LS-101
LAN to Serial Device server

User's Manual

Revision History

Revision No	Date	Author	Remarks
0.1	August 29, 2001	IDC	Initial document

INTRODUCTION

Overview

Almost all instruments and most industrial equipment support a serial port (called the craft port) that is primarily used to program the device.

In a typical scenario, the user takes a laptop to the device and through custom software, programs the device or the instrument.

Being able to control and program instruments remotely through the LAN or the Internet is very desirable and has obvious advantages.

The LS-101 device server does precisely that.

The LS 101 connects the serial devices to the Ethernet.

With the full-featured serial handshake signals and 10/100 Base T-network interface it is now easy to network enable any device that has serial port.

Features

- ?? Internet enables any device that has serial port
- ?? Use existing software
- ?? TCP/IP, ICMP, HTTP and DHCP Protocols supported
- ?? Automatic 10/100-BaseT selections
- ?? Communicate only with Trusted systems
- ?? Configuration is protected with the password
- ?? Baud rates up to 230.4Kbps
- ?? Data size 7 or 8
- ?? Stop bits 1 or 2
- ?? Parity Odd or Even or None
- ?? Flow control Hardware, XON/XOFF, none
- ?? Easy configuration
- ?? Modem mode of operation
- ?? Diagnostic LED indicators
- ?? Compact size (3.4 X 2.3 X 0.9 inches)
- ?? Operating temperature -10 to 65 C

Applications

- ?? SCADA (Supervisory Control And Data Acquisition)
- ?? Vending machines
- ?? Energy management
- ?? Test Instrumentation

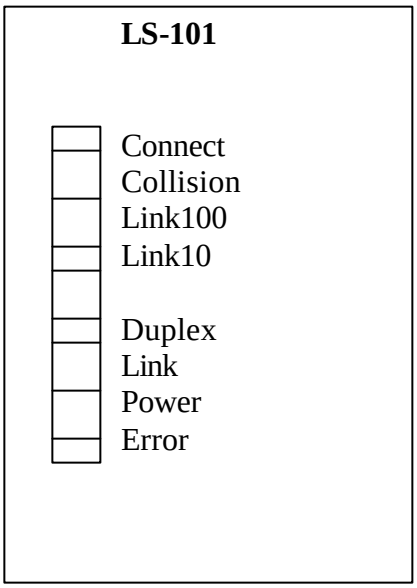
?? Cable set-top boxes
?? Credit card terminals
?? POS Terminals
?? CNC Machines
?? Security Systems
?? Medical Industry

Packing List:

With the LS 101, please verify that you have received:

1. LS-101 Unit
2. RS232 Cable
3. User Manual
4. Power adapter
5. Configuration Software Disk

Getting Started



Serial Connector

LED's Description

LED name	Description
Connect	TCP/IP connection has been established with the server.
Collision	Collision occurred on the Ethernet
Link-100	Link-100 Activity
Link-10	Link-10 Activity
Duplex	Glows when the Ethernet Link is operating in Full Duplex mode
Link	Ethernet Link status
Power LED	Power supply
Error	Error occured

DIP Switch settings are read only at the power on.
DIP Switch Settings: -

Switch 4	Switch 3	Switch 2	Switch 1	Mode of operation
X	OFF	OFF	ON	Configuration Mode (RS232)
OFF	OFF	ON	OFF	LAN to Serial (Bi-directional) (RS232)
ON	OFF	ON	OFF	LAN to Serial (Bi-directional) (RS485)
OFF	ON	OFF	OFF	Modem mode (RS232)
ON	ON	OFF	OFF	Modem mode (RS485)
ON	**ON**	**ON**	**ON**	**Load factory defaults.** **Note:- Since it erases the user configuration, please use this mode in caution.**

The LS-101 can operate in three modes (DIP switch selectable) of operation. Please refer to chapter on “Configuration”.

1. Configuration Mode
2. LAN to Serial converter
3. Modem mode

All the operating modes are described below:

LS-101 can also be configured through the web browser.

First we need to configure the LS 101.

Configuration Mode of Operation

In this mode we configure the LS-101. Please set the switches as indicated below for “Configuration Mode”.

DIP Switch Settings:-

Switch 4	Switch 3	Switch 2	Switch 1	Mode of operation
OFF	OFF	OFF	ON	Configuration Mode

In this mode, the serial port parameters are set to 9600-baud 8N1.

Installation

Set the LS-101 to the Configuration mode using the Dipswitch as indicated above. Connect the serial port of the system to the LS-101 as shown in the figure below. Power on the LS-101. In the configuration mode the LS-101 serial port parameters are set to 9600, 8, n, 1.

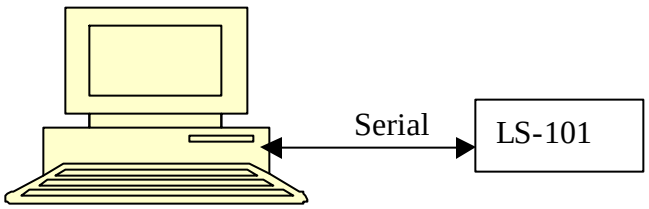


Fig. Configuring the LS-101.

The LS-101 can be configured using IDC supplied configuration program LS101.exe or using any Terminal Emulation program (Hyperterminal).

For proper operation the following parameters must be set:

LS-101 Parameter	Factory Default	Description
IP Address	192.168.002.020	IP address of the LS-101
Server Port	5000	Listening port on LS-101
Subnet mask	255.255.255.0	Subnet mask of the LS-101
Gateway	192.168.002.001	Gateway of the LS-101
DHCP	Disabled	Enable/Disable the DHCP. i.e. Automatically obtain the Ethernet parameters from the server.
Trusted Systems Feature	Disabled	Any system on the network can communicate with the serial device. If Enabled, Communication is permitted with any of the trusted Systems.
Trusted Systems IP addresses list	0.0.0.0	Allow TCP/IP connections to only these systems.
Remote Server feature	Disabled	If Remote Server feature is Disabled AND there is NO Client connected to LS-101, data received on the RS-232 port is discarded. If Remote Server feature is enabled AND there is NO Client connected to the LS-101, data received on RS-232 port is sent to one of the Remote servers at the specified port.
Remote Server IP addresses list	0.0.0.0	The IP address of the system to which this LS-101 has to make the connection
Baud rate	9600	Serial port baud rate
Data size, Parity and stop bits	8 N 1	Serial port Data size, parity and stop bits
Flow control	None	Serial port Handshaking control
Password	IDC	Used to protect the configuration

Configuring LS-101 through the LS101.exe

Set the Serial port parameters to 9600, 8, n, 1. Power on the LS-101. The LS-101 displays the Sign-on message and prompts the user to enter the password as “IDC”.

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Enter the Configuration Password:

Once the correct password is entered, the LS-101 will displays the current LAN and serial parameters set in the EEPROM and main configuration menu as shown below

LS-101 IP address =192.168.002.020.
Server Port number = 05000
Subnet mask =255.255.000.000.
Gateway Address =192.168.002.001.
DHCP Disabled
Trusted Systems Feature Disabled
Remote Server feature Disabled

Serial Host Baud rate=9600
Serial Data, Parity, Stop bits=8 N 1
Serial Flow control=None

A. Set IP address
B. Set Subnet mask
C. Set Gateway
D. Enable/Disable DHCP
E. Enable/Disable Trusted Systems feature
F. Trusted Systems IP addresses
G. Enable/Disable Remote Server feature
H. Remote Servers IP addresses
I. Set Host Baud rate
J. Select Data size, Parity, Stop bits
K. Select the Flow Control
L. Set Configuration Password
M. Display current parameters
N. Save to EEPROM
Enter the choice:

Select the choice and set the LS-101 LAN/Serial parameters appropriately.

After all the parameters are set select the choice ‘L’ to save the parameters to the EEPROM on the LS-101. Set the DIP switch (Table 1) to the desired mode of operation Power off and ON the LS-101. Power on the LS-101 will read the DIP switch, EEPROM for serial and LAN parameters and operate accordingly.

For simple check use “ping <LS-101 IPADDRESS>” command.

LAN to Serial Mode

In this mode of operation the data is transferred from LAN to serial and vice versa in a transparent mode. To select this mode, please set the DIP switch position as shown:-

DIP Switch Settings: -

Switch 4	Switch 3	Switch 2	Switch 1	Mode of operation
OFF	OFF	ON	OFF	LAN to Serial (Bi-directional)

The fig.1. Describes the existing scenario. The Serial Software running on the server will read/write to its serial port (COM1/2…) to communicate with the serial device.

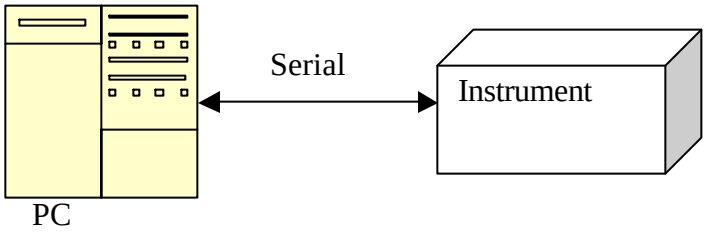

Fig. 1. Existing scenario

Internet/LAN enable the serial device by using two LS-101's (operating in the LAN to Serial mode of operation) as shown in the fig. 2. Use the same software and communicate with the serial device seamlessly. In this scenario the serial device can be accessed or controlled through remotely over Internet or LAN.

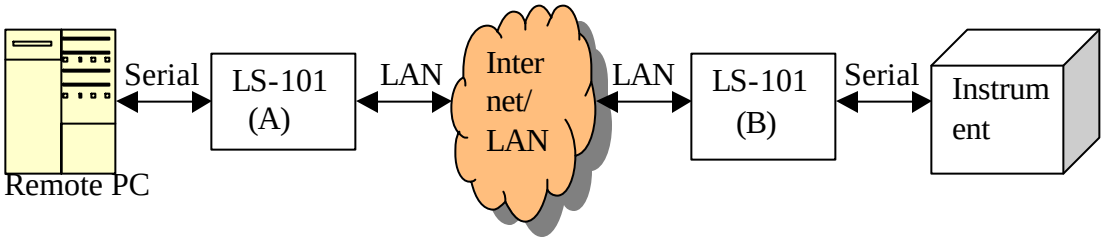

Fig. 2. Internet/LAN enable the serial device (Server running serial software)

Using the network software communicate with the serial device as shown in the following fig.

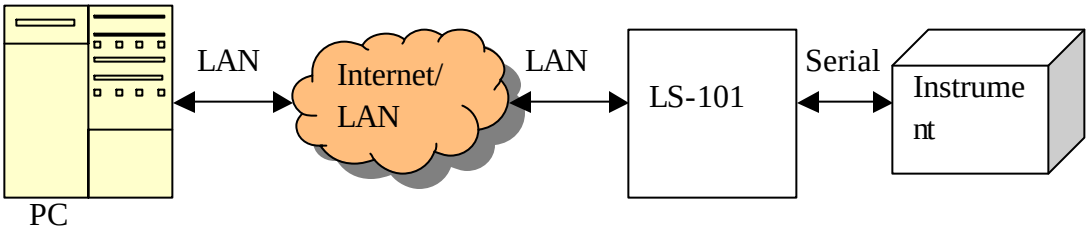

Fig 3. Internet/LAN enable the serial device (Server running Network software)

Modem Mode of Operation

In this mode of operation the LS-101 emulates a dial up modem.
For transparency to existing software, the LS 101 accepts modem "AT" commands. These commands are listed in Table 1.
The DIP switch is set as shown

DIP Switch Settings: -

Switch 4	Switch 3	Switch 2	Switch 1	Mode of operation
OFF	ON	OFF	OFF	Modem mode

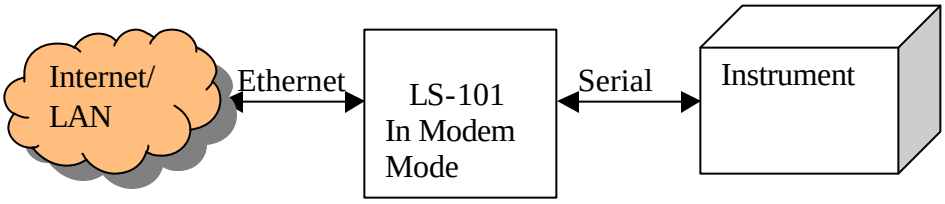

Fig2. Modem mode of operation.

The LS-101 is always in one of two states; the command state or the on-line state.

Command State

The LS-101 assumes the command state whenever power is applied. This state allows the LS-101 to be configured for the particular application. In the command state the data received from the serial port is treated as commands and responses are sent back. LS-101 operation is controlled by AT commands Table 1.

On-line State

The command ATD<IP address> is used to connect to the remote server. Once the connection is established LS-101 send CONNECT response to the serial device. The LS-101 will enter into the on-line state i.e. what ever data received through the serial port is

sent to the LAN and vice versa. You can switch into the command mode by using the escape sequence"+++".

Modem mode Command Reference

Command Guidelines

Carriage Return (CR)
The command line must end with a carriage return. The LS-101 will not begin to execute the command until it receives a CR.

Attention Code
Command lines must begin with the characters AT.

A/ Command
The A/ Command instructs the LS-101 to repeat the last successful command line stored in the buffer. A/ may be used to reconnect the previous server when busy condition is encountered. A/ is used in place of AT and no carriage return is required.

Backspace Key
Prior to pressing carriage return, editing can be done with the backspace key.

Result Codes
Result codes are responses by the LS-101 to commands. Result codes may be English words or digits.

Unimplemented AT commands
If an unimplemented command is entered, no action is taken by the LS-101 and ERROR result code is issued.

Escape Code Sequence
The three-digit escape code sequence forces the LS-101 to the command state from the on-line state. The escape code sequence is "+++".

Result codes

Digit Code	Word Code	Meaning
0	OK	Command Line Executed without errors
1	CONNECT	Connected to the server
2	RING	Some server is trying to connect to the LS-101
3	NO CARRIER	Connection lost
4	ERROR	Invalid command, error in command line
7	BUSY	Unable to connect to remote host (server)

AT Commands

Command	Facory Default	Parameters/Description
AT		**Attention Code**. **AT** is the command line prefix (Attention code). AT Precedes the command line except for +++(escape) and A/ (repeat) commands. Parameters:- None
A		**Answer command**. **A** forces the LS-101 to go to auto answer mode.
A/		**Repeat Last Command. A/** repeats the previous command
D[S=x]<Ipaddress>		**Dial Command. D** causes the LS-101 to connect to the remote host (server) with the IP address that follows. Valid characters are 0-9, . Optional S=x (x = 0, 1, 2, 3) causes the LS-101 to establish connection with stored IP address servers.
En	N = 1	**Off-line Echo Character Option. En** controls command echo to the host Parameters: n = 0, 1 N = 0 Disables echo N = 1 Enables echo (factory default)
Fn	N = 1	**On-line Echo Character Option. Fn** determines whether characters are echoed to the host from the LS-101 in the on-line state. Parameters: n = 0, 1 N = 0 Enables echo N = 1 Disables echo (factory default)
Hn	N = 0	**Connect control option. Hn** controls the connection to the host. Parameters: n = 0 N = 0 Disconnect the TCP/IP connection
In	N = 3	**Identification/Checksum Option. In** interrogates the LS-101 for its product identification Parameters: n = 3 N = 3 IDC LS-101 Rev 1.0
O		**On-line Command. O** forces the LS-101 to the on-line state from the command state. When the LS-101 is in the on-line state, it will return to the command state upon receipt of the escape code.
Qn	N = 0	**Result Code Display Option. Qn** enables the modem to send result codes.

		Parameters: n = 0, 1 N = 0 Enables the return of result codes (factory default) N = 1 Disables the return of result codes (Quiet)
Vn	N = 1	**Result Code Form Option. Vn** determines the type of result code Parameters: n = 0, 1 N = 0 Result code is sent as digits (short form) N = 1 Result code is sent as words (long form Or verbose) (factory default)
Zn	N = 0	**Recall Stored Profile Option. Zn** causes the LS-101 to fetch the stored configuration from non-volatile memory and store it in the active configuration area. An OK result code is returned. Parameters: n = 0, 1 N = 0 Recall stored profile 0 (previously Stored with **&W0**) (factory default)
+++		**Escape Code Sequence.** The escape code sequence forces the modem to the command state from the on-line state. It consists of a three-character escape code sequence surrounded by escape guard times. The delay between issuance of each escape character must not exceed the escape guard time. The escape guard time is defined as the time delay required between the last character transmitted and the first character of the escape code. The guard time is **1 Second** and the escape character sequence is **+++.** The escape character must be entered three consecutive times. To enter the escape code sequence perform the following:- WAIT AT LEAST 1 SECOND (After the last character has been transmitted) Enter: +++ (Delay less than one second between characters) WAIT AT LEAST 1 MORE SECOND (Before transmitting another character). The LS-101 returns to the local command state and sends the OK result code. The LS-101 will not disconnect the TCP/IP connection until it receives an ATH command. The ATO command will make the LS-101 to go back to

		on-line state.
&Dn	N = 0	**Data Terminal Ready Option. &Dn** controls the Data Terminal Ready (DTR) options. Parameters: n = 0, 2 N = 0 LS-101 ignores DTR (factory default) N = 2 LS-101 disconnects the TCP/IP Connection and assumes the Command state when DTR is de-Activated.
&V		**View Active Configuration and User Profiles.** The active and stored profiles are displayed along with the stored IP addresses.
&Zn=x		**Store IP Address. &Zn** stores upto four IP addresses into the NVRAM for later recall by the DS dial stored number command. Parameters: n = 0, 1, 2, 3 X = <IP ADDRESS> Example:- AT&Z1=10.0.0.121 <CR> ATDS=1<CR>

The LS-101 serial port (DB25 Female connector) is wired as DCE.

Pin No.	Signal Name	Input/Output
2	TXD	Input
3	RXD	Output
4	RTS	Input
5	CTS	Output
6	DSR	Output
7	GND	
8	DCD	Output
20	DTR	Input

Remaining Pins are NC (Not connected)

The LS-101 serial port (DB9 Female connector) is wired as DCE.

Pin No.	Signal Name	Input/Output
1	DCD	Output
2	RXD	Output
3	TXD	Input
4	DTR	Input
5	GND	
6	DSR	Output
7	RTS	Input
8	CTS	Output
9	RI	Output

RS-485 related Jumpers JP1, JP2 and JP3 near the RS485 connector

JP1	Short	Insert a 620 Ohm resistor between GND and RS485 Signal B (Pull-down resistor)
	Open	Remove a 620 Ohm resistor between GND and RS485 Signal B (Pull-down resistor)

JP2	Short	Insert a 120 Ohm resistor between RS485 Signals A and B (Terminating resistor)
	Open	Remove a 120 Ohm resistor between RS485 Signals A and B (Terminating resistor)

JP3	Short	Insert a 620 Ohm resistor between Vcc and RS485 Signal A (Pull-up resistor)
	Open	Remove a 620 Ohm resistor between Vcc and RS485 Signal A (Pull-up resistor)

Frequently Asked Questions (FAQs):-

1. Where can I use the LS-101 ?

Ans. As a bi-directional LAN to serial converter, the LS-101 can be used to Net enable any instrument/device that has a serial port. With the LS-101 installed, all such devices can now be monitored and controlled remotely.

2. What are the Ethernet features supported?

Ans. LS-101 supports auto detection of 10/100 Mbps link, Half/Full duplex, auto negotiation. Visual indicators are provided for Link, Full Duplex, Link 10-Activity, Link-100 Activity, and Collision.

3. What are the Ethernet standards supported?

Ans. LS-101 supports IEEE 802.3/802.3u and 802.3u clause 28.

4. Which Internet protocols are supported?

Ans. LS-101 supports TCP/IP, ICMP, DHCP, ARP

5. Can I Ping the LS-101?

Ans. Yes. LS-101 supports ICMP for these purposes.

6. What is the Ethernet (MAC address) of the LS-101?

Ans. The Ethernet (MAC Address) of every LS-101 is printed on the LABEL. The Ethernet (MAC Address) will start with 00-07-91.

7. Any security features incorporated?

Ans. LS-101 supports two security features. 1. Configuration Password, 2. Communicate only with the Trusted systems.

8. What is a trusted system?

Ans. A trusted system is an IP address that is authorized to communicate with LS-101. Communication with other IP addresses server is ignored.

9. I have a different requirement, will IDC be able to support?

Ans. Definitely. For custom design and features, please contact IDC.