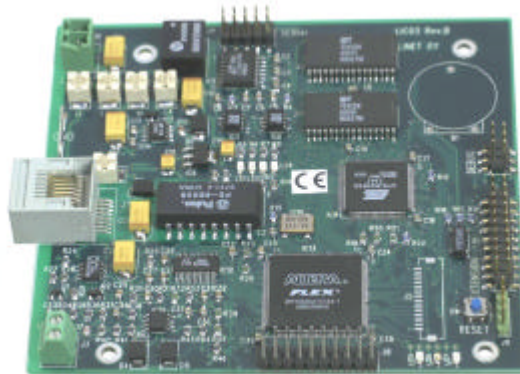

SOFTWARE SPECIFICATION V6.3

SOFTWARE FOR LIC03 LINET NETWORK CONTROLLER



1 GENERAL INFORMATION

This document describes the key features of the system software shipped with the Linet LIC03 network controller. Hardware specifications and ordering information are documented in the LIC03 data sheet.

The LIC03 controller software runs on an onboard RISC processor. The tasks for the software are

- to control the groups within the Linet system;
- to control the host interfaces and their protocols;
- to offer services for setting up the network;
- (optionally) to run application specific add-ons.

The software runs with 'SSX' multi-tasking real-time operating system and is written in ANSI C.

2 CONFIGURATION

2.1 CONFIGURATION INTERFACES

A user interface has to be connected to the LIC03 controller to set-up and configure the network. It may either be a fixed interface including 4x20 char display with 8 softkey pushbuttons, or a terminal connected to the controller's serial port.

2.2 SYSTEM PARAMETERS

The following system parameters can be set with the user interface. Note that 'net save' instruction should be used to save the parameters on the on-board eeprom memory.

Serial line parameters:

- baud rate,
- parity on/off.

Ethernet interface parameters:

- IP address,
- port.

Other parameters:

- time and date,
- net frame size.

3 NET SAVE

The Linet text save format consists of lines of ASCII characters. The first character of a line determines the interpretation of the line. This document applies to save file version 2.

A semicolon initiates a comment: everything from the semicolon until end of line is ignored. Empty lines are allowed.

The default number base is ten (decimal). An octal value is marked by prefixing it with 0q or 0Q (e.g. 0q16 = 14 decimal). A hexadecimal value is marked by prefixing it with 0x or 0X (e.g. 0x15 = 21 decimal).

Interpretation of code lines:

CODE LINE	INTERPRETATION
v n	version n (this applies to version 2)
m n	frame length n
g i t	group i of type t
m1 i n	master on or sole master group n for slave group i
m0 i n	master off group n for slave group i
n i g	node i in group g
d i t	group i delay t (XDELAY group); group i set-value t (CONTROL group)
e	end of description

The code lines v and m must be the first lines in this order, and the code line e must be last. The order of other code lines is not fixed. The Linet controller outputs the code lines in the order of the table above.

The group types are coded as follows:

CODE	NAME	INTERPRETATION
0	NONE	no group
1	TOGGLE	toggle group
2	DIMMER	dimmer group
3	IOGROUP	I/O-group
4	XLAMP	lamp group with fault detect
5	LMON	lamp fault monitor
6	XDELAY	delay timer
7	WCALL	waiter call
8	DATA EXCH.	data exchange
9	DATA8	8 bit data
10	DATA12	12 bit data
11	DATA16	16 bit data
12	AD/STATE	analog in / toggle out
13	CONTROL	control group

4 HOST INTERFACES

4.1 SERIAL LINE

The serial interface includes a set of run-time instructions to input and/or output the nodes in the network.

Group control instructions:

NAME	SYNTAX	RETURNS	APPLIES TO	OPERATION
SET	S g	OK! / ERR	TOGGLE DIMMER IOGROUP AD/STATE	Toggle group, I/O-node, AD/state: set SWNO output. Dimmer group: enable PWM output.
CLEAR	C g	OK! / ERR	TOGGLE DIMMER IOGROUP AD/STATE	Toggle group, I/O-node, AD/state: clear SWNO output. Dimmer group: clear output and set pwm duty cycle to 50%.
STEP UP	+ g	OK! / ERR	DIMMER	Step up PWM output duty cycle.
STEP DN	- g	OK! / ERR	DIMMER	Step down PWM output duty cycle.
IN	I g	value / ERR	TOGGLE DIMMER IOGROUP DATA8 DATA12 DATA16 AD/STATE CONTROL	Input group value: toggle, dimmer and iogroups: 1/0; AD/state and control groups: 12 bit AD value; data8 groups: 8 bit data etc.
OUT	O g v	OK! / ERR	DATA8 DATA12 DATA16 CONTROL	Output value v to group g.

g = group id, 1 <= g <= 200 or 0x01 <= g <= 0xC8

d = data, 0 <= d <= 255 or 0x00 <= d <= 0xFF (data 8-bit group)

0 <= d <= 4095 or 0x000 <= d <= 0xFFFF (data 12-bit group)

0 <= d <= 65535 or 0x0000 <= d <= 0xFFFF (data 16-bit group)

System instructions:

NAME/SYNTAX	OPERATION
INIT	initializes the system
CONFIG	enters the 'configure network' menu
GET	net save (see paragraph 3)
PUT	net load (see paragraph 3)
ECHO ON	toggles echoing of characters
ECHO OFF	-"-
ACK	acknowledges a message

4.2 ETHERNET (LINET UDP/IP NETWORK PROTOCOL)

4.2.1 Protocol overview

The IP/UDP protocol is run on the 10BASE-T Ethernet connection to the controller. The protocol corresponds to the IETF (Internet Engineering Task Force) specifications (RFCs).

4.2.2 Controller addressing

The controller uses one UDP port. The port number and IP address of the controller are configured during controller setup. The IP address should belong to the IP subnet of the Ethernet segment the controller is to be connected to. (On the test versions the IP address is 192.168.42.13 and the port is 1313.)

4.2.3 Request / response cycle

The controller sends only on request from the network. A response packet is sent for each request packet. The response packet is sent to the IP address and port marked as sender in the request packet.

The controller can respond to multiple requesters. The requests are processed in sequence: a new request is processed only after the pervious request is responded to. If the rate of requests exceeds the possible response rate, the extra requests are silently discarded.

4.2.4 Data types

All packet data is in binary format. The binary data entities are 8 bit or 16 bit unsigned integers. The 16 bit data is sent in network order: most significant byte first. (Note that this is the opposite to the internal ordering in both the controller and an IBM PC.)

4.2.5 UDP packet header

In all packets there is a common 4 byte header:

BYTE OFFSET	BYTES	FIELD
0	1	protocol version, now 0
1	1	packet type, see below
2	2	flags, reserved

The packet types defined are:

CODE	TYPE
0	status request
1	status response
2	structure request
3	structure response

4.2.6 Network status packets

A network status packet reads and/or sets up all groups in the network. The packet contains a 200 entry array of 4 byte entries after the packet header. Each entry describes one group, the first entry is group 1.

BYTE OFFSET	BYTES	FIELD
0	1	group type, see below
1	1	flags
2	2	group value

The flags field contains currently one flag: if bit 0 is on, the request wants to change the group state to value in the packet. If the flag bit 0 is off, the value field is ignored.

The group types and corresponding group value type are:

TYPE CODE	GROUP TYPE	VALUE TYPE
0	NONE	none
1	TOGGLE	on/off
2	DIMMER	0=off, 1=on, 2=step up, 3=step down
3	IOGROUP	1 bit I/O
4	XLAMP	1 bit I/O
5	LMON	1 bit I/O
6	XDELAY	16 bit, delay value / 10 ms
7	WCALL	waiter call
8	DATA EXCH.	not usable
9	DATA8	8 bit, data value
10	DATA12	12 bit, data value
11	DATA16	16 bit, data value
12	AD/STATE	AD value (12 bit)
13	CONTROL	AD value (12 bit)

5 FIELD UPDATING

The software and OS running on the controller can be upgraded using a PC with a terminal application that supports XMODEM protocol. To do this, connect the terminal to the controller via serial port, press 'L' while the controller boots, and start XMODEM transmission. The terminal bit rate must be set to 9600 bits/s. Newest controller software is available at <http://www.linnet-network.com/html/solutions.html>.

6 UPGRADES

VERSION 6.3 CHANGES

- *CONTROL* group added. A CONTROL group is used to replace thermostats when controlling temperature (or other magnitude). While configuring, the A/D-converter of the node will be enabled.
- *STEP UP/DOWN* instructions over UDP/IP added.

VERSION 6.2 CHANGES

- *Setting of node configuration data via serial line corrected.* This function did not work properly in the previous version.

VERSION 6.1 CHANGES

- *AD/STATE* group added. An AD/STATE group is a 12 bit data group on input and a 1 bit output group on output. While configuring, the A/D-converter of the node will be enabled.

- *Setup options for serial line bit rate and parity added to serial line menus.* The setup breaks the serial line control temporarily, so the controlling line parameters have to be changed also before proceeding.
- *Addition of field updating.* The startup code is extended so that it is possible to download a new version of the software & OS via the serial port using XMODEM protocol.
- *XDELAY group handling changed.* The delay is changed to be retriggerable. The XDELAY groups are changed to be remotely controllable both from serial line and UDP/IP. The output value is the count of seconds left. The input value is the trigger signal.
- *Reordering of serial control menus.* The serial control menus below 'config' command are re-ordered to match the keyboard / display control menus.
- *Init -command handling corrected.*
- *UDP port handling corrected.* The UDP port handling in previous versions responded to similar-numbered port in the controlling host. Corrected to respond to the port the command is coming from.
- *Correction of unset clock.* The clock displayed seconds as 80, when the clock was not set and running. Corrected the display to show 1 January 2000 at 00:00:00.

7 OTHER INFORMATION

Linnet products are not suitable for use as safety critical components (a) in life support devices, (b) in or on an aircraft, (c) in a nuclear plant, without the written approval of Linet Oy.

US pat. 5.920.253. Patented in the USA and Finland. Other patents pending. 'Linnet' is a registered trademark. In the interest of product development, Linet Oy reserves the right to alter or improve the specification or design at any time without notice.

Copyright Linet Oy, 2002. Copying is permitted only when the material is not modified and is kept as a whole.