REC 501
ANSI X3.28 Half-Duplex Protocol Description

Technical Description Manual

ABB

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Contents

Overview of Protocol

The ANSI X3.28 protocol includes three layers of the ISO OSI model: the Physical Layer, the Data Link Layer and the Application Layer. The physical layer defines the hardware-dependent specifications of the ANSI X3.28 communication interface. The data link layer defines the frame formats and the transmission procedures of the ANSI communication. The application layer defines the information elements and the service functions of the ANSI communication.

Data Link Layer

The data link layer controls the flow of communication. It determines the encoding of data and transfers data packets from the source node to the destination node over the physical link. This can be performed by using the half-duplex link layer protocol. The link layer protocol performs this job without concern for the contents of the message and its function.

Half-Duplex Link Protocol

The half-duplex data link layer protocol is used over a multidrop communication link for one master and one or more slaves. The master can poll, send messages to and receive messages from each node of the multidrop link. Before transmitting any data, the slave must always wait for permission from the master. As part of the duplicate message detection, both master and slave compares the second (SRC), third (CMD), fifth and sixth bytes (TNS bytes) of the message received with the same bytes of the previous message received. If there is no deviation between the sets of bytes, the message is classified as a retransmission of the previous message.

Frame Formats of Half-Duplex Link Protocol

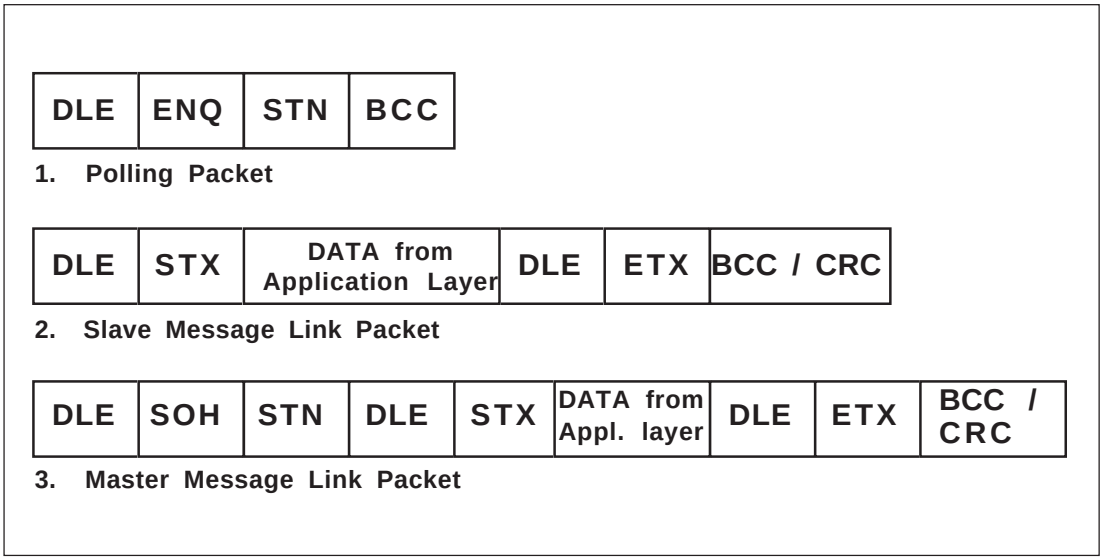

Fig. 1. Frame formats of half-duplex protocol

Symbols of half-duplex protocol:

Symbol	Type	Explanation
DLE SOH	control	Sender symbol indicating the start of a master message.
DLE STX	control	Sender symbol separating the multi-drop header from data.
DLE ETX	control	Sender symbol terminating a message.
BCC / CRC	data symbol	Checksum characters for error checking of message.
DLE ACK	control	Response symbol for successfully received message.
DLE NAK	control	Global link reset command only issued by the master. Causes the slaves to cancel all messages ready to be transmitted to the master.
DLE ENQ	control	Sender symbol issued only by master, starting a poll command.
DLE EOT	control	Response symbol used by slaves if there is no message response to a poll.
STN	data symbol	Station number of the slave node on the half-duplex link.
APPL. DATA	data symbol	Single character data bytes from the application layer.
DLE DLE	data symbol	Symbol representing the data value 10 (hex).

Application Layer

The application layer controls and executes the actual commands found in the communication between nodes. The application layer typically consists of two application program modules: the Command Initiator and the Command Executor. The Command Initiator receives a message from the application process, converts this message to an ANSI application layer message format and sends it to the protocol driver. The protocol driver forms the ANSI link layer of this message, before it is sent to the ANSI interface. The Command Executor waits for incoming messages from the ANSI protocol driver. It performs the necessary conversions before delivering the message to the application process.

Message Formats of Application Layer

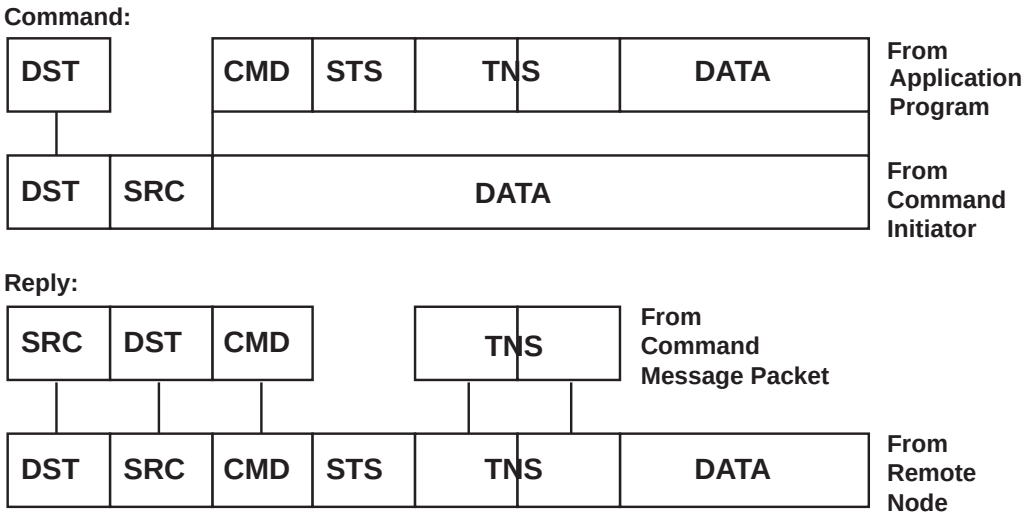

Fig. 2. Message packet formats of application layer

The bytes of message packet format of application layer:

Symbol	Explanation
DST	Destination node number for the message.
SRC	Source node number of the message.
CMD	Command code. Priority - 6th bit - is not used in REC 501. Cmd/Reply is the 7th bit. Then CMD is either 0x or 4x in REC 501.
STS	Status code of transaction. Low nibble is not used in REC 501. High nibble is for remote status code.
TNS	Transaction number (2 bytes). Note: LSB byte comes before MSB byte.
FNC	Function code, used with some message codes. Located after TNS bytes.
ADDR	Address of memory location (2 bytes). Note: LSB byte is located before MSB byte. The address bytes are part of the data and located at the beginning of the data.
SIZE	Number of bytes to be transferred (read command). This is a data byte.
DATA	Data values being transferred by the message.

Address Map

Data type	Start address (decim word addr.)	Length (words)	Format
DI data	0	500	16-bit binary
DO data	500	250	16-bit binary
EV data	750	250	16-bit binary + time stamp
AI data	1000	500	32-bit binary
AO data	1500	500	32-bit binary
Parameter data buffer	2000	168	ASCII
Time write	2300	9	BCD
Time read	2350	9	BCD
Event data	2400	4	32-bit data + time stamp
Version	2500	15	ASCII
System parameters	3000	500	16-bit binary
Counter time stamps	3500	1500	BCD
Object parameters	5000	5500	16-bit binary

Some specific Data Formats

Data format of multievent message:

Addr1 Event1 Addr2 Event2…Addr*n*+32768 Event*n*

The address (Addr1…Addr*n*) is 2 bytes (lsb the first). The data (Event1…Event*n*) consists of 2 data bytes and either a 4-byte (old timestamp format) or a 6-byte (full timestamp format) timestamp. This so called multievent format is not in accordance with the ANSI standard.

This ANSI implementation also has a multi-object feature. In the read command the start address (address of the first data objects will be read) and the number of bytes to be read (this number must be *n* times the requested data type size) have to be given. The answer contains many successive data fields beginning from the object data of the start address and ending with the object data of the end address, which is the start address + number of requested bytes. Spaces (no data objects) between the start and the end address are filled with the value 0x00.

Multiobject data format:

Data1 Data2 Data3 0x00 Data5 ... Data*n*

Note:
Data4 object is 0x00, because there is no Data4 object.

This multiobject feature is available only for the "Block Read" commands of counters and analogue & digital input data objects and it is not in accordance with the ANSI standard.

Full Timestamp Format:

The full timestamp value contains a 6-byte timestamp with a 0.1 millisecond resolution. The first 4 bytes contain time-of-day information as a number of 0.1 millisecond increments since midnight. The last 2 bytes give the day number starting from 1980, i.e. 1.1.1980 was day number 1.

Time byte 1 (least sign. byte)
Time byte 2 (least sign. byte)
Time byte 3 (least sign. byte)
Time byte 4 (most sign. byte)
Day number (least sign. byte)
Day number (most sign. byte)

Addresses of Digital Inputs

Parameter	ANSI address read	Length of entry (words)	Values *)	Corresponding SPA parameter
Object status #1	0	1	0 = undefined (inputs 00) 1 = closed 2 = open 3 = undefined (inputs 11)	I3, ch1
Object status #2	1	1	0 = undefined (inputs 00) 1 = closed 2 = open 3 = undefined (inputs 11)	I3, ch2
Input X2 (1/2)	2	1	0 = not active 1 = active	I4
Input X2 (3/2)	3	1	0 = not active 1 = active	I5
Input X2 (4/5)	4	1	0 = not active 1 = active	I6
Input X2 (6/5)	5	1	0 = not active 1 = active	I7
Input X2 (7/8)	6	1	0 = not active 1 = active	I8
Battery voltage level	7	1	0 = OK 1 = low	I11
Power supply temperature	8	1	0 = normal 1 = overheated	I9
Auxiliary supply connection state	9	1	0 = connected 1 = disconnected	I10

*) Format of the value is described in the chapter "Address Map"

Addresses of Digital Outputs

Parameter	ANSI address write/read	Length of entry (words)	Value *)	Corresponding SPA parameter
Open select #1 (secured operation)	500/100 **)	1	0 = not selected 1 = selected	V1, ch1
Open select #2 (secured operation)	501/101	1	0 = not selected 1 = selected	V1, ch2
Close select #1 (secured operation)	502/102	1	0 = not selected 1 = selected	V2, ch1
Close select #2 (secured operation)	503/103	1	0 = not selected 1 = selected	V2, ch2
Operation counter #1	504/104	1	0...10000	V5, ch1
Operation counter #2	505/105	1	0...10000	V5, ch2
Execute selected open/close operation #1	506/-	1	1 = execute	V3, ch1
Execute selected open/close operation #2	507/-	1	1 = execute	V3, ch2
Cancel selected open/close operation #1	508/-	1	1 = cancel	V4, ch1
Cancel selected open/close operation #2	509/-	1	1 = cancel	V4, ch2
Reset minimum battery voltage	510/-	1	1 = reset	V7
Reset pulse counting history buffers #1	511/- ****)	1	1 = reset	V9, ch1
Reset pulse counting history buffers #2	512/- ****)	1	1 = reset	V9, ch2
Blocking object 1	-/113	1	0 = not blocked 1 = blocked	No SPA parameters
Blocking object 2	-/114	1	0 = not blocked 1 = blocked	No SPA parameters
Input status, each bit is one input	-/115 ***)	1	Bit 0 = Input 1 Bit 1 = Input 2 Bit 2 = Input 3 Bit 3 = Input 4 Bit 4 = Input 5	No SPA parameters
Heatings	-/116	1	0 = off 1 = on	I12

*) Format of the value is described in the chapter "Address Map".

**) Items with two ANSI addresses: The first address is the write address, the second is the read address.

***) If the input is configured as a pulse counter its state is not reported.

****) Write command resets the value of the counter.

Addresses of EV Data

The following table shows the connection between ANSI addresses (EV data) and events. These objects can also be read with the block-read command using the address range 1-9.

Parameter	ANSI address read	Length of entry (words)	Values *)	Corresponding SPA event codes
Object status #1	750	3	0 = undefined (inputs 00) 1 = closed 2 = open 3 = undefined (inputs 11)	E40 - E43, on channel 1
Object status #2	753	3	0 = undefined (inputs 00) 1 = closed 2 = open 3 = undefined (inputs 11)	E40 - E43, on channel 2
Input X2 (1/2)	756	3	0 = deactivated 1 = activated	E1, E2
Input X2 (3/2)	759	3	0 = deactivated 1 = activated	E3, E4
Input X2 (4/5)	762	3	0 = deactivated 1 = activated	E5, E6
Input X2 (6/5)	765	3	0 = deactivated 1 = activated	E7, E8
Input X2 (7/8)	768	3	0 = deactivated 1 = activated	E9, E10
Battery voltage level	771	3	0 = normal 1 = low	E11, E12
Power supply temperature	774	3	0 = normal 1 = overheated	E13, E14
Auxiliary supply connection state	777	3	0 = reconnected 1 = disconnected	E15, E16

*) Format of the value is described in the chapter "Address Map", 16-bit data, 32-bit time stamp (in format sec, min, msec lsb and msec msb eight bits each)

If the spontaneous event parameter (V233 = 2 or 3) is set so that EVDATA is sent and multi-event transmission is activated (V239 = 1), many EVDATA objects are transferred in one packet by using the Block Write command (cmd code = 0x08).

Addresses of Analogue Data

Parameter	ANSI address write/read	Length of entry (words)	Value *) (range)	Corresponding SPA parameter
Temperature inside enclosure	-/1000	2	-40...+60 (-40...+60°C)	I1
Battery charging voltage	-/1002	2	240...300 (24.0...30.0 Vdc)	I2
Minimum battery voltage	-/1004	2	0...280 (0.0...28.0 Vdc)	V6
Intermediate counter value 1, ch1	-/1006	2	0....999 999	V11, ch1
Intermediate counter value 1, ch2	-/1008	2	0....999 999	V11, ch2
Period counter value 1, ch1	-/1010	2	0....999 999	V20, ch1
Period counter value 1, ch2	-/1012	2	0....999 999	V20, ch2
Period counter value 2, ch1	-/1014	2	0....999 999	V22, ch1
Period counter value 2, ch2	-/1016	2	0....999 999	V22, ch2
Period counter value 3, ch1	-/1018	2	0....999 999	V24, ch1
Period counter value 3, ch2	-/1020	2	0....999 999	V24, ch2
Delta for spontaneous transmission of enclosure temperature data	1522/1022 **)	2	1...10 (1...10°C)	V237
Delta for spontaneous transmission of battery charging voltage	1524/1024 **)	2	1...50 (0.1...5.0 Vdc)	V238

*) Format of the value is described in the chapter "Address Map"
**) Items with two ANSI addresses: The first address is the write address, the second is the read address.

Addresses of Parameter Data Buffer

Parameter	ANSI address	Length of entry *)
Transparent SPA buffer in Transparent SPA buffer out	2000 (write) 2040 (read)	80 characters 255 characters

*) Format of the value is described in the chapter "Address Map"

The host first writes a transparent SPA message to the beginning of the parameter data buffer and then reads the reply message from the address: start of buffer + 40 words. The structure of the buffer is illustrated in Fig. 3. "Parameter data buffer".

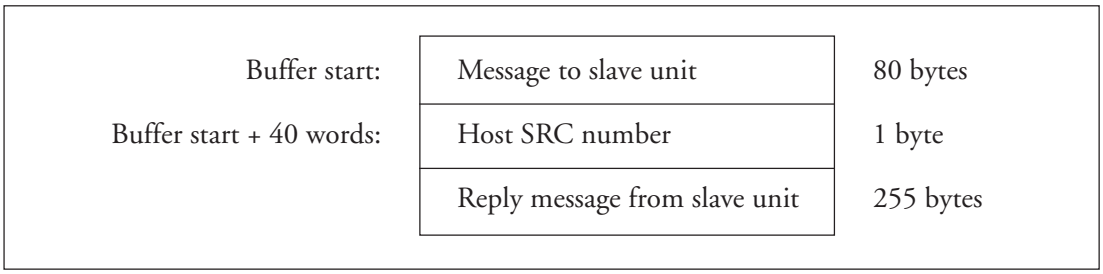

Fig. 3. Parameter data buffer.

Addresses of Time

Parameter	ANSI address write/read	Length of entry (words)	Value *)	Corresponding SPA parameter
Date and time	2300/2350	9	YY-MM-DD HH.MM;SS.mss	D

*) Format of the value:
word 0 = status (always 0)
word 1 = weekday (1...7)
word 2 = year (0...99)
word 3 = month (1...12)
word 4= day (1...31)
word 5= hour (0...23)
word 6 = minute (1...59)
word 7 = second (1...59)
word 8 = milliseconds (always 0)

All the words contain a 3-digit BCD-coded value in the format 0000xxxx xxxxxxxx, where x is a bit 0 or 1.

Addresses of Events

Parameter	ANSI address read	Length of entry (words) *)
Event data	2400	4

*) Format of the value is described in the chapter "Address Map", 32-bit data, 32-bit time stamp (in format sec, min, msec lsb and msec msb eight bits each).

Event identification:

	Byte 3	Byte 2	Byte 1	Byte 0
32 bits =	00000000	0UUUUUUU	UUUCCCCC	CCEEEEEE
		Unit number	Channel number	Event number

Unit number = Event identification / 8192
Channel number = (Event identification / 64) mod 128
Event number = (Event identification) mod 64

REC 501 has an event buffer containing the 30 latest events.

Address of Version

Parameter	ANSI address read	Length of entry *)
Program version of the PSC3 or PSC4 units	2500	30 characters

*) Format of the value is described in the chapter "Address Map".

Addresses of System Parameters

Parameter	ANSI address write/read	Length of entry (words)	Value *)	Corresponding SPA parameter
Event mask for inputs, lower	3200/3100	1	0...255	V155
Event mask for inputs, upper	3201/3101	1	0...255	V156
Event mask for counters	3202/3102	1	0...15	V157
Event mask for outputs	3203/3103	1	0...255	V158
Event mask for open/close (channel 1)	3204/3104	1	0...63	V159
Event mask for open/close (channel 2)	3205/3105	1	0...63	V159
Internal fault code	-/3106	1	1...255	V169
Reading of unit status information	-/3107	1	0 = normal state 1 = unit been subject to automatic reset 2 = overflow of event register 3 = events 1 and 2 together	C
Resetting of unit status	3208/-	1	0 = reset	C
Resetting of device software (power-up)	3209/-	1	1	
ANSI Spontaneous events enable	3220/3120	1	0 = spontaneous transmission of events disabled 1 = events transferred via ANSI address 2400 2 = events transferred as EV data 3 = events via address 2400 and as EV data	
ANSI Spontaneous input data mask	3221/3121	1	0 - 1023 (00H - 3FFH) one bit for each input: bit 0, Temperature inside enclosure (I1), bit 1, Battery charging voltage (I2), bit 2, Status of an object (I3 ch.1 and ch.2), bit 3, Battery voltage at testing (I11), bit 4, Power supply temperature (I9), bit 5, Auxiliary supply on/off (I10) bit 6, object 1 blocking input bit 7, object 2 blocking input bit 8, input states (Counter inputs are masked) bit 9, heating	

Parameter	ANSI address write/read	Length of entry (words)	Value *)	Corresponding SPA parameter
ANSI Spontaneous input data enable	3222/3122	1	0 = spontaneous transmission of data disabled 1 = spontaneous transmission of data enabled	
Modem diagnostic interval	3223/3123	1	0...255 min	V224

*) Format of the value is described in the chapter "Address Map".

Addresses of Counter Time Stamps

Parameter	ANSI address read	Length of entry (words)	Value *)	Corresponding SPA parameter
Time stamp for the storage of period counter registers 1, channel 1	3500	3	DD.HH.MM	V21, ch1
Time stamp for the storage of period counter registers 1, channel 2	3503	3	DD.HH.MM	V21, ch2
Time stamp for the storage of period counter registers 2, channel 1	3506	3	DD.HH.MM	V23, ch1
Time stamp for the storage of period counter registers 2, channel 2	3509	3	DD.HH.MM	V23, ch2
Time stamp for the storage of period counter registers 3, channel 1	3512	3	DD.HH.MM	V25, ch1
Time stamp for the storage of period counter registers 3, channel 2	3515	3	DD.HH.MM	V25, ch2

*) Format of the value:
word 0 = day (1...31)
word 2 = hour (0...23)
word 3 = minute (1...59)
All the words contain a 3-digit BCD-coded value in the format 0000xxxx xxxxxxxx, where x is a bit 0 or 1.

Communication Parameters

The ANSI communication can be locally configured by using the parameters V230... V238. Remote parameterizing via the ANSI protocol is disabled for safety reasons, with the exception of special ANSI commands: Set ENQ, Set NAK, Set Timeouts and Set Variables, see chapter "Types of commands".

Data	Channel	Para-meter	Data direction	Values	Default
Selection of active protocol (not valid at parameteri-zation	0	V202	R,W	0 = SPA protocol 1 = remote protocol	0
Station address	0	V210	R,W	0…255	255
Data transfer rate	0	V211	R,W	0.3; 0.6; 1.2; 4.8; 9.6; or 14.4 kBd	1.2
CTS delay	0	V213	R,W	0…255 = 0…2550 ms	3
RTS keep up delay	0	V214	R,W	0…255 = 0…2550 ms	1
Parity	0	V230	R,W	0 = no parity 1 = odd 2 = even	0
Data bits	0	V231	R,W	7 or 8 data bits	8 bits
Checksum calculation mode	0	V232	R,W	0 = CRC 1 = BCC	0
Spontaneous events enable	0	V233	R,W	0 = spont. transmission of events disabled 1 = events transferred via ANSI address 2400 2 = events transferred as EV data 3 = events via address 2400 and as EV data	3
Spontaneous input data mask	0	V234	R,W	0 - 1023 (00H - 3FFH) one bit for each input: bit 0, Temperature inside enclosure (I1), bit 1, Battery charging voltage (I2), bit 2, Status of an object (I3 ch.1 and ch.2), bit 3, Battery voltage at testing (I11), bit 4, Power supply temperature (I9), bit 5, Auxiliary supply on/off (I10) bit 6, object 1 blocking input bit 7, object 2 blocking input bit 8, input states (Counter inputs are masked) bit 9, heating	0 (no mask)

Data	Channel	Para-meter	Data direction	Values	Default
Spontaneous input data enable	0	V235	R,W	0 = spont. transmission of data disabled 1 = spont. transmission of data enabled	1
Analogue data format	0	V236	R,W	0 = 32-bit integer	0
Delta for spontaneous transmission of enclosure temperature data	0	V237	R,W	1...10 (1...10°C)	5°
Delta for spontaneous transmission of battery charging voltage data	0	V238	R,W	1...50 (0.1...5.0 Vdc)	1.0 V dc
Multievent	0	V239	R/W	0 = disable 1 = enable	0
ENQ limit	0	V240	R/W	0…100	3
NAK limit	0	V241	R/W	0…100	3
Reply time-out	0	V242	R/W	0…3000 = 0…1200S	3000
Time stamp format	0	V243	R/W	0 = old format 1 = Full_Timestamp	0

Note!
Spontaneous transfer of data is used when "spontaneous input data is enabled" and "spontaneous input data is not masked".

0xFFFF (full mask) = all objects are active

The REC 501 also includes a special feature which can be used with the public switched telephone network and spontaneous data transmission. The unit automatically dials up the connection to the network control system when some of the non-masked spontaneous data has changed.

Status Codes

The STS byte provides information about the execution or failure of a command that was transmitted. The STS byte is divided into two nibbles: local error (low nibble) and remote error (high nibble).

A local error occurs when the local node is unable to transmit a message to the remote node. The local node interface turns the command around, updates the STS byte with the appropriate local error code and returns this response to the message source. Local STS error codes are not used in the REC 501 unit, because there is no function handling these status codes in the application layer.

A remote error occurs when the command is successfully transmitted to a remote node, but the remote node is unable to execute the command. The remote node forms a reply message with the appropriate remote error code in the STS byte.

A remote STS error code is always returned in response to the ANSI master node, when the command received is OK or an error occurs while the command is being executed in the REC 501 unit slave node. See table "Remote error codes". The ANSI protocol of the REC 501 contains the history of the STS codes which have been sent. The history of remote STS codes (8-bit STS counters) can be read using the ANSI "Diagnostic Status" command.

Remote STS codes:

Code	Explanation
0x00	The status of the whole message transaction is OK.
0x10	The command or function code of the message is illegal.
0x20	The critical data of the command message is illegal.
0x30	The ANSI address is out of range in the msg received.
0x40	Error in object conversion parameters.
0x50	No POD object that matches the search function.
0x60	Error in the POD search index type.
0x70	No database index assignment of the POD object.
0x80	Illegal ANSI address of special data object.
0x90	Message buffer is full or out of memory.
0xA0	The last message received is lost, because of error.
0xB0	The last message sent is lost, because of error.
0xC0	The processing of transaction info fails.
0xD0	The last read function of database object fails.
0xE0	The last write function of database object fails.
0xF0	The execution process of command msg fails.

Types of Commands

There are four basic types of commands: read, write, diagnostic/setup and mode select. The write command can be divided into Bit Write and Block Write.

The status information from other nodes is obtained using the diagnostic/setup commands. In addition, some parameters of an interface module can be altered. The mode select command is not used in this application.

The message codes of the ANSI protocol:

Description of command:	CMD:	FNC:
Diagnostic counter reset	06	07
Diagnostic loop	06	00
Diagnostic read	06	01
Diagnostic status	06	03
Read	01	N/A
Bit write	05	N/A
Block write	08	N/A
Set ENQs	06	06
Set NAKs	06	05
Set time-out	06	04
Set variables	06	02

Command	Explanation
Diagnostic counter reset	Resets all diagnostic counters to zero.
Diagnostic loop	Checks the integrity of the transmission over the transmission link. The same data as that received is returned.
Diagnostic read	Reads the diagnostic counter. See table " 16-bit diagnostic counter" in the chapter "Diagnostic counters".
Diagnostic status	Reads the history of the remote STS codes. See the table "Remote STS codes" in the chapter "Status codes".
Read	Reads a data item from the address range: DI, AI, Parameter data buffer, Time, Event data, Version and System parameters.
Bit write	Sets bits in the DO address range.
Block write	Changes data value only in the AO address range. It is also used with parameter data write, time, time write, version write, system parameter write and object parameter write.
Set ENQ	Sets the max. number of ENQs accepted by the device per message transmission.
Set NAK	Sets the max. number of NAKs accepted by the device per message transmission. Normally not used in REC 501.
Set Time-outs	Sets the max. time the device waits for the ACK for its transmission. It is also used with receive msg time-out control. The given value is multiplied by 265, because the basic unit of the time-out value is millisecond.
Set Variables	Sets ENQ, NAK and time-out together. The given time-out value is multiplied by 256, because the basic unit of the time-out value is millisecond.

Diagnostic Counters

The diagnostic counters are a type of tracers, which show the whole functionality of the ANSI protocol software when it processes the commands received and responds to them or sends event / spontaneous messages to the ANSI master node.

By checking the values of these counters it is possible to check, if the contents of the message are valid and processing has been successful.

The history of Diagnostic counters, described in the table of the 16-bit Diagnostic counters, can be read by using the ANSI "Diagnostic Read" command.

16-bit diagnostic counters:

Counter	Location
TRY_TO_SEND_MSG (to master node)	0
OK_TRANSMITTED_MSGS (to master node)	1
RECEIVED_ACKS	2
RECEIVED_NAKS	4
FAILED_TRANSMISSIONS	8
OK_RECEIVED_MSGS	10
TRANSMITTED_ACKS	11
RECEIVED_ENQS	13
RECEIVED_DUPLICATE_MSGS	14
RECEIVED_START_CHARS	15
IGNORED_MSGS	16
CTRL_ABORTED_MSGS	18
RECEIVED_BROADCAST_MSGS	21
MSGS_WITH_FAULTY_NODE_NRO	23
RECEIVED_POLL_MSGS	24
TRANSMITTED_EOTS	25
CMDS_TO_EXECUTOR (sent from link layer)	31
MSGS_SENT_TO_SELF	33
MSGS_SENT_BY_INITIATOR	37
CMDS_RCVD_BY_EXECUTOR	38
REPLIES_SENT_BY_EXECUTOR	39
REPLIES_RCVD_BY_INITIATOR	40
BUFFER_OVERFLOW_ERRORS	41
LOST_ACKS	43
RETRANSMISSION	44
RECEIVE_MSG_FAILS	45
TRANSMIT_TIMEOUTS	46
RECEIVE_TIMEOUTS	47
RX_PARITY_ERR	48
RX_FRAME_ERROR	50
CHECK_SUM_ERRORS	51
CRC_FRAME_ERR	52
CTS_TIMEOUTS	53

Note. Locations not used are zero.

Example Configuration

This chapter gives an example of how to set different parameters when:
- the unit communicates using ANSI X3.28 HD protocol
- the optional plug-in modem is communicating over the public line
- one input is used as pulse counter by counting periods of 1 hour
- one object is controlled
- local remote switch is used
- heating control is used
- spontaneous transfer of status changes of selected objects is enabled
- IRF output is used

This configuration requires the following setup:

• Remote communication parameters for ANSI X3.28 HD

V202 =1	Setting of the ANSI X3.28 HD protocol in use.
V210 = 50	Setting of the ANSI address to 50.
V211 = 9.6	Setting of the communication speed to 9600 bps.

• Modem communication parameters

V220 =1	Public line in use.
V221 = ATV0X0E0F0&K3S0=2&D0&R1	Setting of modem init string. Commands explained in modem manual 1MRS750577-MUM.
V222 = ATD1234567	Setting of the dialling string and telephone number 1234567 of master station.
V223 = ~~~+++~~~ATH	Setting of hangup string.

• Functional parameters

S5 = 80	Input 4 is programmed as pulse counter 1.
S8 = 8	Output 3 is programmed for heating control.
S7 = 4	Output 4 is programmed as IRF output.
1S11 = 60	Counting time set to 60 minutes.

• Event mask from the chapter Addresses of System Parameters

V157 = 4	Event masks programmed to correspond to the need of counter 1.
2V159 = 0	Event masks programmed to correspond to the need of counter 1.

• ANSI X3.28 HD application layer communication parameters

V233=2	Spontaneous transfer of ANSI events as EV data.
V234=52	Spontaneous transmission of status of controlled objects, power supply temperature and status of auxiliary supply enabled.
V235= 1	Spontaneous transmission of data enabled.

All other parameter settings can be left as defaults.

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