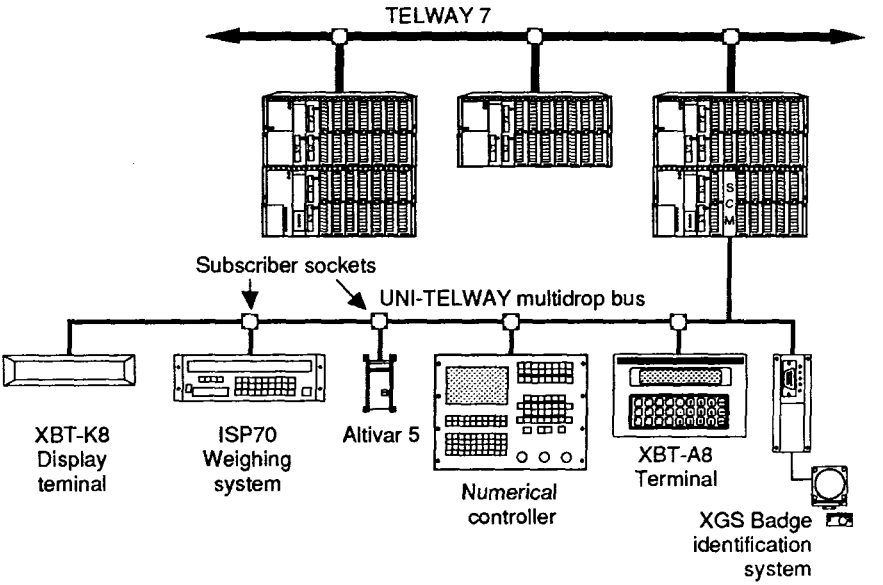
5.1 Introduction

- **UNI-TE protocol**

  UNI-TE is the application layer of the UNI-TELWAY industrial communication protocol.

- **Introduction**

  UNI-TELWAY is a multidrop industrial bus which is the standard means of communication between the various products in the Telemecanique range. UNI-TELWAY is also used for communication with devices such as supervision systems and management computers. Physical, data link, network and application layers conform to the I.S.O. specifications of the O.S.I. model. *



- **Principle**

  UNI-TELWAY requires :
  - at the data link level, a fixed master (e.g. TSX7 PLC) which manages and checks communication exchanges (XBT-A8 cannot be a master).
  - at the application layer level, 1 to 27 slave devices which may be either CLIENTS or SERVERS, depending on their status with respect to the data link layer.

THE CLIENT ASKS THE SERVER A QUESTION,
THE SERVER REPLIES TO THE CLIENT'S QUESTION

* O.S.I. : Open System Interconnect
I.S.O. : International System Organization

- **XBT-A8 UNI-TELWAY**

  - XBT-A8 terminals operating with UNI-TE support all the ADJUST mode functions (when connected to a programming port) and also have the following advantages :
    - Programming terminal ports of the TSX7 PLCs are freed,
    - Terminals operate in multidrop with other devices connected to the bus,
    - Remote devices can be accessed via a Telemecanique network architecture (TELWAY 7, UNI-TELWAY, MAPWAY, etc.).

THE ADDRESS SYSTEM IS DESCRIBED IN THE UNI-TELWAY BUS "REFERENCE GUIDE" TSX D24004E

- **Status of the XBT-A8**

  - XBT-A8s are SLAVES at the DATA LINK LAYER,
  - XBT-A8s may be CLIENTS or SERVERS at the APPLICATION LAYER.

XBT-A8 CLIENT
NO APPLICATION PROGRAM IN THE SERVER DEVICES (e.g. : TSX7)

XBT-A8 SERVER :
REQUESTS PROGRAMMED IN THE CLIENT DEVICES (e.g. : TSX7)

- **Communication protocol management**

THE XBT-A8 OCCUPIES TWO ADDRESSES ON THE UNI-TELWAY BUS

SERVER ADDRESS : This is the address used by CLIENT control systems for sending their requests to the XBT-A8 terminal.

This address is defined by :
- With the XBT-A in point-to-point (e.g. TSX ⇔ XBT-A) address 1 is coded by the connection cable, for example on the TSX side within the 25-pin connector
- With the XBT-A connected to a subscriber socket (e.g. TSX SCA62) the address is coded by the SCA62 micro-switches.

CLIENT ADDRESS : This address is used by the XBT-A8 for sending messages to SERVER devices. It is transparent to the user.

CLIENT ADDRESS = SERVER ADDRESS + 1

Note : These two addresses are independent to those specified in the XBT-A8 configuration for the to message variables or the STATUS BLOCK (see section 4 CONFIGURATION MODE).

These 2 addresses are those of the XBT-A8 itself.

5.2 Function modes

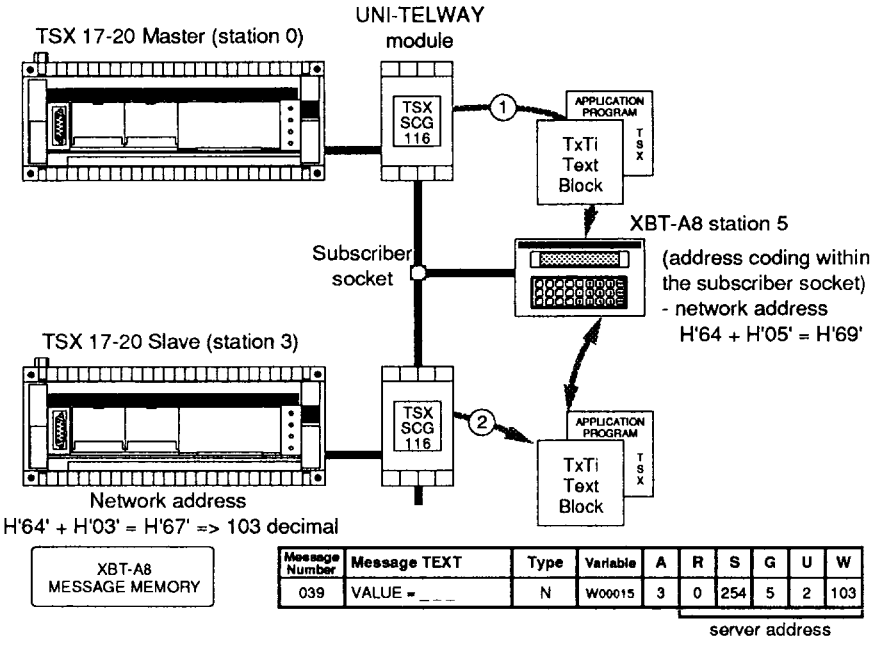
- **XBT-A8 SERVER**

The XBT-A8 is called a SERVER when it responds to a command given by a CLIENT device.

CLIENT devices request XBT-A8 services by sending standard UNI-TE requests (via TSX7 text blocks).

TYPES OF REQUEST	XBT-A8 FUNCTIONS
GENERAL USE	- IDENTIFYING EQUIPMENT - PROTOCOL VERSION - STATUS (STATE OF THE TERMINAL) - MIRROR - READING ERROR COUNTERS - RESETTING ERROR COUNTERS
WORKING MODES	- INITIALIZATION
ACCESS TO DATA (XBT-A8 RESOURCES) read/write bits/words list of bits/list of words	- MANAGEMENT OF XBT RESOURCES (LEDS, keyboard, buzzer) - DISPLAYING MESSAGES (PREDEFINED OR NOT) - READING PREDEFINED MESSAGES - HANDLING OPERATOR REPONSES
MANAGEMENT OF SEMAPHORES	- RESERVATION - DERESERVATION - RENEWING THE RESERVATION
FILE TRANSFER	REMOTE UPLOADING/DOWNLOADING (message area)

Examples of the XBT-A8 as a SERVER



Message Number	Message TEXT	Type	Variable	A	R	S	G	U	W
039	VALUE = _ _ _	N	W00015	3	0	254	5	2	103

server address

① Modifying a parameter
- The TSX 17-20 master requests that message 039 (H'0027) be displayed with the operator response (Type N). XBT-A8 acts as SERVER,
- The XBT-A8 displays the following : VALUE =_ _ _ and the value of the variable W00015 read from station 3 blinks,
- The operator enters his response and confirms it by pressing (ENTER) ,
- The XBT-A8 writes the new value to variable W00015 in station 3 and updates it on the display (A=3) every second.

② Inhibiting access to the configuration mode
- The TSX 17-20 slave requests that the XBT-A8 keyboard be locked (inhibiting using the (ENTER) plus (FUNCT) key combination.),
- XBT-A8 resource address, H'0384' (see section 5.5),
- The XBT-A8 carries out the operation requested.

Function modes

	CLIENT TEXT BLOCK		
	CONFIGURATION	TRANSMISSION TABLE	RECEPTION TABLE
①	**TSX7 MASTER** TYPE : Local EXCHG REQUEST : TxTi,C = H'0714' (write word) DESTINATION : TxTi,M = H'0069' (XBT-A server) TRANSMISSION : TxTi,L = 4 (length 4 bytes)	(XBT-A display address) H'0191' (Message N°) H'0027'	TxTi,R = H'00FE'
②	**TSX7 SLAVE (station 3)** TYPE : Local EXCHG REQUEST : TxTi,C = H'0710' (write bit) SENDER ADDRESS : TxTi,M = H'0168' (AD1= 1) TRANSMISSION : TxTi,L = 10 (length 10 bytes)	H'00' (R) H'00' H'05' (G) H'FE' (S) H'69' (W) H'02' (U) H'03' H'84' H'00' H'00'	TxTi,R = H'00FE'

Note : For information on programming text blocks the reader should refer to the relevant TSX7 PLC manual.

Function modes

- **XBT-A8 as a CLIENT**

TYPES OF REQUEST	XBT-A8 FUNCTIONS
DATA ACCESS (e.g. : TSX) Read / write objects (bits / words / list of bits / list of words) of the devices connected	FUNCTION KEYS (associated with the messages stored in the XBT-A8 which has UNI-TE addressing)

Storing messages in the XBT-A8 :

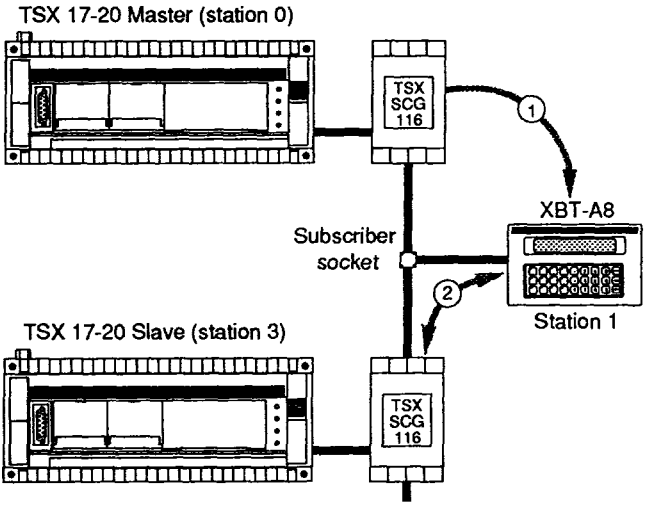
- Direct access
- The key number on the XBT-A8 (Nos. 1 to 12) corresponds to the message number (Nos. 001 to 012) with its associated variable,
- Indirect access, using FUNCT key together with a number between 13 and 99,
- The type of dialogue (types V, N or D) with the TSX 7 variable.
- The server device (Network, Station, Gate, Module, Channel) e.g. : TSX.

Pressing the function keys associated with the XBT-A8 messages causes the following to occur, in a way which is transparent to the application :

- The message is displayed (XBT-A8 behaves as a SERVER),
- A request is made to read (type V, D, N) or to write (type F, N) the variable (XBT-A8 behaves as a CLIENT).

Function modes

Examples of the XBT-A8 as a CLIENT



① Modifying a parameter :
- Pressing [F7] gives access to message N° 007,
- The text QUANTITY = ___ is displayed.
- The value of variable W00210 in the Master TSX17 is read and is displayed blinking.
- The operator enters his response and confirms it with [ENTER] which causes the new value to be written to variable W00210 in the TSX17-20 master.

② Sending commands (a working mode) :
- Pressing [F12] causes the word "AUTOMATIC" to be displayed,
- Bit B0077 is set to 1 in the TSX17-20 slave (station 3 : address H'67' = H'64' + H'03' = 103 decimal),
- Releasing [F12] causes the display to clear and sets bit B0077 to 0.

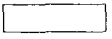
	XBT-A8 MESSAGES										
	OBJECTIVE	SERVER	N°	TEXT	TYPE	TSX7 VARIABLE	SERVER ADDRESS				
							R	S	G	U	W
①	Modification	TSX 17 Master	007	QUANTITY =___	N	W00210	0	254	0	254	0
②	Control	TSX 17 Slave	012	AUTOMATIC	F	B0077	0	254	5	0	103

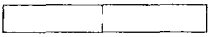
NO TSX17-20 APPLICATION PROGRAM IS NEEDED

5.3 UNI-TE requests

- **Conventions used in the diagrams**

  In this section, which describes the UNI-TE requests, the following conventions are used in the diagrams :

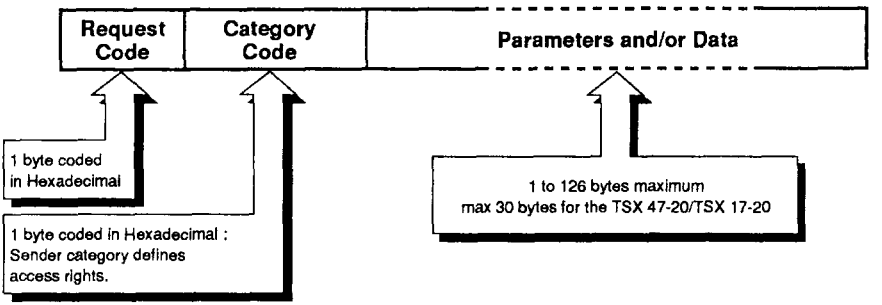
   represents 1 byte

   represents 1 word of 16 bits or 2 bytes

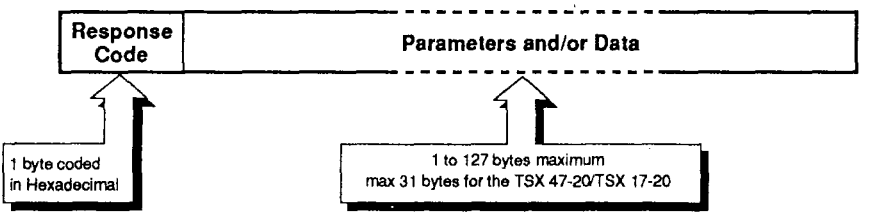
- **General**

  Communication taking place essentially by a system of questions and answers called REQUESTS and CONFIRMATION REPORTS.

- **Request format**
  - A request consists of :



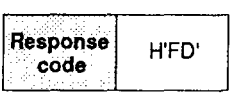
- **Confirmation report format**
  - A confirmation report consists of :



- **Negative response**

  The XBT-A8 may send a negative response if the syntax of the request is incorrect.

  The negative response code is the same for all requests.

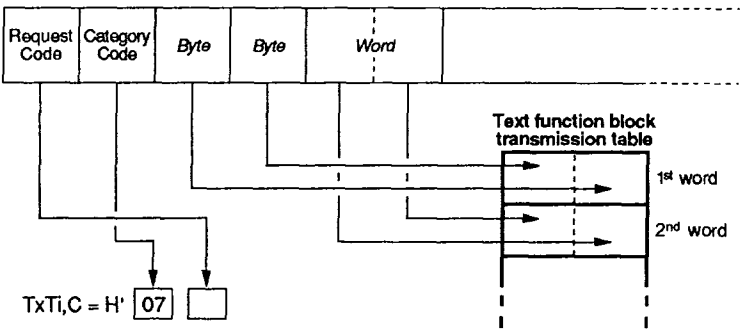


- **Using a text function block**

TSX master PLC

The application program for the CLIENT master PLC sends the request by using a text function block. This text block (written in the language selected by the user ; in Literal : EXCHG to "LADDER" S, I, 0 for requests which need a confirmation report), must include all the request parameters.
The relationships between the request/confirmation report structure and the text block parameters are as follows :

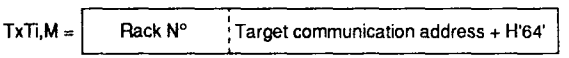
Transmission



Example : Write objects request = H'37'
TxTi,C = H'0737'

Comment : The category code must always be H'07" (for TSX7s).

TxTi,M Consists of the physical location of the TSX SCM 21 module in the TSX master (for TSX47, 67, 87 PLCs), followed by the target communication address (coded in Hexadecimal) plus H'64'.

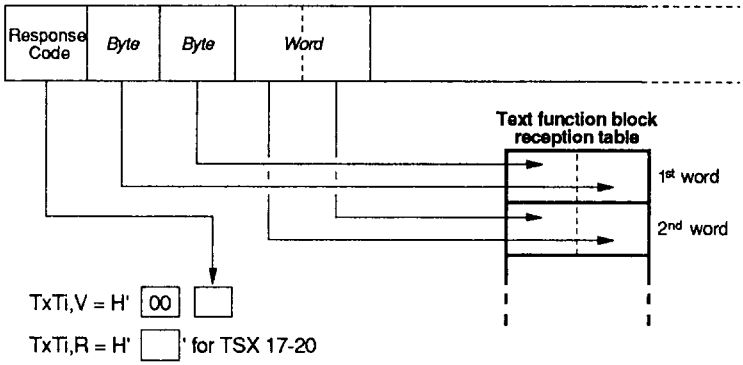


Example TXTi,M = H'0365' corresponds to the master module (TSX SCM 21) installed in rack 0 slot 3 and is addressed to the XBT-A8 at communication address 1 (H'01' + H'64').

TxTi,L This is the length of the transmission table (in bytes) containing the parameters and/or data.

UNI-TE requests

Reception



The value is updated after reception

TxTi,S Consists of the number of bytes received by the text block reception table in the event of successful communication. In the event of faulty communication, TxTi,S has the following values :

1 : exchange cancelled by RESET,
2 : length of transmission table error,
3 : exchange fault (see section 2.8),
4 : module fault,
5 : parameter error or too many TxTs are active at the same time,
6 : message received is longer than allowed,
10 : indirect text block address incorrect.

TxTi,D This bit changes to state 1 when the text block exchange is complete.

TxTi,E This bit changes to state 1 if there is an exchange error.

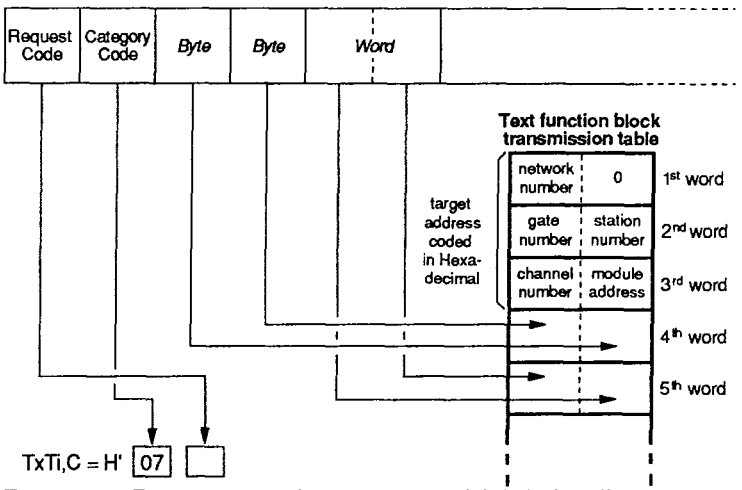
UNI-TE requests

PLC slave

A PLC slave (CLIENT) sends a request by using a text function block in the application program. This text block (written in the language selected by the user ; in Literal : EXCHG, to "LADDER" S, I, 0 for requests which need a confirmation report) must include all the request parameters.

If a PLC slave is the CLIENT, it must specify the target communication address when the request is sent. This address, coded in 5 bytes, must be inserted at the **start** of the text block transmission table.
The relationship between the structure of a request/confirmation report and the text block parameters are as follows :

Transmission on Ad1



Example : Request to read a message which is being displayed.
XBT-A8 = H'36'
TxTi, C = H'0736

TxTi,M The address of the sender consists of the physical location of the slave PLC in the TSX SCM 21 module, followed by the **origin** communication address Ad1 (coded in Hexadecimal) plus H'64'.

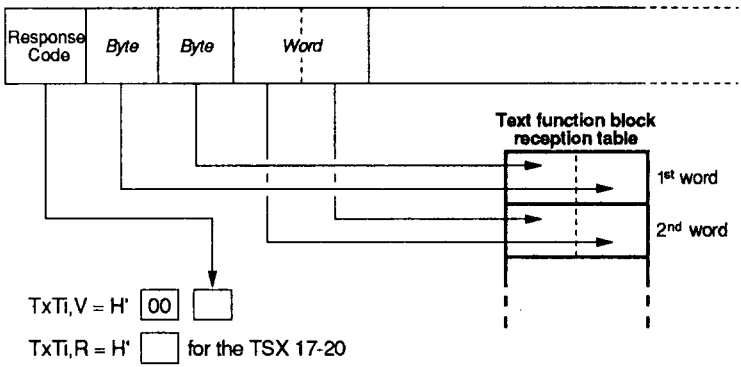
TxTi,M =	Rack N°	Target communication address + H'64'

Example : TxTi,M = H'066B' corresponds to the slave module installed in rack 0, slot 6. The message sender has the communication address 7 (corresponding to Ad1) (H'07' + H'64' = H'6B').

TxTi,L This is the length of the transmission table (in bytes), including the target address.

UNI-TE requests

Reception at Ad1



TxTi,S Consists of the number of bytes received by the text block reception table in the event of successful communication. In the event of faulty communication, TxTi,S has the following values :

1 : exchange cancelled by RESET,
2 : length of transmission table error,
3 : exchange fault (see section 2.8),
4 : module fault,
5 : parameter error or too many TxTs are active at the same time,
6 : message received is longer than allowed,
10 : indirect text block address incorrect.

TxTi,D This bit changes to state 1 when the text block exchange is complete.

TxTi,E This bit changes to state 1 if there is an exchange error.

5.4 General requests

- **Device identification request**

This request allows the server device to provide in its response, information about the type of product, its software version and commercial reference number.

Request format :

Request code	Sender category code
H'0F'	H'07'

Confirmation report format : Positive response.

Designation	Response code	Type of product	Product variant	Product version	String length	Commercial reference data
Format	1 byte	1 byte	1 byte	1 byte	1 byte	11 bytes
Code	H'3F'	H'1E'	H'28'	H'11'	H'0B'	H'58' H'42' H'54' H'41 ..... H'30'
Comments	-	XBT-A8	Latin version	Software version E.g. V1.1	11 bytes	XBT-A8-1010

Example :

CLIENT TEXT BLOCK		
CONFIGURATION	**TRANSMISION TABLE**	**RECEPTION TABLE**
Type : LOCAL EXCHG TxTi, C = H'070F' TxTi, M = H'0069 E.g. : station 5 (XBT-A8 SERVER) TxTi, L = 0 (bytes)		Reception on AD1 H'28' H'1E' H'0B' H'11' H'42' H'58' H'2D' H'54' H'38' H'41' H'31' H'5F' H'31' H'30' H'30' TxTi, R = H'3F' (TSX17) or TxTi, V = H'003F'

Note : This request is always valid, whether the terminal is reserved or not.

General requests

- **Request for protocol version**

  This request allows the client to supply the protocol version for the application which it supports, the maximum message length and the size of the request file. The server returns its own characteristics. This then allows the client to transmit requests in a format and size which are known to both parties.

Request format :

Designation	Request code	Sender category code	Maximum size of message	Length	Version
Format	1 byte	1 byte	1 word	1 byte	1 byte
Code	H'30'	H'07'	Depends on sender	Depends on sender	H'01'
Comments	-	-	Ignored by the XBT-A8	Ignored by the XBT-A8	UNI-TE version supported by the client (ignored by the XBT-A8)

Confirmation report format : Positive response.

Designation	Response code	Maximum size of message	Sequence length	UNI-TE version	Size of request file
Format	1 byte	1 word	1 byte	1 byte	1 word
Code	H'60'	H'00 40'	H'01'	H'10'	H'00 00'
Comments	-	Maximum size of network data frame (type+address+request) which can be processed by the XBT-A8	-	-	Not handled by l'XBT-A8

Example :

CLIENT TEXT BLOCK		
CONFIGURATION	**TRANSMISSION TABLE**	**RECEPTION TABLE**
TSX7 MASTER Type : LOCAL EXCHG TxTi, C = H'0730' TxTi, M = H'0069' E.g. : station 5 XBT-A SERVER TxTi, L = 4 (bytes)	H'.. ..' H'01' H' '	H'00' H'40' H'10' H'01' H'00' H'00' TxTi, R = H'60' (TSX17) or TxTi, V = H'0060'

Note : This request is always valid, whether the terminal is reserved or not.

General requests

- **Request for terminal status**

The response of the server provides detailed information about the status of the device.

Request format :

Designation	Request code	Sender category code	Required detail
Format	1 byte	1 byte	1 byte
Code	H'31'	H'07'	H'00' à H'02'
Comments	-	-	H'00' = No data H'02' = Program memory checksum H'03' = Memory checksum (messages + configuration)

Confirmation report format : Positive response.

Designation	Response code	Current state	Mask state	Data
Format	1 byte	1 byte	1 byte	1 word
Code	H'61'	b7 ..... b0	H'64'	Depends on required detail byte
Comments	-	b2 = 1 if messages are lost (message checksum error) b5 = 1 terminal awaiting operator reponse b6 = 1 if no action is being executed (not awaiting response nor updating the variable).	Mask the non-significant bits of the current state	If details required : H'00' = no data H'02' = program memory checksum H'03' = memory checksum (messages + configuration)

Example : Request for terminal status.

Example :

CLIENT TEXT BLOCK		
CONFIGURATION	**TRANSMISSION TABLE**	**RECEPTION TABLE**
TSX7 MASTER Type : LOCAL EXCHG TxTi, C = H'0731' TxTi, M = H'0069' (E.g. : station 5) XBT-A SERVER TxTi, L = 2 (bytes)	H'00' | H'00'	H'64' | H'40' TxTi, R = H'61' (TSX17) or TxTi, V = H'0061'

General requests

- **Mirror request**

This request tests the system and the communication route.
The XBT-A8 SERVER returns the same sequence of bytes in the confirmation data field as those received in the request data field.

Request format :

Designation	Request code	Sender category code	Data
Format	1 byte	1 byte	n bytes
Code	H'FA'	H'07'	H'48' H'45' H'4C' H'4F'
Comments	-	-	Byte group 126 max 30 max with TSX 47-20/TSX 17-20

Confirmation report format : Positive response.

Designation	Response code	Data
Format	1 byte	n bytes
Code	H'FB'	H'48' H'45' H'4C' H'4F'
Comments	-	Group of bytes sent at the request of the CLIENT (received bytes are re-transmitted)

Example :

CLIENT TEXT BLOCK		
CONFIGURATION	**TRANSMISSION TABLE**	**RECEPTION TABLE**
TSX7 MASTER Type : LOCAL EXCHG TxTi, C = H'07FA' TxTi, M = H'0069' (E.g. : station 5) XBT-A SERVER TxTi, L = 4 (bytes)	H'45' H'48' H'4F' H'4C' Byte group	H'45' H'48' H'4F' H'4C' TxTi, R = H'FB' (TSX17) or TxTi, V = H'00FB'

Note : There is no negative response.

General requests

- **Request to read error counters (UNI-TELWAY diagnostic)**

  Each station keeps a log of the data link errors (errors related to characters, frames or protocol) by counting 4 types of error in 4 counters (16-bit words).

Request format :

Request code	Sender category code
H'A2'	H'07'

Confirmation report format : Positive response

Designation	Response code	Number of messages sent not acknowledged	Number of messages sent refused	Numberof messages received not acknowledged	Number of messages received refused
Format	1 byte	1 word	1 word	1 word	1 word
Code	H'D2'	H'0000' to H'7FFF'	H'0000' to H'7FFF'	H'0000' to H'7FFF'	H'0000' to H'7FFF'
Comments	-	Not acknowledged by ACK or NACK	Refused by NACK re-transmitted to XBT-A8	Received not acknowledged by XBT-A8	Refused by NACK re-transmitted by XBT-A8

Note : The counters do not overflow, they remain at the maximum value (32767) until they are reset to zero by a 'Reset counters to zero' request.

Example :

CLIENT TEXT BLOCK		
CONFIGURATION	**TRANSMISSION TABLE**	**RECEPTION TABLE**
TSX7 MASTER Type : LOCAL EXCHG TxTi, C = H'07A2' TxTi, M = H'0069' (E.g. : station 5) XBT-A SERVER TxTi, L = 0 (bytes)		H'00 | 08' 8 messages sent not acknowledged H'00 | 58' 88 messages sent refused H'00 | 24' 36 messages received not acknowledged H'00 | 00' No received messages refused TxTi, R = H'D2' (TSX17) or TxTi, V = H'00D2'

General requests

- **Request to reset error counters to zero**

  This request resets the 4 error counters in the XBT-A8 to zero.

Request format :

Request code	Sender category code
H'A4'	H'07'

Confirmation report format : Positive response

Response code	H'FE'

Example :

CLIENT TEXT BLOCK		
CONFIGURATION	TRANSMISSION TABLE	RECEPTION TABLE
TSX7 MASTER Type : LOCAL EXCHG TxTi, C = H'07A4' TxTi, M = H'0069' (E.g. : station 5) XBT-A SERVER TxTi, L = 0 (bytes)		TxTi, R = H'FE' (TSX17) or TxTi, V = H'00FE' (the 4 counters are reset to zero)