Xanura Home Automation
RS232 interface type CTX35

MBO 1991 298-401 CA

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1 Overview

The Xanura communication transceiver CTX35 is a power line carrier transceiver with 9600bps/19.2Kbps serial data communications. A building automation system or other IBM compatible PCs can use the CTX35 to monitor and control XANURA A10 or other X-10 compatible control modules. It can receive and transmit standard XANURA and XANURA extended control protocols. Transmit commands and received data is reformatted in ASCII such as A1 ON, B3 DIM, etc. to make it more user friendly than other similar devices. The CTX35 has a received data buffer feature, which insures that the host computer will never miss a monitored transmission. Communicates to a host via RS485 or RS232 at baud rates of 9600bps or 19.2Kbps (default). Baud rate is hard-wired selectable by EATON HOLEC. Other settings: No parity, 8 databits, 1 stopbit. Maximum 30 byte packet via interface buffer (RS485 or RS232).

1.1 RS485/RS232 signals

Has locations to store ten distinct frames. If the frames that are sent to the CTX35 are identical to the frames sent to the CTX35 immediately before and there were no zero crossings between the frames, only one location will be taken. Once this buffer is full, the CTX35 will respond to the next attempt to send data to the CTX35 with the "STATUS, BUFFER FULL" response. This means that the previous send of data filled the buffer.

**Note: if the previous send to the CTX35 contained more than one frame and they were distinct, it is possible that one or more of those frames were not put into the buffer. The STATUS, BUFFER FULL is sent when the buffer is full upon sending data to the CTX35, it is not sent when the buffer becomes full AFTER sending data to the CTX35.*

If XANURA transmissions are desired with no zero crossings between frames, and the XANURA information desired to be sent will not fit in the 30 byte limitation of the receive packet, the "Send XANURA Data to CTX35" command can be used. This allows the desired XANURA information to be sent as many times as desired without the CTX35 actually transmitting. Once the desired XANURA information is transmitted to the CTX35 via RS232 or RS485, the "Transmit XANURA Data on Power Line" command can be sent to send the information out on to the power line without any zero crossings between frames. The frames must be identical.

1.2 Xanura signals

The CTX35 has locations to store up to 64 different PCC frames or packets (64 buffer locations). If the same frame is received more than once without a zero crossing between the frames, only one location will be used to store this information. This leaves 63 locations for different frames. If a frame is received more than 32 times without a zero crossing between frames, the CTX35 will only store the first 32 frames. All subsequent identical frames that follow without a zero crossing between them will not be logged. This allows it to receive up to 64 identical 32- frame PCC transmissions. If the CTX35 is in polite mode, it will look for collisions as it is transmitting, and if it sees a collision it will stop transmitting. It will wait for six zero crossings before trying to transmit again. There is no limitation on the number of retries.

1.3 Test software

On the website www.xanura.nl you will be able to download test software for your computer to send or receive Xanura commands via the CTX15 or CTX35.

2 Protocol

A = Address:	(CTX35-RS485) This is defined mechanically or via software through the user's control module (default address = 0).
C = Checksum	This is defined as the sum of all previous bytes.
TYPE = Type	This is defined by XANURA extended code protocol.
! = ACK	
?= NAK	
(un) = upper nibble	
(ln) = lower nibble	

2.1 Quick reference

Format key	
" "	constant strings
+	indicates a concatenation of strings
{ }	contains required information
[ ]	contains optional information
( )	comments

2.1.1 Packet description

- Parity: None
- Data Bits: 8
- Stop Bits: 1
- Baud Rate: 9600 or 19200

2.1.2 RS485/RS232 signal sent to CTX35

"$>"	(protocol format)
"28"	(device type)
{AA}	(address type)
{CTX35 COMMAND, SUB-COMMAND}	(see Table 2)
[Letter Code + Number Code]	(A01-P16)
" " (space character)	(indicates zero crossing gap)
[Letter Code + X -10 Command]	(see table 2)
[Letter Code + ,[N]" + Unit Data + Data + Command +Type]	(extended message format)
{CC}	(checksum)
"#"	(protocol format)

2.1.3 RS485/RS232 signal received from CTX35

"$<"	(protocol format)
"28"	(device type)
{AA}	(address type)
{! or ?}	(! ACK ? NAK)
[Letter Code + Number code]	(A01-P16)
" "(space character)	(indicates zero crossing gap)
[Letter Code + X -10 Command]	(see Table 2)
[Letter Code + ‚[N]" + Unit Data + Data +Type + Command]	(extended message format)
or	
[CTX35 Data]	(this can only be sent by itself)
{CC}	(checksum)
"#"	(protocol format)

2.1.4 Table 1

CTX35 commands	
0	Send Sub Command to CTX35 0- Query CTX35
1	Transmit XANURA Data on Power Line
2	Send XANURA Data to CTX35
3– Z	Reserved for Future Use

2.1.5 Table 2

Xanura commands	
ON	On
OFF	Off
DIM	Dim
BGT	Bright
ALN	All Lights On
AUF	All Units Off
ALF	All Lights Off
HRQ	Hail Request
HAK	Hail Acknowledge
SON	Status ON
SOF	Status OFF
SRQ	Status Request

If the CTX35 can not accept any more XANURA commands to be sent out on the powerline, it will respond with a packet indicating its buffer is full...$<2800!S0CE#.

3 Required packet information

"$"	This byte will always be the 1 st byte of any packet involving the CTX35.
">" or "<"	This byte will always be the 2 nd byte of any packet involving the CTX35.
"2"	This byte will always be the 3 rd byte of any packet involving the CTX35.
"8"	This byte will always be the 4 th byte of any packet involving the CTX35.
"A" (un)	ASCII representation of the upper nibble of the hex value of the address. This byte will always be the 5 th byte of any packet involving the CTX35. This byte will always be an ASCII 0
"A" (ln)	ASCII representation of the lower nibble of the hex value of the type. This byte will always be the 6 th byte of any packet involving the CTX35. Valid addresses are 016 - F16.
! or ?	This byte is only contained in a response from the CTX35. It will always be the 7 th byte.

3.1 CTX35 command

This byte is only used in a transmit to the CTX35. It will always be the 7 th byte.
CTX35 COMMAND is a byte that will contain a value with a range of 0-9 and A-Z. This byte will contain the ASCII representation of the digit or the letter desired, e.g. „0" - „9" and „A" - „Z".
*If the 0 command is sent, an additional byte (8 th byte) must be sent to select specific command.

CTX35 command	
0	Send Sub Command to TI (*see Table 1 for specific sub commands)
1	Send XANURA Data on Power Line (transmit)
2	Send XANURA Data to CTX35 (store received data)
3-Z	Reserved for Future Use.

{"PLACE OPTIONAL INFORMATION (see below) IN PACKET HERE"}	
"C" (un)	ASCII representation of the upper nibble of the hex value of the checksum. This byte will always be the third from the last byte of any packet involving the CTX35.
"C" (ln)	ASCII representation of the lower nibble of the hex value of the checksum. This byte will always be the second from the last byte of any packet involving the CTX35.
"#"	This byte is always the last byte of any packet..CTX35 Installation Instructions

4 Optional packet information

The following information can be in any order. It is important to note that the maximum packet length is 30 bytes. 10 bytes are reserved for required packet information (listed above).
There are 4 types of data that are included in the Optional Packet information.

1. Letter Code/ Number Code
2. Zero Crossing denotation.
3. Letter Code/ Command Code
4. Extended Code Message

The above information can be represented in the packet in any order and combination. Each type of information and how it is represented is described below.

4.1 Letter Code / Number Code example "A" "0" "1"

4.1.1 Letter Code

This byte will contain the ASCII representation of the letters A - P.

4.1.2 Number Code

This information requires two bytes and is the ASCII representation of the Number Code.
"2 Digit Number Code" (tens place)
"2 Digit Number Code" (ones place)
As stated above, the 2 Digit Number Code is comprised of two bytes, a tens place byte and a ones place byte. The valid range is 1-16 where 1 is represented by "0" "1" and 16 is represented by "1" "6" and so on.

4.2 Zero Crossings example "(space)"

This byte will contain the ASCII representation of the space character. It represents six zero crossings **between valid transmissions.** It does not denote number of zero crossings.

4.3 Letter Code/ Standard XANURA Command example "A" "O" "N"

4.3.1 Letter Code

This byte will contain ASCII representation of the letters A-P.

4.3.2 Standard XANURA Code

This information will require two to three bytes. The following defines the XANURA Standard Commands. The packet data will be the ASCII representation of the following letters.

ON	On
OFF	Off
DIM	Dim
BGT	Bright
ALN	All Lights On
AUF	All Units Off
ALF	All Lights Off
HRQ	Hail Request
HAK	Hail Acknowledge
SON	Status On
SOF	Status Off
SRQ	Status Request

4.4 Extended Code Message example "A" "[" "1" "]" "1" "6" "F" "F" "A" "E"

This is the most complex information handled by the CTX35. One extended code message will require 8 bytes in any packet of the CTX35.

Letter Code + [N] + Unit Data + Data + Type + Command.

4.4.1 Letter Code

(defined above).

4.4.2 N

This byte is the ASCII representation of the extended code number. Valid range is ASCII 1 -3. This number is preceded by the ASCII character [and followed by the ASCII character].

4.4.3 Unit Data

This information requires two bytes and is the ASCII representation of the Unit Data Code.

"2 Digit Unit Data Code" (tens place)

"2 Digit Unit Data Code" (ones place)

The 2 Digit Unit Data Code is comprised of two bytes, a tens place byte and a ones place byte. The valid range is 1-16 where 1 is represented by ,0" ,1" and 16 is represented by ,1" "6" and so on.

4.4.4 Data

This information requires two bytes. It is the ASCII representation of the hex value of the data desired to be sent.

Data (un)	ASCII representation of the upper nibble of the hex value of the address.
Data (ln)	ASCII representation of the lower nibble of the hex value of the address.

4.4.5 Type

This byte is the ASCII representation of the hex value of the type.

4.4.6 Command

This byte will contain the ASCII representation of the hex value of the bit pattern of the command.

5 Miscellaneous

The CTX35 can store up to 64 XANURA frames (CTX35 has 64 buffer locations). The CTX35 will also store up to 32 of the same frames in one buffer location if received one right after another with no zero crossings between them. This means that "theoretically" the CTX35 can store 32 identical frames x 64 of the buffer locations (Note: Extended code frames are the longest).
If the CTX35 receives invalid data it will respond with a packet containing a "?" NAK.
If the CTX35 receives valid data and can accept, it will respond with a packet containing a ,"!" ACK.
If the CTX35 receives a request for all received XANURA commands and has none, the CTX35 will respond with a packet containing no optional information along with an ACK.

5.1 Indication LEDs

The Rx and Tx LEDs on the front of the CTX35 indicate communications between the external automation system and the CTX35.
When Rx flashes, the CTX35 receives from the external system.
When Tx flashes, the CTX35 sends to the external system.

5.2 Cable pinout configuration

RS232	Pin 2 = Tx
	Pin 3 = Rx
	Pin 5 = Ground
	All other pins unused

RS485	Pin 3 = RS485 (+)
	Pin 8 = RS485 (-)

5.3 Longest RS232 packet expected from CTX35

Extended code frames take 10 bytes to report so 10 x 32 possible identical frames x 64 buffer locations =20,480 bytes (+ header and footer information). Having said that, the chances of getting 32 possible identical frames x 64 buffer locations are very slim. That would mean that 64 x 32 extended code frames were transmitted one right after another with no zero crossings between them.

5.4 Calculating the largest string to expect from CTX35 depending on polling interval (PCC side)

Extended code frames are 62 bits in length and are usually sent twice, so one actual transmission of two extended code pairs takes 1.24 seconds (50Hz). Desired poll interval will influence how large a string of information to expect from the CTX35 when queried. For example if the CTX35 is polled every 10 seconds, that would."theoretically" allow for 10 extended code frame pairs.
Ten (# of extended code frame pairs) x 10 (bytes to report) = 200 bytes.

Example: 7 bytes (for the header) + 200 bytes (the data) + 10 bytes (space between each frame pair) + 3 bytes (the footer) = 220 bytes for a 10 second poll interval using extended code.
A few points about how often to poll...the example used extended code to show how large a buffer will possibly be need. How often to poll? If you are using standard code, more often, because it takes less time to fill the CTX35's buffer.

5.5 Query or poll interval

A standard code frame is 22 bits and is usually sent twice (44 bit frame pairs). There is always at least 6 zero crossings between each frame pair. That adds up to 50 bits per frame pair (including the 6 zero crossings). Fifty (50) bits takes .5 seconds to transmit on the powerline so it would take the 64 buffer locations 32 seconds to fill up. This is if there is a constant PCC signal being transmitted for a period of 32 seconds and each frame pair was distinct (this rarely happens, but is theoretically possible).
**This information influences how large a string to expect from the CTX35 when queried.
The CTX35 can receive approximately 26 extended code frame pairs in 32 seconds. How often to poll also is influenced by how fast information is needed from the powerline. Poll intervals are dependent on the type of application.

6 Technical data

Supply voltage	230 V, 50 Hz
Input current	< 50 mA
Signal strength sending	> 5 Vpp in 5 Ohm
Signal sensitivity	15 mVpp min, > 50 mVpp bij 120 kHz
Serial connection	9-pin Sub D-connector
Approval	EN 60950, EN 55022, EN 55024
Marks	CE

7 Undisturbed functioning of Xanura home automation

Electrical equipment and systems can be sensitive to signals from other equipment, which causes electro magnetic disturbance. In the European Union, countries agreed upon laws for the immunity (sensitivity) of signals of other equipment as well as equipment emission (disturbance). When equipment or applications in a certain surrounding comply with the valid standards, they will not disturb each other's operations (they are called "Electro Magnetic Compatible").

For residential surroundings, where the home automation system Xanura is being applied, the European standard for immunity is standardised in EN 61000-6-1. Equipment that complies with this standard is resistant to electro magnetic emission of other equipment, which complies with the European standard EN 61000-6-3 for residential surroundings.
Experience has shown that in domestic surroundings, equipment is being used which has an EMC-emission level that is above the levels stated in EN 61000-6-3. This equipment can disturb the correct functioning of the Xanura-modules. The immunity of the Xanura built-in modules is therefore revaluated and equivalent to EN 61000-6-2 (the more severe European standard for immunity in industrial surroundings).

Nevertheless, the application area for Xanura will remain restricted to residential areas.

Eaton is therefore not responsible for the disfunctioning of the Xanura system as a consequence of equipment in the building with emission levels that exceed the maximum allowed levels set as standard for residential, commercial and semi-industrial surroundings stated in EN 61000-6-3.

Application area	Valid European Standard		Xanura- home automation*
	Immunity of equipment	Emission of equipment	Immunity and emission standards
Residential Commercial Semi-industrial	61000-6-1	61000-6-3	Compatible/ meets the requirements

* Condition is that the total Xanura-system is installed in accordance with valid instructions supplied by a certified and trained Xanura dealer.

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