setting" of the time synchronization, a correction time can be directly set in the RTU.

The line delay time with the help of the IEC 870-5-5 function " Acquisition of the message runtime" (Type identifier 106) is not carried out.

2.7.2. Correction Factor for Selective Station Realtime Remote Synchronization

(Applies to UMPM02, Rev. 005)

With the "Selective station realtime remote synchronization" option enabled, in the parameterizable minutes grid a short message is sent out in accordance with IEC-TC-57, Part 5.2. (Status of Link) for calculating the correction factor.
As default, only "DMS in ring configuration" or "DMS with WT in ring configuration" are supported. It is also possible to enable the EZFS on "USER SETTING" on the transmission device.

Correction factor per station =

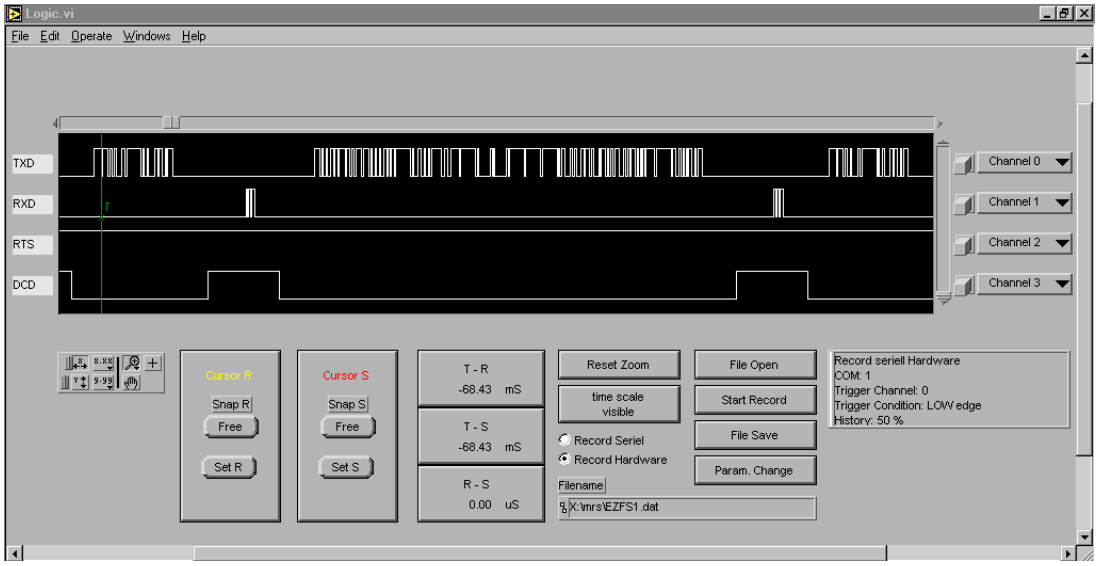
$$\frac{\Delta t - \Delta tel\_runtime}{2}$$

$$\Delta tel\_runtime = \Delta tel\_runtime\_ms + t_p + t_v + t_{stab} + t_{prell} + 18ms + 3ms$$

Notes:

18 ms..... Until the level collapses, only for use with DCD in the RTU.
3 ms..... Software processing time
Δt ..... Time from sending out the last byte of the call message until receipt of the last byte of the reply message.

Subsequently, the realtime remote synchronization is done with the corrected time.



2.8. Data Block Formats Used - "PST Control Message " (Function Code 161)

For the structure, see the "Ax 1703 Data Block Formats" description.

2.8.1. PST Control Message

Description	Function no.	Possible station no.	Additional parameter 1	
START call cycle	0	125	Not defined	
STOP (disable) call cycle	1	125	Not defined	
CONTINUE (enable) call cycle	2	125	Not defined	
Continuous call Station x ON	3	0 – 99	0 – 65535	1)
Continuous call Station x OFF	4	0 – 99	Not defined	
main transmission line AKTIVE	5	0 – 99	Not defined	4)
stand-by transmission line AKTIVE	6	0 – 99	Not defined	4)
Include station in cycle	128	0 - 99	Not defined	3)
Exclude station from cycle	129	0 - 99	0,1	2) 3)

1) 0 ..... START persistent cycle without time
1 – 65535 ..... n * 100 ms continuous call

2) 0 ..... remove a station fault which may exist
1 ..... leave a station fault which may exist

3) A station can only be included or excluded if the station has been parameterized.
If the station number is not known, a "Faulty PST message" error occurs.

4) See Chap. 2.10.
(only meaningful in using with ACP 1703, in Ax 1703, activation over topology)

2.8.2. PST Status Information - Status Lines

The status lines CTS, DTR and DSR are generated in the status information.

2.8.3. PST Status Information - General

2.8.3.1. Station-selective Status Information (Station nos. 0 – 99) (only on enabling of the Repeater Operation option)

State	Status information number	Description	Signal type
Main route parameterized	0	A main route has been parameterized in the routing parameterization .	ST
Main route OK	1		ST
Main route faulty	2		ST
Main route NOK	3		ST
Standby route parameterized	8	A standby route has been parameterized in the routing parameterization.	ST
Standby route OK	9		ST
Standby route faulty	10		ST
Standby route NOK	11		ST

2.8.3.2. Cycle State Status Information (Station no. 255)

State	Status information number	Description	Signal type
Cycle IDLE	0	Cycle control is stopped. User data messages continue to be sent.	ST
Cycle NORMALMODE	1	Cycle control running in normal mode (polling of the RTUs).	ST
Continuous call	2	Continuous call is made to an RTU.	ST
Cycle stopped	3	Cycle control has been stopped via PST control message	ST
DAA running	6	A BROADCAST message is being sent now.	ST
Data message	7	A station-selective data message is being sent now.	ST

2.9. Transmission Device

(Valid as from UMPM02, Rev. 004)

As from Rev. 004 it is possible to use a transmission device with preset time; the use of a "user setting" is also possible.

Default times:

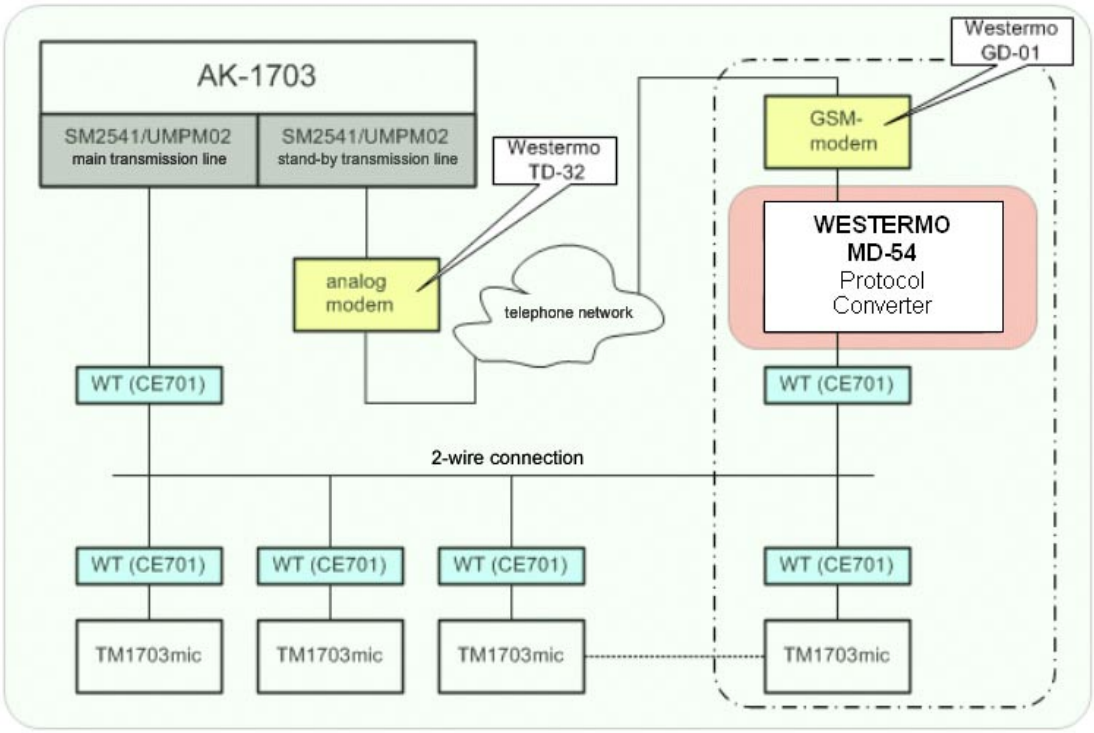
Transmission medium	Operating mode	RTS fixed	tp	tv	tn	tdis	DCD	t-bounce	t-stab??	t-duration	t-delay	
4-wire	RS-232	YES	0	0	3 bit	35	YES	5	5	10000	200	
2-wire	RS-232	NO	0	30	3 bit	35	YES	5	5	10000	200	
DMS 1)	RS-232	YES	0	0	5 bit	0	NO	0	0	0	0	
DMS 2)	RS-232	NO	0	50	5 bit	35	YES	5	5	10000	200	
OPTICAL	RS-232	NO	0	1	0	0	NO	0	0	0	0	
RADIO - Digital	RS-232	NO	30	100	11 bit	50	YES	10	5	0	200	
RADIO - Analog	RS-232	NO	50	300	50	100	YES	10	5	0	200	
Direct conn.	RS-485	NO	0	1	0	0	NO	0	0	0	0	
DLC modem	RS-232	NO	0	1 bit	1 bit	0	NO	0	0	0	0	3)
4-wire SAT CE701	RS-232	YES	0	0	3 bit	0	YES	5	5	10000	200	4)
2-wire SAT CE701	RS-232	NO	22	30	3 bit	0	YES	5	5	10000	200	4)

All times are n*1 ms.

1) DMS in ring configuration.
2) DMS with WT in ring configuration.
3) As from UMPM02, Rev. 007
4) As from UMPM02, Rev. 009

2.10. Stand-by Transmission Line Concept via GSM Modem (or via analog Modem)

(from revision 13)



Function:

If a station falls out on the main transmission line, it should be xxxxxx on the stand-by transmission line.

The MASTER stand-by transmission line build the connection over the telephone net only if a station is notified as fallen out from the MASTER main transmission line. The connection setup is performed only via a state line.

Both MASTER work in coordinated operation, i.e. only one of the two MASTER is aktive at the same time.

2.10.1. Configuration GSM Modem

Master station: Westermo TD-32
Remote terminal unit: Westermo GD-01 (GSM) + Westermo MD-54 Protocol Converter

Assignment of the cable:

Modem TD-32 → Ax/ACP-1703 with PatchPlug CM2860
(25-pole → RJ-45)

25-pole Plug PIN #	→	**RJ-45 Plug** PIN #
2	TxD	4 (blue)
3	RxD	5 (blue-white)
7	GND	6 (green)
8	CTS	1 (orange)
20	DTR	8 (brown)

Modem GD-01 (GSM) → MD-54 Protocol Converter
(9-pole → 9-pole channel 0)

9-pole Plug PIN #	→	**9-pole Plug** PIN #
2	TxD	3
3	RxD	2
5	GND	5
8 ┐	CTS	
4 ┘	DTR	

MD-54 Protocol Converter → CE-701 Modem
(5-pole channel 3 → RJ-45)

5 pol. Stecker PIN #	→	**RJ-45 Stecker** PIN #
5	GND	6 (Grün)
4	CTS	2 (Orange)
3	NOT USED	
2	RxD	4 (Blau)
1	TxD	5 (Blau-Weiß)

2.10.2. Configuration ANALOG

Master station: Westermo TD-32
Remote terminal unit: Westermo TD-32 + Westermo MD-54 Protocol Converter

Assignment of the cable:

Modem TD-32 → Ax/ACP-1703 mit PatchPlug CM2860
(25 pol. → RJ-45)

25 pol. Stecker PIN #	→	**RJ-45 Stecker** PIN #
2	TxD	4 (Blau)
3	RxD	5 (Blau-Weiß)
7	GND	6 (Grün)
8	CTS	1 (Orange)
20	DTR	8 (Braun)

Modem TD-32 → MD-54 Protocol Converter
(25 pol. → 9 pol. channel 0)

25 pol. Stecker PIN #	→	**9 pol. Stecker** PIN #
2	TxD	2
3	RxD	3
7	GND	5

MD-54 Protocol Converter → CE-701 Modem
(5-pole channel 3 → RJ-45)

5-pole plug PIN #	→	**RJ-45 plug** PIN #
5	GND	6 (green)
4	CTS	2 (orange)
3	NOT USED	
2	RxD	4 (blue)
1	TxD	5 (blue-white)

2.10.3. Parameter Setting of the "MD-54 Protocol Converter"

The MD-54 is to parameterize in following order:

1) separation from the voltage supply
2) on DIP switch 1 the 2nd Switch at ON
3) establish the connection with a HyperTerminal (on channel 0)
   adjustment of the HyperTerminal: 9600/8N1
4) reestablishment of the voltage supply
5) the menu of the MD-54 appears on the HyperTerminal
6) parameterize

```
** Function *********************
* 1.............=>CTS-generator *
* 2...XON/XOFF to CTS-converter *
********************************
>1

** Main menu ************
* 1...Initiate channels *
* 2.......View channels *
* 3.......Save settings *
* 4...............About *
************************
>1

** Channel ******
* 1...Channel 0 *
* 2...Channel 3 *
*****************
>1

** Interface (CH0)******
* 1.............RS-232 *
* 2....RS-485 (2-wire) *
* 3....RS-422 (4-wire) *
************************
>1

** Parity (CH0) ******
* 1.............None *
* 2.............Odd *
* 3.............Even *
**********************
>1

** Number of stopbits (CH0) ******
* 1.........................One *
* 2.........................Two *
********************************
>1
```

```
** Wordlength (CH0) ******
* 1..............7 bits *
* 2..............8 bits *
*************************
>2

** Baudrate (CH0) ******
* 1.........1200 bit/s *
* 2.........2400 bit/s *
* 3.........4800 bit/s *
* 4.........9600 bit/s *
* 5........19200 bit/s *
* 6........38400 bit/s *
* 7........57600 bit/s *
* 8.......115200 bit/s *
************************
>4

** Transmit condition (CH0) ******
* 1.........................RTS *
* 2.........................Time *
*********************************
>2

** Time CTS - data out (CH0) ******
* 1...........................10ms *
* 2...........................50ms *
* 3..........................150ms *
* 4..........................250ms *
* 5...................User defined *
***********************************
>3

** Time CTS passive (CH0) ******
* 1.........................0ms *
* 2........................10ms *
* 3........................50ms *
* 4.......................100ms *
* 5...............User defined *
*******************************
>4
```

```
** Main menu ************
* 1...Initiate channels *
* 2.......View channels *
* 3.......Save settings *
* 4...............About *
************************
>1

** Channel ******
* 1...Channel 0 *
* 2...Channel 3 *
*****************
>2

** Interface (CH3)******
* 1.............RS-232 *
* 2....RS-485 (2-wire) *
* 3....RS-422 (4-wire) *
************************
>1

** Parity (CH3) ******
* 1.............None *
* 2..............Odd *
* 3.............Even *
**********************
 >3

** Number of stopbits (CH3) ******
* 1............................One *
* 2............................Two *
********************************
>1

** Wordlength (CH3) ******
* 1...............7 bits *
* 2...............8 bits *
*************************
>2

** Baudrate (CH3) ******
* 1.........1200 bit/s *
* 2.........2400 bit/s *
* 3.........4800 bit/s *
* 4.........9600 bit/s *
* 5........19200 bit/s *
* 6........38400 bit/s *
* 7........57600 bit/s *
* 8.......115200 bit/s *
************************
>1
```

```
** Transmit condition (CH3) ******
* 1.........................RTS *
* 2.........................Time *
**********************************
>2

** Time CTS - data out (CH3) ******
* 1...........................10ms *
* 2...........................50ms *
* 3...........................150ms *
* 4...........................250ms *
* 5..................User defined *
**********************************
>3

** Time CTS passive (CH3) ******
* 1.........................0ms *
* 2.........................10ms *
* 3.........................50ms *
* 4.........................100ms *
* 5...............User defined *
*******************************
>4

** Main menu ************
* 1...Initiate channels *
* 2.......View channels *
* 3.......Save settings *
* 4...............About *
************************
>3
```

Reestablishment of the operating state:

1) separation from the voltage supply
2) on DIP switch 1 the 2nd Switch at OFF
3) reestablishment of the voltage supply

2.10.4. Parameter Setting of the Modems

The parameter setting of the modems occurs also offline with a HyperTerminal. Before operation all AT commands have to be stored manual at the modem

AT commands modem (TD-32) – upon master station:

AT&FE1S0=0
AT&D2%E0&B1
ATX3S7=100S30=120
AT&C1
AT\N0W1
ATF0
AT&Z0=(phone number)
AT&K0
ATE0
AT&W
AT&W0

AT commands GSM modem (GD-01) - upon remote terminal unit:

AT&F
ATS0=1
AT+CPIN=1703
AT+CBST=7,0,0
AT+IFC=0,0
AT+DS=0,0,512
AT+CMGF=1
AT+ICF=3,4
ATE0
AT&W

AT commands modem (TD-32) - upon remote terminal unit:

AT&FE1S0=1
AT&D0%E0&B0
ATX3S7=100S30=120
AT&S0&C1
AT\N0W0
ATF0
AT&W
AT&A1
AT&K0
ATE0
AT&W
AT&W0

2.10.5. Parameter Setting in the OPM

Following parameters have to be changed in the OPM (system technique):

On the stand-by transmission line master below "Allgemeine Einstellungen" / "Übertragungseinrichtung (UE)" the SAT modem "2-Draht Überwachungsleitung" (SAT-CE701 via Westermo TD32) has to be adjusted.

Additionally the parameter setting of the character monitoring time has to be changed on the stand-by transmission line master to 20 ms.
→ Find it below "Advanced parameters" / "Monitoring times" / "Character monitoring time"

Possibly adjust the acknowledgement monitoring time at 1 second!

2.11. Control Location Selection

From **revision 13** it is possible to parameterize the control location within the protocol monitoring (PST). For further details see description DA0-048-1.xx (PST).
It is to be applicational ensured, that after startup respectively selective startup the control location is adjusted. Further it has to be deleted with the OUT command if the control location is changed, before the next control location is adjusted.

A. Appendix: Diagnoses

A.1. Class internal

Class internal - Record 0 : Internal error in the operating system

Bit	Description
00	RAM error
01	STACK error The defined stack range has been exceeded; Replace system element or notify SAT.
02	Firmware shut down Diagnosis: - Read out system diagnostics ring (command ID R) in ST emulation (possibly store to file)
03	Too little free space There is not enough free RAM memory available for the dynamic memory management; Diagnosis: - Change parameterization of size definitions (e.g. realtime rings, pool size) - Notify SAT.
08	CPU 80186 error Occurs on an internal software error.

Class internal - Record 2 : Parameter error ZSE

Bit	Description
00	Parameter error detected by SIP
01	Parameter error of the LOCAL parameter block no. 06 Diagnosis: - TI 38-40 and 136-143 requires parameter setting with time - TI 160 requires parameter setting without time - transmission of the objects on GI with/without time; value > 3 - Octett count cause of transmission (COT) <> 2 - Octett count common address of ASDU (CAASDU) <> 2 - Octett count information object address (IOA) <> 3 - Octett count time stamp <> 7
02	Parameter error ZSE general
03	Parameter setting with invalid stationnumber. Diagnosis: Selected stationnumber is greater than 100 and also not a broadcast-station number.

Bit	Description
04	Parameter setting with invalid station number. Diagnosis: Same station number is used more then once.
05	Invalid Parameters for IEC870 link-layer
06	Invalid Parameters for IEC870 application layer
07	Invalid Parameters for Redundancy
15	Parameter setting for time zone not valid

Class internal - Record 3 : ZSE format conversion error

Bit	Description
00	Format conversion error in the transmit direction
02	Format conversion error in the receive direction
15	Conversion error in PST-controll-messages Diagnosis: - Read out system diagnostics ring (command ID R) in ST emulation and notify SAT (possibly store to file)

Class internal - Record 4 : Invalid Parameters for protocol specific application layer

Bit	Description
00	Error when preparing the routing information
01	Invalid Parameters for master co-ordination or routing function

A.2. Class external

Class external - Record 0 : DFC-Bit Timeout for the Stations Nr. 0 - 15

Bit	Description
00	DFC-Bit Timeout for the Stations Nr. 0
01	DFC-Bit Timeout for the Stations Nr. 1
02	DFC-Bit Timeout for the Stations Nr. 2
03	DFC-Bit Timeout for the Stations Nr. 3
04	DFC-Bit Timeout for the Stations Nr. 4
05	DFC-Bit Timeout for the Stations Nr. 5
06	DFC-Bit Timeout for the Stations Nr. 6
07	DFC-Bit Timeout for the Stations Nr. 7
08	DFC-Bit Timeout for the Stations Nr. 8
09	DFC-Bit Timeout for the Stations Nr. 9

Bit	Description
10	DFC-Bit Timeout for the Stations Nr. 10
11	DFC-Bit Timeout for the Stations Nr. 11
12	DFC-Bit Timeout for the Stations Nr. 12
13	DFC-Bit Timeout for the Stations Nr. 13
14	DFC-Bit Timeout for the Stations Nr. 14
15	DFC-Bit Timeout for the Stations Nr. 15

Class external - Record 1 : DFC-Bit Timeout for the Stations Nr. 16 - 31

Bit	Description
00	DFC-Bit Timeout for the Stations Nr. 16
01	DFC-Bit Timeout for the Stations Nr. 17
02	DFC-Bit Timeout for the Stations Nr. 18
03	DFC-Bit Timeout for the Stations Nr. 19
04	DFC-Bit Timeout for the Stations Nr. 20
05	DFC-Bit Timeout for the Stations Nr. 21
06	DFC-Bit Timeout for the Stations Nr. 22
07	DFC-Bit Timeout for the Stations Nr. 23
08	DFC-Bit Timeout for the Stations Nr. 24
09	DFC-Bit Timeout for the Stations Nr. 25
10	DFC-Bit Timeout for the Stations Nr. 26
11	DFC-Bit Timeout for the Stations Nr. 27
12	DFC-Bit Timeout for the Stations Nr. 28
13	DFC-Bit Timeout for the Stations Nr. 29
14	DFC-Bit Timeout for the Stations Nr. 30
15	DFC-Bit Timeout for the Stations Nr. 31

Class external - Record 2 : DFC-Bit Timeout for the Stations Nr. 32 - 47

Bit	Description
00	DFC-Bit Timeout for the Stations Nr. 32
01	DFC-Bit Timeout for the Stations Nr. 33
02	DFC-Bit Timeout for the Stations Nr. 34
03	DFC-Bit Timeout for the Stations Nr. 35
04	DFC-Bit Timeout for the Stations Nr. 36
05	DFC-Bit Timeout for the Stations Nr. 37

Bit	Description
06	DFC-Bit Timeout for the Stations Nr. 38
07	DFC-Bit Timeout for the Stations Nr. 39
08	DFC-Bit Timeout for the Stations Nr. 40
09	DFC-Bit Timeout for the Stations Nr. 41
10	DFC-Bit Timeout for the Stations Nr. 42
11	DFC-Bit Timeout for the Stations Nr. 43
12	DFC-Bit Timeout for the Stations Nr. 44
13	DFC-Bit Timeout for the Stations Nr. 45
14	DFC-Bit Timeout for the Stations Nr. 46
15	DFC-Bit Timeout for the Stations Nr. 47

Class external - Record 3 : DFC-Bit Timeout for the Stations Nr. 48 - 63

Bit	Description
00	DFC-Bit Timeout for the Stations Nr. 48
01	DFC-Bit Timeout for the Stations Nr. 49
02	DFC-Bit Timeout for the Stations Nr. 50
03	DFC-Bit Timeout for the Stations Nr. 51
04	DFC-Bit Timeout for the Stations Nr. 52
05	DFC-Bit Timeout for the Stations Nr. 53
06	DFC-Bit Timeout for the Stations Nr. 54
07	DFC-Bit Timeout for the Stations Nr. 55
08	DFC-Bit Timeout for the Stations Nr. 56
09	DFC-Bit Timeout for the Stations Nr. 57
10	DFC-Bit Timeout for the Stations Nr. 58
11	DFC-Bit Timeout for the Stations Nr. 59
12	DFC-Bit Timeout for the Stations Nr. 60
13	DFC-Bit Timeout for the Stations Nr. 61
14	DFC-Bit Timeout for the Stations Nr. 62
15	DFC-Bit Timeout for the Stations Nr.

Class external - Record 4 : DFC-Bit Timeout for the Stations Nr. 64 -79

Bit	Description
00	DFC-Bit Timeout for the Stations Nr. 64
01	DFC-Bit Timeout for the Stations Nr. 65

Bit	Description
02	DFC-Bit Timeout for the Stations Nr. 66
03	DFC-Bit Timeout for the Stations Nr. 67
04	DFC-Bit Timeout for the Stations Nr. 68
05	DFC-Bit Timeout for the Stations Nr. 69
06	DFC-Bit Timeout for the Stations Nr. 70
07	DFC-Bit Timeout for the Stations Nr. 71
08	DFC-Bit Timeout for the Stations Nr. 72
09	DFC-Bit Timeout for the Stations Nr. 73
10	DFC-Bit Timeout for the Stations Nr. 74
11	DFC-Bit Timeout for the Stations Nr. 75
12	DFC-Bit Timeout for the Stations Nr. 76
13	DFC-Bit Timeout for the Stations Nr. 77
14	DFC-Bit Timeout for the Stations Nr. 78
15	DFC-Bit Timeout for the Stations Nr. 79

Class external - Record 5 : DFC-Bit Timeout for the Stations Nr. 80 -95

Bit	Description
00	DFC-Bit Timeout for the Stations Nr. 80
01	DFC-Bit Timeout for the Stations Nr. 81
02	DFC-Bit Timeout for the Stations Nr. 82
03	DFC-Bit Timeout for the Stations Nr. 83
04	DFC-Bit Timeout for the Stations Nr. 84
05	DFC-Bit Timeout for the Stations Nr. 85
06	DFC-Bit Timeout for the Stations Nr. 86
07	DFC-Bit Timeout for the Stations Nr. 87
08	DFC-Bit Timeout for the Stations Nr. 88
09	DFC-Bit Timeout for the Stations Nr. 89
10	DFC-Bit Timeout for the Stations Nr. 90
11	DFC-Bit Timeout for the Stations Nr. 91
12	DFC-Bit Timeout for the Stations Nr. 92
13	DFC-Bit Timeout for the Stations Nr. 93
14	DFC-Bit Timeout for the Stations Nr. 94
15	DFC-Bit Timeout for the Stations Nr. 95

Class external - Record 6 : DFC-Bit Timeout for the Stations Nr. 96 -99

Bit	Description
00	DFC-Bit Timeout for the Stations Nr. 96
01	DFC-Bit Timeout for the Stations Nr. 97
02	DFC-Bit Timeout for the Stations Nr. 98
03	DFC-Bit Timeout for the Stations Nr. 99

A.3. Class communication

Class communication - Record 2 : Communication error to Station no. 0 - 15

Bit	Description
00	Communication error to Station no. 0
01	Communication error to Station no. 1
02	Communication error to Station no. 2
03	Communication error to Station no. 3
04	Communication error to Station no. 4
05	Communication error to Station no. 5
06	Communication error to Station no. 6
07	Communication error to Station no. 7
08	Communication error to Station no. 8
09	Communication error to Station no. 9
10	Communication error to Station no. 10
11	Communication error to Station no. 11
12	Communication error to Station no. 12
13	Communication error to Station no. 13
14	Communication error to Station no. 14
15	Communication error to Station no. 15

Class communication - Record 3 : Communication error to Station no. 16 - 31

Bit	Description
00	Communication error to Station no. 16
01	Communication error to Station no. 17
02	Communication error to Station no. 18
03	Communication error to Station no. 19

Bit	Description
04	Communication error to Station no. 20
05	Communication error to Station no. 21
06	Communication error to Station no. 22
07	Communication error to Station no. 23
08	Communication error to Station no. 24
09	Communication error to Station no. 25
10	Communication error to Station no. 26
11	Communication error to Station no. 27
12	Communication error to Station no. 28
13	Communication error to Station no. 29
14	Communication error to Station no. 30
15	Communication error to Station no. 31

Class communication - Record 4 : Communication error to Station no. 32 - 47

Bit	Description
00	Communication error to Station no. 32
01	Communication error to Station no. 33
02	Communication error to Station no. 34
03	Communication error to Station no. 35
04	Communication error to Station no. 36
05	Communication error to Station no. 37
06	Communication error to Station no. 38
07	Communication error to Station no. 39
08	Communication error to Station no. 40
09	Communication error to Station no. 41
10	Communication error to Station no. 42
11	Communication error to Station no. 43
12	Communication error to Station no. 44
13	Communication error to Station no. 45
14	Communication error to Station no. 46
15	Communication error to Station no. 47

Class communication - Record 5 : Communication error to Station no. 48 - 63

Bit	Description
00	Communication error to Station no. 48
01	Communication error to Station no. 49
02	Communication error to Station no. 50
03	Communication error to Station no. 51
04	Communication error to Station no. 52
05	Communication error to Station no. 53
06	Communication error to Station no. 54
07	Communication error to Station no. 55
08	Communication error to Station no. 56
09	Communication error to Station no. 57
10	Communication error to Station no. 58
11	Communication error to Station no. 59
12	Communication error to Station no. 60
13	Communication error to Station no. 61
14	Communication error to Station no. 62
15	Communication error to Station no. 63

Class communication - Record 6 : Communication error to Station no. 64 - 79

Bit	Description
00	Communication error to Station no. 64
01	Communication error to Station no. 65
02	Communication error to Station no. 66
03	Communication error to Station no. 67
04	Communication error to Station no. 68
05	Communication error to Station no. 69
06	Communication error to Station no. 70
07	Communication error to Station no. 71
08	Communication error to Station no. 72
09	Communication error to Station no. 73
10	Communication error to Station no. 74
11	Communication error to Station no. 75
12	Communication error to Station no. 76

13	Communication error to Station no. 77
14	Communication error to Station no. 78
15	Communication error to Station no. 79

Class communication - Record 7 : Communication error to Station no. 80 - 95

Bit	Description
00	Communication error to Station no. 80
01	Communication error to Station no. 81
02	Communication error to Station no. 82
03	Communication error to Station no. 83
04	Communication error to Station no. 84
05	Communication error to Station no. 85
06	Communication error to Station no. 86
07	Communication error to Station no. 87
08	Communication error to Station no. 88
09	Communication error to Station no. 89
10	Communication error to Station no. 90
11	Communication error to Station no. 91
12	Communication error to Station no. 92
13	Communication error to Station no. 93
14	Communication error to Station no. 94
15	Communication error to Station no. 95

Class communication - Record 8 : Communication error to Station no. 96 - 99

Bit	Description
00	Communication error to Station no. 96
01	Communication error to Station no. 97
02	Communication error to Station no. 98
03	Communication error to Station no. 99

A.4. Class test

Class test - Record 0 : Test mode of the operating and base systems

Bit	Description
00	Memory test disabled

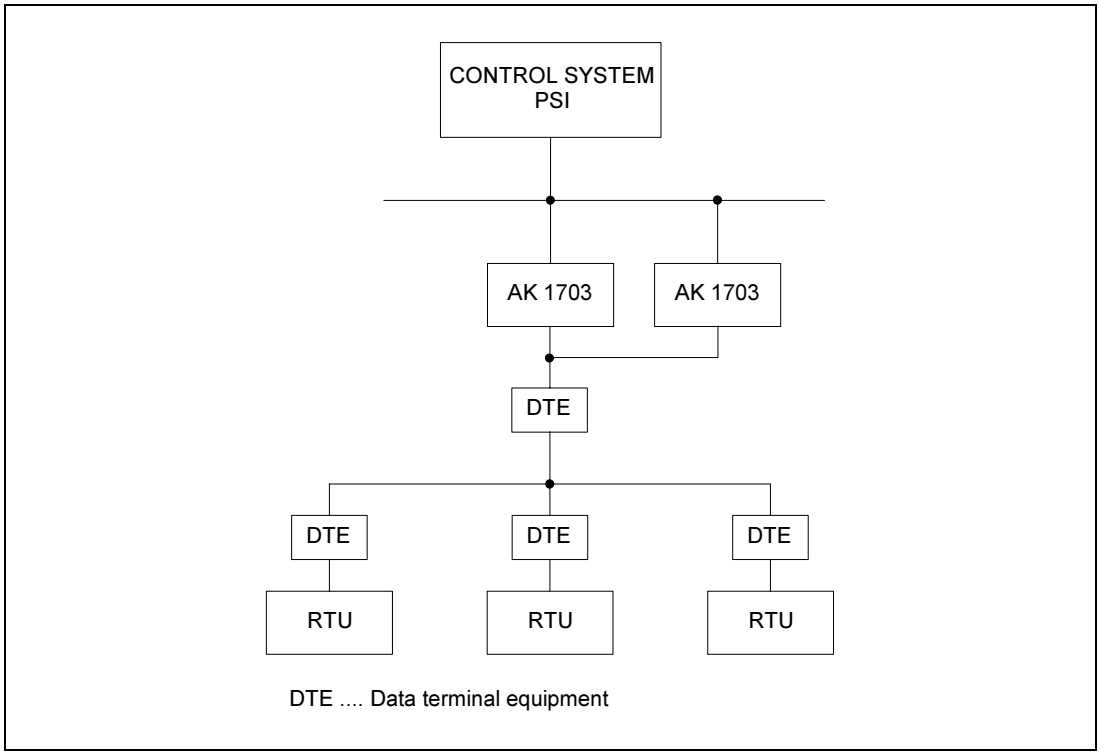
B. Appendix: Description of Transparent Mode

B.1. General

In "transparent mode“ all valid received messages are packed into a "user data container" and forwarded in the direction of the control system . All process data messages and system messages which are to be sent are already prepared by the control system in the IEC 60870-5-101 format and are likewise made ready for the protocol in a "user data container" for sending out.

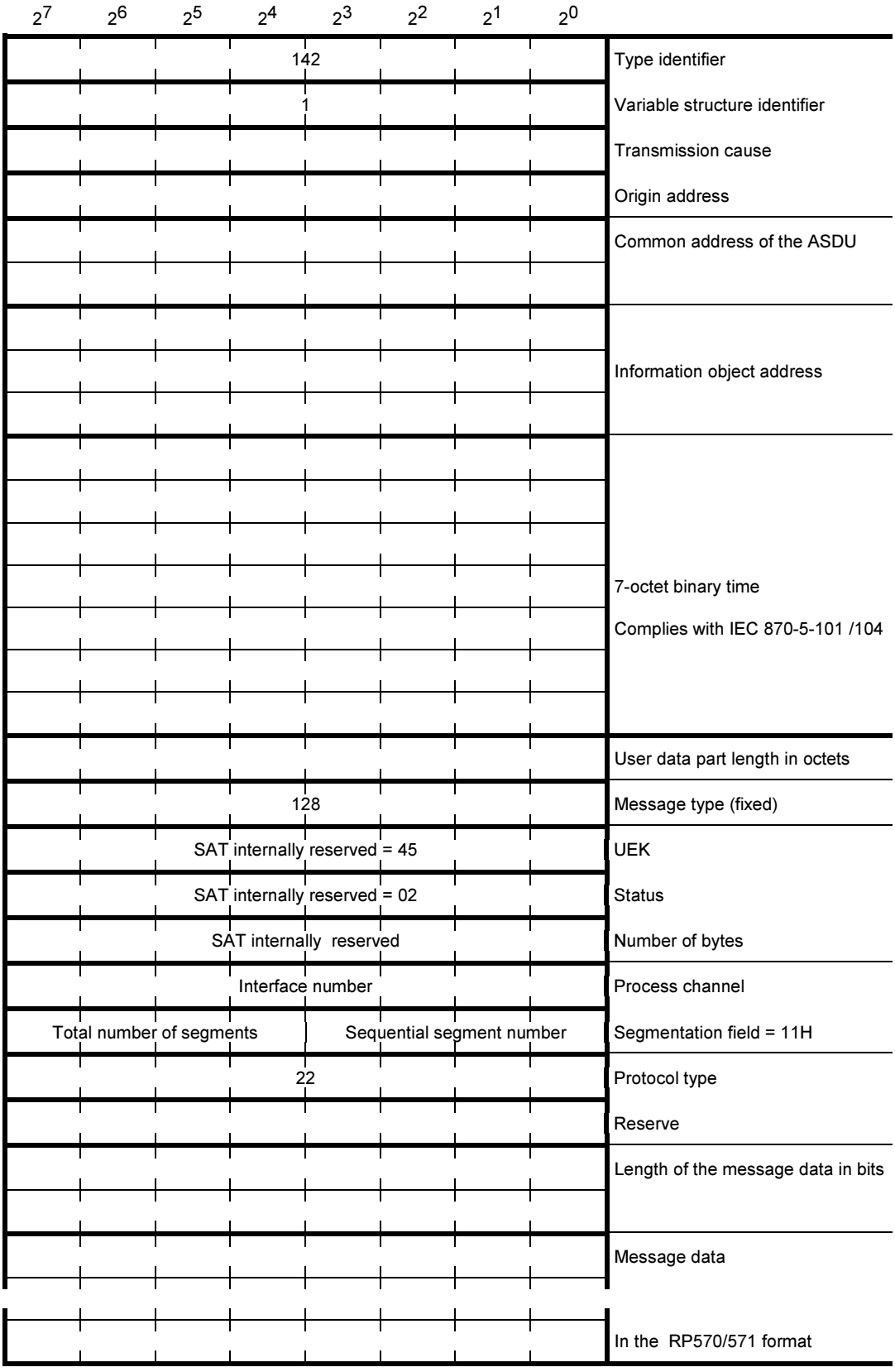
The transmission of the user data container is done with type identification 142 in the private range of IEC-60870-5-101 or IEC-60870-5-104.

B.2. Addressing



Every RTU is issued with a component number based on the station number (St#). Each station must also be issued with a region number via the topology parameterization (all stations of a line must have the same region number).
In this way, the user data container (for each station) is in principle addressed. The address of the data container is the same in the command and binary information directions.

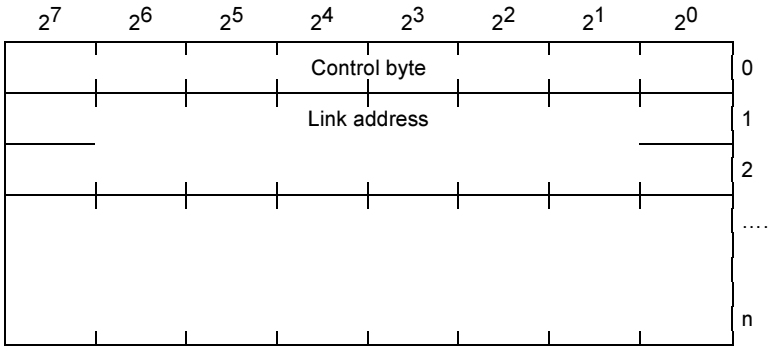
B.3. User Data Container



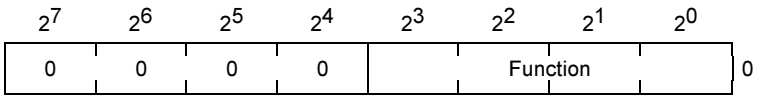
Description of the contents:

Transmission cause	Monitoring direction = Spontaneous (3) Control direction = Activation (6)
Common address of the ASDU ...	1st octet = Region number of the connected station 2nd octet = Component number of the connected station
Information object address...	1st octet = 255 2nd octet = 255 3rd octet = 191 (sub-address)
Binary time ...	Earliest possible acquisition time of a message in the AK 1703. Time tagging on the base system element (BSE)
Length of user data in octets...	Exclusive message type
Number of bytes…	Length of the message data (in bytes) + 6
Segmentation field...	4-bit total number of the segments Total size = 15 segments of 50 octets each 4-bit sequential number of the segment (the first segment has Segment Number 1)
Length of the message data in bits...	Always the total length in all segments

Structure of the message data:

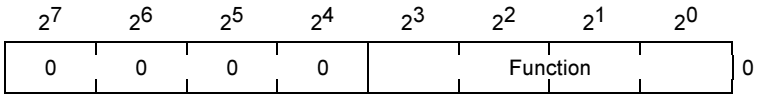


Control byte - Control system → IEC 870-5-101



Function	Description
3	User data SEND / CONFIRM
4	User data SEND / NO REPLY

Control byte - IEC 870-5-101 → Control system



Function	Description
3	User data SEND / CONFIRM
4	User data SEND / NO REPLY

Link address

The length of the link address (0, 1, 2 bytes) is determined by a parameter in the protocol.

C. Appendix: Bibliography

The following documents are recommended to supplement the " UMPM02" description:

IEC 870-5-1, "Transmission Frame Formats"
(1st issue, February 1990)

DIN EN 60870-5-101 "Fernwirkeinrichtungen und Fernwirksysteme" [Telecommunications equipment and telecommunications systems]
Part 5: Transmission protocol
Main section 101: Application-related standards for basic telecommunications tasks
(IEC 870-5-101: 1995) German version EN 870-5-101: 1995

DIN EN 60870-5-5 "Fernwirkeinrichtungen und Fernwirksysteme" [Telecommunications equipment and telecommunications systems]
Part 5: Transmission protocol
Main section 5: Fundamental application functions
(IEC 870-5-5: 1995) German version EN 870-5-5: 1995

SAT Description: "Ax 1703 Data Formats"
Item number: MA0-000-x.xx

SAT Description: "IEC 60870-5-101 and 104 Interoperability"
Item number: DA0-040-x.xx

DIN 19244 "Fernwirkeinrichtungen und Fernwirksysteme" [Telecommunications equipment and telecommunications systems]
Part 10: Message Formats

DIN 19244 "Fernwirkeinrichtungen und Fernwirksysteme" [Telecommunications equipment and telecommunications systems]
Part 52: Transmission Procedures of the Connection Layer

DIN 19244 "Fernwirkeinrichtungen und Fernwirksysteme" [Telecommunications equipment and telecommunications systems]
Part 53: Transmission Protocol
Main section 3: General Structure of the Application Data

D. Appendix: Parameter Documentation

D.1. Common settings

Parameter	Description	Values/Ranges
baud rate receiving direction	baud rate receiving direction	[50] 50 [Bd] [75] 75 [Bd] [100] 100 [Bd] [110] 110 [Bd] [134] 134,5 [Bd] [150] 150 [Bd] [200] 200 [Bd] [300] 300 [Bd] [600] 600 [Bd] [1050] 1050 [Bd] [1200] 1200 [Bd] [1800] 1800 [Bd] [2000] 2000 [Bd] [2400] 2400 [Bd] [4800] 4800 [Bd] [9600] 9600 [Bd] [19200] 19200 [Bd] [38400] 38400 [Bd] [56000] 56000 [Bd] [57600] 57600 [Bd] [64000] 64000 [Bd]
baud rate transmit direction	baud rate transmit direction	[50] 50 [Bd] [75] 75 [Bd] [100] 100 [Bd] [110] 110 [Bd] [134] 134,5 [Bd] [150] 150 [Bd] [200] 200 [Bd] [300] 300 [Bd] [600] 600 [Bd] [1050] 1050 [Bd] [1200] 1200 [Bd] [1800] 1800 [Bd] [2000] 2000 [Bd] [2400] 2400 [Bd] [4800] 4800 [Bd] [9600] 9600 [Bd] [19200] 19200 [Bd] [38400] 38400 [Bd] [56000] 56000 [Bd] [57600] 57600 [Bd] [64000] 64000 [Bd]
interface modem	Selection of the interface modem. Most of the parameters for the predefined interface modems are standardized and not changeable.	[0] free defineable [1] SAT Modem "4-wire circuit transmission line" (SAT-VFM,-WT,-WTK,-WTK-S,-CE0700) [2] SAT Modem "2-wire circuit transmission line" (SAT-

Parameter	Description	Values/Ranges
		VFM,-WT,-WTK,-WTK-S,-CE0700) [3] SAT-DMS (ring configuration) [4] SAT-DMS (ring configuration; AU remote via WT) [5] OPTICAL [6] radio digital [7] radio analogue [8] NULL-Modem interface (RS-485) [9] SAT-DLC-Modem (CE0740,-CE0741,-CE0742,-LA0740,-LA0741) [10] SAT Modem "4-wire circuit transmission line" (SAT-CE0701) [11] SAT Modem "2-wire circuit transmission line" (SAT-CE0701) [12] SAT Modem "2-wire circuit transmission line" (SAT-CE0701 over modem) [13] SAT Modem "2-wire circuit transmission line" (SAT-CE0701 over Westermo TD-32) [14] SAT Modem "2-wire circuit transmission line" (SAT-CE0701 over Westermo GD-01) [15] NULL-Modem interface (RS-232) [100] SATTELLINE 2ASxE time slot radio modem

D.2. Common settings | SAT-DLC-Modem

Parameter	Description	Values/Ranges
DIP switch S1/1	The internal Baudrate at the DLC-Modem must be parametrized via DIP-Switches direct at the DLC-Modem and must accord to this parametrization.	[0] OFF [1] ON
DIP switch S1/2	The internal Baudrate at the DLC-Modem must be parametrized via DIP-Switches direct at the DLC-Modem and must accord to this parametrization.	[0] OFF [1] ON
DIP switch S1/3	The internal Baudrate at the DLC-Modem must be parametrized via DIP-Switches direct at the DLC-Modem and must accord to this parametrization.	[0] OFF [1] ON
DIP switch S1/4	The internal Baudrate at the DLC-Modem must be parametrized via DIP-Switches direct at the DLC-Modem and must accord to this parametrization.	[0] OFF [1] ON
frequency range		[0] 10-30kHz [1] 30-90kHz

D.3. Common settings | Time slot radio modem (SATTELLINE 2ASxE)

Parameter	Description	Values/Ranges
failure monitoring		Integer [###] 0 to 255 [min]
length of time slot		Integer [##] 1 to 59 [s]
start second of time slot		Integer [##] 0 to 59 [s]

D.4. Common settings | free defineable transmission facility

Parameter	Description	Values/Ranges
Bit timing: (only for "Isochronous")	Bit timing: (only for "Isochronous") either external (from RXC-inpu) or intern (at TXC-output)	[0] extern (bit timing from RXC input) [1] internal (bit timing at the TXC-output)
DCD assessment	DCD assessment	[0] Not enabled [1] Enabled
Transm.delay contin.lvl tr.line(tcldly)	A further message transmission is carried out for "continuous level", at the latest, after expiry of the "Transmission delay".	Float [####.#] 0.1 to 6553.5 [s] 0 [s]
asynchron_isochron	asynchronous (V.24/V.28, 16 x bit timing) or isochron (X.24/X.27 1 x bit timing)	[0] asynchronous "V.24/V.28" (16 x bit timing) [1] Isochron "X.24/X.27" (single bit timing)
bounce suppression time (tbounce)	bounce suppression time (tbounce)	Integer [#####] 0 to 65535 [ms]
continuous level monitoring time (tcl)	continuous level monitoring time (tcl)	Float [####.#] 0.1 to 6553.5 [s] 0 [s]
disable time (tdis)	disable time after a received message	Integer [#####] 0 to 32767 [ms / Bit]
disable time time base (tdis)	Parametrized times in bits depend on the the baudrate!	[0] Bit [ms / Bit] [1] ms [ms / Bit]
electrical interface	electrical interface	[0] RS232 (V.24/V.28) [1] RS422 (V.11) [2] RS485 (V.11)
pause time (tp)	Before a message transmission the set pause time is waited before switching on the transmit level (RTS).	Integer [#####] 0 to 32767 [ms/Bit]
pause time_time base (tp)	Parametrized times in bits depend on the the baudrate!	[0] Bit [ms / Bit] [1] ms [ms / Bit]
run-out time (tn)	After the end of the message transmission, the transmit level(RTS) is only switched off after expiry of the reset time.	Integer [#####] 0 to 32767 [ms / Bit]
run-out time_time base	Parametrized times in bits depend on the the baudrate!	[0] Bit [ms /Bit]

Parameter	Description	Values/Ranges
(tn)		[1] ms [ms /Bit]
set up time (tv)	After switching on the transmit level (RTS) the message transmission is started after expiry of the set-up time. Note: For "tv=0" there is no carrier switching (RTS=OFF)!	Integer [#####] 0 to 32767 [ms / Bit]
set up time_time base (tv)	Parametrized times in bits depend on the the baudrate!	[0] Bit [ms / Bit] [1] ms [ms / Bit]
stability monitoring time (tstab)	stability monitoring time (tstab)\ The "new" DCD state is only utilized\ after expiry of the stability monitoring time\ for the message synchronisation.	Integer [#####] 0 to 65535 [ms]

D.5. Message retries

Parameter	Description	Values/Ranges
Retries for INIT-messages (after reset)	Number of max. message retrys	Integer [###] 0 to 255
Retries for data msg. "unack. to all"	Number of max. message retrys	Integer [###] 0 to 255
Retries for station selective data msg.	Number of max. message retrys	Integer [###] 0 to 255

D.6. Redundancy

Parameter	Description	Values/Ranges
Delay time standby=>active	delay time in case of sitch over from STANDBY->ACTIVE 0 = switch without delay	Integer [####] 0 to 2000 [s]
behavior if passive	behavior if passive	[0] interface "TRISTATE" [1] "interface "ACTIVE", listening mode (=STANDBY) [3] "interface "ACTIVE", calling mode (=OPERATION)
receive timeout standby	receive timeout in standby mode 0 = no monitoring!	Float [####.] 0 to 60000 [s]

D.7. Station call prioritization

Parameter	Description	Values/Ranges
No. of stat. calls in high priority lvl	Number of station calls until level change	Integer [##] 0 to 99
No. of stat. calls in low prior. lvl(A)	Number of station calls until level change	Integer [##] 0 to 99

Parameter	Description	Values/Ranges
No. of stat. calls in low prior. lvl(B)	Number of station calls until level change	Integer [##] 0 to 99
No. of stat. calls in mid. priority lvl	Number of station calls until level change	Integer [##] 0 to 99

D.8. Advanced parameters

Parameter	Description	Values/Ranges
Minute raster of RT remote sychroniz.	0 = each minute	Integer [###] 0 [min] 1 to 255 [min]
Pause between dialling retries		Integer [###] 0 to 255 [min]
Repeater function (Routing)	Enabling of the routing function	[0] Not enabled [1] Enabled
Standbymaster	Standbymaster can be activated with protocol control messages	[0] Not enabled [1] Enabled
continuous cycle	continuous cycle	[0] Not enabled [1] Enabled
masterkoordination	Several coordinated MASTER can use the same transmission line The coordination of the MASTER\ is controlled with DTR/DSR. The RTU detects the assigned Master because of the radio area identifier.	[0] Not enabled [1] Enabled
radio area identifier/master number	Messages to stations which are only available via routing stations are transmitted with the parameterized "radio area identifier". With Master-coordination, the MASTER no. corresponds to the radio area identifier 0= no radio area ident. / Master no.	Integer [###] 0 1 to 255
selective RT remote sychronization		[0] Not enabled [1] Enabled
stand-by transmission line delay time	0 = switch without delay	Integer [###] 0 to 255 [s]

D.9. Advanced parameters | IEC-parameter

Parameter	Description	Values/Ranges
DFC-timeout	receive timeout in standby mode 0 = no monitoring!	Float [####.] 0 to 60000 [s]
Redundancy operating mode		[0] AX1703 [1] Norwegian User Conventions (NUC)
number of bytes linkaddress	Number of bytes linkaddress	[1] 1 Byte [2] 2 Byte

Parameter	Description	Values/Ranges
set originator address in transmit direction always up 0		[0] NO [1] YES

D.10. Advanced parameters | IEC-parameter | Summertime bit, Weekday in the real-time stamp (transmission)

Parameter	Description	Values/Ranges
set days of week (DOW) always up 0		[0] NO [1] YES
set summer time (SU) always up 0		[0] NO [1] YES

D.11. Advanced parameters | Message conversion

Parameter	Description	Values/Ranges
Message conversion receive direction	Message conversion receive direction	[0] SAT AX1703 Mode [1] Container mode
Message conversion transmit direction	Message conversion transmit direction	[0] SAT AX1703 Mode [1] Container mode

D.12. Advanced parameters | Software test points

Parameter	Description	Values/Ranges
DLC-Correction factor		[0] NO [1] YES
Handshake RTS,GPB (ASCII-Mode)	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
Handshake RTS,GPB (HEX-Mode)	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
Init-end processing	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
User-Softwaretestpoint 10		[0] NO [1] YES
User-Softwaretestpoint 11		[0] NO [1] YES
User-Softwaretestpoint 12		[0] NO [1] YES

Parameter	Description	Values/Ranges
User-Softwaretestpoint 13		[0] NO [1] YES
User-Softwaretestpoint 14		[0] NO [1] YES
User-Softwaretestpoint 15		[0] NO [1] YES
User-Softwaretestpoint 2		[0] NO [1] YES
User-Softwaretestpoint 3		[0] NO [1] YES
User-Softwaretestpoint 4		[0] NO [1] YES
User-Softwaretestpoint 5		[0] NO [1] YES
User-Softwaretestpoint 6		[0] NO [1] YES
User-Softwaretestpoint 7		[0] NO [1] YES
User-Softwaretestpoint 8		[0] NO [1] YES
User-Softwaretestpoint 9		[0] NO [1] YES
ZDT-filter	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
correction time of the time synchr.	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
data and acknowledgement between BSE	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
level locking station locking	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
mask for blocking data pick-up	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
master-standby switchover	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES
stop_serialtest_after_comm_error	The change of this parameter required profoundness communication knowledge. A specialist should be contacted before.	[0] NO [1] YES

D.13. Advanced parameters | call procedure per type identification

Parameter	Description	Values/Ranges
continuous call time 0	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 1	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 10	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 11	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 12	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 13	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 14	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 2	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 3	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 4	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 5	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 6	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 7	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 8	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]
continuous call time 9	When a message is transmitted to a selective station, this station can be interrogated permanent for a definable time. (0=no perman	Float [####.#] 0.0 to 6000.0 [s]

Parameter	Description	Values/Ranges
type identification 0 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 1 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 10 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 11 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 12 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 13 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 14 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 2 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 3 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 4 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 5 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 6 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 7 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 8 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255
type identification 9 (TI)	After a message is transmitted to a selective station, it can be continuously interrogated for a parameterizable time (=continuous calling).	Integer [###] 0 to 255

D.14. Advanced parameters | coordination several masters

Parameter	Description	Values/Ranges
Coordination monitoring time		Integer [#####] 0 to 65535 [s]
number of transmitting calls	Number of transmitting calls	Integer [###] 0 to 255

D.15. Advanced parameters | monitoring times

Parameter	Description	Values/Ranges
Character monitoring time	Maximum pause between sequential bytes of a message. After a message interruption was detected, the idle monitoring time is started.	Integer [#####] 0 to 32767 [ms / Bit]
Character monitoring time_time base	Parametrized times in bits depend on the the baudrate!	[0] Bit [ms / Bit] [1] ms [ms / Bit]
expected_acknowledgem_time_corr_factor	The expected acknowledgement time is determined automatically. Signal transfer times and other delays must be considered in the "expected acknowledgement time correction factor."	Float [###.##] 0 to 655.35 [s]
idle monitoring time	After transmission faults or message interruption, the line is monitored for quiescent state. After expiry of this monitoring time, the resynchronisation of the receiver takes place. By using the DCD input, faster resynchronisation can be achieved.	Integer [#####] 0 to 32767 [ms / Bit]
idle monitoring time_time base	Parametrized times in bits depend on the the baudrate!	[0] Bit [ms / Bit] [1] ms [ms / Bit]

D.16. Advanced parameters | real time remote sychronization

Parameter	Description	Values/Ranges
correction time of message transfer time		Integer [#####] 0 to 65535 [ms]
minute raster measuring msg.transf. time	0= 1 minute cycle	Integer [###] 0 to 255 [min]

D.17. Advanced parameters | routing

Parameter	Description	Values/Ranges
limit of retries until changover	In case of failure of the main transmission line after reaching the limit of retries until changeover to the stand-by transmission line further retries are transmitted over the stand by transmission line.	Integer [###] 0 to 254
routing procedure	With the dynamic routing procedure only the used routing information is entered in the message.	[0] Dynamically [1] Statically