TOTAL ENGINEERING SERVICES TEAM, INC.

LB-100 VOICE RESPONSE RTU

January 20, 1989

1.0 INTRODUCTION

The LB-100 is a small RTU/SCADA system designed to operate over voice grade telephone lines and radio systems. It is a second generation product based on systems that have been installed since 1981. The primary communications into the unit is via local or telephone keypad using standard DTMF tones (touch-tone). Responses from the unit are via a digitized voice that can be customized for each installation.

2.0 LB-100 FEATURES

2.1 FUNCTIONAL OPERATION

The LB-100 basically operates as a first out annunciator, although the normal annunciator "windows" are not actually required. The alarms are reported via telephone line to a maximum of 16 numbers. An access code is required to operate the system, so no-answers and wrong numbers will not take the unit out of it's alarm condition.

After making a connection, the unit will report the alarm using the digitized voice and then wait for further operator action. Possible actions include examining other input points, controlling outputs, resetting timers, etc. If nothing is done, the unit will time-out and hang up all by itself.

2.2 INPUTS

The main function of the LB-100 is to monitor switch closures that represent alarm or process status information. Switch inputs can be any type of dry contact closure, either normally open or closed. The main circuit board has eight opto-isolated inputs that connect to the field switches via an on-board terminal strip. An expansion unit is also available to expand the inputs up to 128.

2.3 OUTPUTS

The main board also has eight reed relay outputs that can be used in several ways. The normal mode is to use the relays as control outputs that can be turned off or on by command from the telephone keypad. Another use is to have the relays "follow" the

corresponding input point while driving an annunciator type display. This allows for flashing "first-out" type operation as found in a normal annunciator.

A third output option is to have an output "pulse" for a programmed time period. This is used for fail-safe timer applications such as hurricane timers on offshore platforms. The unit will maintain an output for the duration of the pulse, and will turn off the output if another pulse command is not received. This allows un-attended production that will automatically be stopped if a loss communications prevents resetting of the pulse timer. Of course, the pulsed output can always be turned off at any time under command as long as the communications line is in operation.

2.4 VOICE MESSAGES

The LB-100 uses a digitized voice that is a digital recording of actual voice messages. It is very similar to "CD" technology, although at a much lower audio quality. The quality of the voice is designed to allow low cost operation while providing a voice that is compatible with the voice signal transmitted by a telephone line. Additional voice quality would not be carried by the telephone, and so it is not recorded in the actual message.

The system requires about 45 phrases for normal operation, and has a capacity 128 messages totaling 96 seconds. Additional message phrases normally include the location name, equipment names, and other applications specific terms. The messages are recorded into a PC and then transferred to ROM chips for installation in the unit. Recording for a typical unit takes about 2 to 3 hours.

Each point can be assigned a message string consisting of a series of individual phrases. For example, if the phrases "COMPRESSOR NUMBER 1" and "COMPRESSOR NUMBER 2" are required, the words "compressor" and "number" can be recorded once and used for each message. This greatly reduces the storage requirements for systems with a large number of points as long as phrases are used often.

After the phrases are placed in the ROM chips, the individual strings that make up each point can be programmed (and re-programmed) from the keypad. This allows for field changes without re-programming the voice roms as long as the required phrases are present in the system.

2.5 ALARM LOGGING

An optional serial printer output is available that will log each alarm condition with a time and date. The messages can be any length, although a short alarm description is recommended. The printer messages must be programmed into the main program ROM

at the time of installation and are not changeable in the field.

3.0 HARDWARE

3.1 CIRCUIT BOARD

The unit normally consists of a single circuit board with associated keypads, switches, and power supplies. The design was done by DATARAN Corp. in 1987 for an annunciator manufacturer, and TEST is using the design with appropriate modifications for the oilfield and industrial environment. The unit is microprocessor based with all RAM, ROM, and I/O being located on the single board. All programming of the unit is done by TEST in the Gretna Office.

3.2 CONTROL SWITCHES, MOUNTING AND ENCLOSURE

The standard unit has all components, switches, battery, and keypad mounted on a backplate for installation in a NEMA type box. Other configurations can be supplied to meet special installation requirements. Each unit is fabricated for each individual installation, so minor hardware changes are not a problem.

The keypad, ACK, RESET, and TEST push buttons are mounted on a metal plate just below the circuit board. These switches come into the processor through opto-isolated inputs, and can be remotely located if desired.

The telephone style keypad is used for all data and command entry, and all functions that can be done locally can also be done remotely over the phone line.

3.3 POWER SUPPLY

The unit normally operates from 120VAC with an internal battery backup for approximately 8 hours of operation. A separate battery on the circuit board will keep the setup information (phone numbers, phrases, etc) safe for several years. Power requirements are very low, so solar power is an available option.

The power to sense the field contact closures can be derived from a fuse protected supply located on the board. This is normally used for switch contacts that are located fairly close to the unit and will not be subject to high levels of electrical interference. If the switches are located far from the unit or are in the area of high electrical noise, a separate power supply should be used to power the inputs. The voltage can be from 5 to 16 volts DC, and need not be regulated.

4.0 LB-100 SOFTWARE

4.1 CONTROL PROGRAM

The LB-100 software is stored in a ROM chip mounted on the circuit board, and controls all functions of the RTU. There are several levels of operation available, although the user normally uses only the Keypad and telephone modes. Other modes include CRT terminal and network operation with other LB-100's.

Because all of the program development was done by TEST, custom versions can be made to suit special applications. Contact TEST for further information on custom programming for the LB-100.

4.2 VOICE GENERATION PROGRAMS

The TEST developed software that creates the digitized voice ROMS is used to store, compress, and catalog the phrases that will be used by the unit. This software runs on an IBM-PC compatible computer and requires a special circuit card to digitize and play-back the phrases. This allows for testing of the messages prior to placing them in ROMS for the final installation.

The program also generates a phrase library list that is unique to each location. This list is then used to make up the phrase strings that make up each message.

5.0 COMMUNICATIONS CONSIDERATIONS

The LB-100 uses DTMF (touch tone) codes that are produced by most telephone in use today. Many devices are available that use these tones to do basic control functions. While the LB-100 appears similar to these devices, it is designed for industrial applications requiring secure operations. The unit will not respond without an access code, and the quality of the touch tones must be such that the unit can clearly understand the commands. If the commands are not being received properly, the unit will not accept them.

The LB-100 requires that a reliable, consistent phone line be available for it to operate properly. Adjustments can be made in the unit to accommodate a variety of line conditions, but these are hardware adjustments that are locations specific. If the condition of the phone line changes, the unit may require adjustment.

Marginal phone lines should be tested with a DEMO unit prior to committing to an installation so that reliable operation can be verified.

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TEST INC.

LB-100 VOICE RTU/SCADA SYSTEM

INSTRUCTION MANUAL

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Software Version 2.22

1.0 INTRODUCTION

This document explains the basic operation of the TEST INC. LB-100 voice RTU/SCADA system. The system is designed and manufactured by TEST INC. Inc, Gretna La. The basic hardware and software features are covered so that the system can be set up and operated with a minimum of operator training.

1.1 SYSTEM DESCRIPTION

The LB-100 RTU/SCADA is a microprocessor based annunciator and control system designed to provide voice annunciation and telephone line or radio system interfacing. The unit operates as a first out annunciator, where a new alarm condition places the system in alarm status. In addition to providing optional local annunciation, the unit will use the telephone line or radio channel to seek a response to the new alarm condition.

In addition to the callout functions, the unit will accept incoming calls to allow remote operators to examine system status and to control outputs.

The standard LB-100 provides more functions than is normally needed by a single installation, and the user only need learn about the features related to his particular application. However, some awareness of the overall capabilities of the LB-100 may provide additional applications of the unit using the existing available commands.

1.2 START UP PROCEDURE

CAUTION: The following procedures and testing are functional. Under no circumstances are voltage breakdown tests or insulation resistance tests to be performed without first consulting the factory. Serious component damage could result due to stray capacitive coupling effects, unless proper procedures are followed.

CAUTION

VOLTAGES DANGEROUS TO LIFE ARE PRESENT WHEN POWER IS APPLIED TO THIS UNIT.

1. Connect 117VAC to the input terminals marked "117VAC INPUT" and turn on the "AC POWER" switch. This will apply power to the battery charger circuit. Turn on the "DC POWER" switch to apply power from the internal battery to the circuit board.

2. After a few seconds, an "Activity" LED located on the LB-100 PCB will begin to blink. If does not flash within 5

seconds, press the CPU RESET pushbutton located on the circuit board.

3. Depress the TEST pushbutton located on the keypad and pushbutton panel. The LB-100 should speak a specific phrase which has been pre-programmed at the factory and is different for each unit. All "Annunciator LEDs" and "Common Alarm LED" should momentarily light.

4. Now you are ready to connect up the field wiring as shown on the drawing(s) included as part of this manual, and begin performing the procedures as outlined in the following paragraphs.

5. A final initial comment worth noting! When you enter any data into the LB-100 via the keypad, every block of data must first be prefixed with a "*" and end with a "#". The first block of data that must be entered, is the "Access Code". Eventhough this code is changeable (see CODE), it has been factory preset at "ART" or 278. Therefore, when you first start up, to begin your program entry procedure, depress any key on the keypad. The machine will prompt, "Enter Access Code". You will then enter a "*" then the numbers "278" followed by a "#". The machine will prompt, "Enter Command". At this time you can enter the next desired command. All of these commands and more are explained in detail in the following paragraphs.

1.3 AVAILABLE COMMANDS

The unit accepts a variety of commands from either the telephone line or the local keypad. The commands provide for system control, phone line control, annunciator control, and input/output control. The commands are explained below in detail. All commands are entered using a general purpose command interface also explained below.

LB-100 COMMAND REFERENCE BY CATEGORY

All commands start with a * and end with a #
Only enter the letters shown in CAPS, ignore lower case.

ANNUNCIATOR CONTROLS

778	RPT	Report current alarms
225	ACKnowledge	Stop first out
737	RES	Reset pending alarms
7655	POLL	List current alarms
7828	STATus	Check single point status
5278	LAST	Say most recent First Out alm
5478255	LISTALL	LIST ALL ALARM POINTS
5478	LIST	list only current alarms
738674	SETMSG	Set the codes for a message
729255	SAYALL	Say all alarm point messages
729542	SAYLIB	Speak library phrases

OUTPUT CONTROLS

66	ON	Turn on an output
633	OFF	Turn off an output
688	OUT	Check output point status
78573	PULSE	Pulse a single output

INPUT CONTROLS

53276	LEARN	Memorize current inputs.
3547	FLIP	Invert current NO/NC STATUS
467	INP	Check status if any input channel
25625	BLOCK	Stop a single alarm channel
276	ARM	Enable a single alarm channel
276255	ARM ALL	Enable all channels

COMMUNICATIONS CONTROL

293	BYE	Terminate communications
2255	CALL	Set and anncounce phone numbers
347	DIR	Set current active phone directory
3425	DIAL	Use system as a phone
00		Quick repeat of the last command.

UNIT CONFIGURATION

6392633	NEWCODE	Change the access code
2633	CODE	Say the access code
43	ID	Say Station ID number
8463	TIME	set time and date
3283	DATE	same as time
7764	PROG	Announce Program version
72726	PARAM	Set parameter value (see list)
468376	INTERN	Internal data accesses
738638	SETNET	Set network parameters
7386387	SETNETS	(more than one net at a time)
7382273	SETBASE	Set base address of on-board points
265378278	COLDSTART	Same as a first time hardware reset
9276	WARM	Same as pushing reset button.

1.4 ALPHABETICAL LISTING

COMMAND NAME	ALPHA CODE	NUMBER CODE	DESCRIPTION
ACKNOWLEDGE	ACK	225	Reset the first out condition.
AGAIN	00	00	Quick way to repeat last command.
ARM ALARM	ARM	276	Arm a single alarm point.
ARM ALL	ARMALL	276255	Arm all alarm channels.
BLOCK ALM	BLOCK	25625	Block out a single alarm.
BYE	BYE	293	Terminate the linkup.
WHO TO CALL	CALL	2255	Set and announce phone numbers.
CODE SPEAK	CODE	2633	Speak current access code.
DATE SET	DATE	3283	Set clock time and date (DATE).
DIRECTORY	DIR	347	Set active directory entries.
FLIP NO/NC	FLIP	3547	Change NO/NC Contact for 1 point.
ID ANNOUNCE	ID	43	Speak location ID.
INPUT CHECK	INP	467	Check status of any input.
LAST F.O.	LAST	5278	Speak most recent First Out Alarm.
LEARN SW'S	LEARN	53276	Learn current contact positions.
LIST ALARMS	LIST	5478	List all currently active alarms.
LIST ALL	LISTALL	54787255	List all alarms with status.
NEW CODE	NEWCODE	6392633	Set a new Access Code.
OUTPUT STAT	OUT	688	Check status of an output channel.
OUTPUT OFF	OFF	633	Turn off a specific output channel.
OUTPUT ON	ON	66	Turn on a specific output channel.
PARAMETER	PARAM	72726	Set parameter functions.
POLL	POLL	7655	Poll and speak all current alarms.
PROGRAM ID	PROG	7764	Announce Program Version & Library Serial Number.
REPORT	RPT	778	List any First Out alarm.
RESET	RES	737	
SET RINGS	RINGS	74647	Set number of rings before answer.
STATUS	STAT	7828	Check status of a single alarm.
TIME SET	TIME	8463	Set clock time and date(same as DATE)

1.5 SOFTWARE REVISION HISTORY

The following software revision list details the features added to recent versions of the program. Use the PROG command to determine the specific version installed in each LB-100.

Version 2.15 5-29-89 Added output channel off-hook control parameter number 29.

Version 2.16 6-13-89 Added remote printer support. Misc internal improvements.

Version 2.17 6-19-89 Fixed bug in PULSE command on expansion outputs. Added horn timeout parameter.

Version 2.18 9-18-89 Internal version - never released.

Version 2.19 11-23-89 Fixed bug in ring counter. Added timing parameters for dial tone and ringback detection. Added LED debug parameter.

Version 2.20 11-27-89 Added parameters 41 through 44. Enhanced ringback detection and associated callout procedures. Added output verification routines. Added max callout count. Added output pulse duration parameter. Improved precision of timing procedures.

Version 2.21 12-15-89 Added parameter 45
Param 45 determines how many 10ms periods outputs are pulsed when then PULSE command is used. This affects all outputs.

Version 2.22 11-03-90 Added parameters 46 and 47.
The tape recorder mode accessed with the special *12345# password entry uses these params to determine how long to wait before announcing messages and the message mode to use. This release also improves the blind callout "hello" messages. Improvement also made in the "hello" messages during ringback detection on callout.

2.0 KEYPAD COMMAND INTERFACE

The LB-100 uses the voice synthesizer and the DTMF (Touch-Tone) telephone keypad as the means of operator communication with the unit. Telephones without built-in Touch-Tone keypads can be used if a separate DTMF generator is held up to the phone mouthpiece. This is not as reliable as the built-in tones, but will work in most cases.

In addition, most units have a local keypad that duplicates the action of someone calling in on the telephone line. Any function possible from the telephone is also available at the local keypad.

Communication is started by calling the unit and waiting for it to answer. Use of the local keypad is started by pressing any key and waiting for the unit's response. When the local keypad is in operation, a LED marked "keypad" will be on.

The unit will always request some type of information from the operator and then wait for a response. The typical pattern is for the unit to request a command, and then ask for one of more numerical entries as the command is processed. When the command is completed, the unit will ask for another command. Commands that do not require any operator data entry (like ACK) will cause the unit to say "OK" to signal that the command has

been completed. The session is terminated when the operator enters the "BYE" command or if the operator fails to enter a command within 60 seconds.

Commands are given names that can be spelled out on the telephone keypad using the letters associated with certain digits on the phone. Alternately, the operator may choose to remember the number patterns for some commands to speed command entry. In any case, commands are actually made up of strings of numbers that can be transmitted over the phone. A telephone keypad is normally arranged as follows:

	ABC	DEF
1	2	3
GHI	JKL	MNO
4	5	6
PRS	TUV	WXY
7	8	9
*	0	#

The letters making up a command are entered by hitting the numbers assigned to the alphabetic characters. For example, the command acknowledge is given the name ACK, and is entered by using the numbers 225. Command entry is done by first hitting the "*" (star) key on the keypad, and then entering the digits making up the command. All commands and data entry are started with a * and terminated with the "#" (pound) key. The unit only accepts digits between the * and # keys. If a mistake is made during a command or data entry, the * key can be used to restart the entry sequence. This is always true except during telephone number entries as explained later. In general however, the * key can be used to restart a command or data entry sequence.

The commands explained below are divided into functional groups. The function of each command is explained and the associated prompts and operator responses are detailed.

2.1 PASSWORD ENTRY

The system requires that a password be entered prior to any command entry session. The password can be any sequence of numbers (that may represent letters if desired) up to a max length of 10. Usually, a nickname for the location is used so that the digits can be easily remembered by using the letters on the telephone keypad. The default password is "278", which stands for "ART", but this should be changed for each location.

Passwords are entered just like any other command. You start with the star * character, and complete with the # character. An error in the entry requires that you use the * key and start the entire entry over.

2.2 RECORDER (ANSWER MACHINE) MODE

Software version 2.22 and later provides a special access code that places the unit in recorder mode. The main purpose of this feature is to allow the unit to place calls to telephone answering machines. By placing the special code (*12345#) in the outgoing message, the user can que the unit to announce the current first out alarm as well as any other current alarms.

Placing the tones in the recorded message may require a hand held tone generator (Radio shack # 43-139), which cost less than $20. The touch tones required to signal the unit will be ignored by any human callers to the answering machine, but will cause the LB-100 to begin the recorder mode sequence.

Therefore, some mention of the tones may be required in the outgoing message so that a human caller will not think the touch tones are the tone that signals the start of recording. Here is a suggested message:

> Hello, this is Bubba. I can't come to the phone right now, so please leave a message after the steady tone. Please ignore the touch tones, and wait for the steady tone before speaking.... *12345#....beeeeeeeeep!

Using this message style, the user will know when to start talking and the LB-100 can hear it's special tone sequence just before it starts talking.

Some recorders take a few seconds to stop talking and start listening to the caller. To accomodate this, the LB-100 has parameter number 46 that determines how long after the *12345# sequence the unit should wait before talking. During the wait period, the unit says "hello" over and over to kill time. Some experimenting with the time delay on each recorded will be required to detemine how long the unit should wait before beginning its announcment.

After the delay, the unit will say the location phrase (stored in point 129), and then it will announce the current first out alarm. If parameter 47 is 0, the unit will terminate the call right away. If parameter 47 is non 0, then the LB-100 will perform the equivalent of the POLL command where it announces all current alarms, including the current first out one again.

Note that a sucessful connection in recorder mode does not automatically ACK the system unless parameter 48 is non zero. If equal to 0, then the system continues down the call list. If non zero, then the system is ACK'd just as if someone had pushed the ACK button or had entered a valid access code.

3.0 SYSTEM CONTROL COMMANDS

3.1 PURPOSE

The system control commands are used to set and control the basic system operation. Functions such as access code revision and session termination are controlled by these commands.

3.2 AGAIN (00)

The AGAIN command is a quick way to repeat the last command entered into the unit. It can be used to avoid having to enter long sequences of command digits when the last command needs to be done again. Simply enter *00# to repeat the last command.

3.3 BYE (293)

The BYE command is used to terminate the command session. The unit will announce "terminating communications"and will go back to standby mode.

3.4 CODE (2633)

CODE is used to announce the current system access code. The unit will say "current access code is" followed by the digits of the access code. If no access code is installed, the unit will say "current access code is empty". The start up powered down access code is "ART" (278).

3.5 DATE (3283) or TIME (8463)

DATE allows the operator to set the current time and date for the CPU real time clock(use with the printer option.) When the unit asks for a number, enter the time and date as 12 digits as follows:

HOUR MIN SECS MONTH DATE YEAR

For example, entering 142530042386 would mean 14:25:30 on March 23, 1986. This exact format must be used, including the 24 hour military clock. The printer will print the current time and date after setting the clock so that the operator may verify correct setting. If a null entry is made, the unit will simply print the current time and date.

3.6 ID (43)

ID will cause the unit to announce the system identification phrase, or system ID. This is useful it the user has more than one LB-100 installed and is unsure of which one is online.

3.7 NEWCODE (6392633)

NEWCODE is used to set a new access code into the system. The unit will announce "enter new access code" and wait for the data entry. If a null data entry is given (simply *# with nothing in between), the unit will simply announce the current access code. The default access code is 278.

The code can be up to 7 digits long. Entering a code of 9999999 (seven nines) will disable the access code feature.

3.8 PROG (7764)

This utility command will announce the software program version number and the serial number of the user's library rom. This is useful in troubleshooting to make sure the proper memory devices are installed in the unit. If a printer is attached, the system will print out several configuration parameters such as network address, number of nodes attached, and the number of local alarm points.

4.0 PHONE LINE CONTROL COMMANDS

4.1 PURPOSE

These commands are used to adjust and announce functions in the unit related to the phone line. Features like setting the phone numbers to be called and the various delay periods fall into this group.

4.2 CALL (2255)

The LB-100 stores phone numbers in a directory. The CALL command is used to set and announce the phone numbers stored in the directory, while the DIR command is used to activate certain numbers in the current directory. There are 16 positions in the directory, with the last one being reserved for the remote printer phone number if this option is installed.

The CALL command is used to change the phone number of a particular directory position in the list. The position (directory number) must be given in order to access the correct phone number. The unit will ask "Enter directory number" and await a number from 1 through 16. The unit will then ask "Enter new phone number" and await the new number. If a null data line is entered (*# alone), the unit will simply announce the current phone number for that directory
position.

Entering phone numbers is slightly different from other data

entry procedures. After the entry is started with the * key, the unit accepts all digits entered until the # key is entered. The * key (after the initial * to start the entry) is used to indicate that a pause in the phone dialing sequence is needed. The digit entered after the * key will be the number of seconds the unit will wait before proceeding with the phone call. A delay of 4 seconds would be entered as *4 within the phone number itself. A delay of 0 seconds is a special code to tell the unit to wait for another dial tone before proceeding.

Entering a phone number consisting of at least 7 consecutive nines will cause that phone directory position to become inactive. When the unit announces the phone number, it will either say the digits in the number or will say that the number is deleted. Any pauses in the number will be announced as "pause 0" or "pause" followed by the number of seconds to wait.

For example, the following sequence would be followed to change the phone number for position 2:

1. Enter *2255# to start the CALL command.

2. The unit will say "Enter Phone Directory Number".

3. Enter *2# to select position 2.

4. The unit will say "Enter New Phne Number".

5. Enter *5551234# to set the phone number to 555-1234.

or Enter *9*05551234# to make the unit dial 9 (to get an outside line), then wait for another dial tone. After getting the dial tone, continue to dial 555-1234.

or Enter *9*41*35551234 to make the unit dial 9, wait 4 seconds, dial 1 (for long distance) and wait 3 seconds, then dial 555-1234.

or Enter *# alone to have the unit announce the current contents of phone number position 2.

or Enter *9999999# to disable phone number position 2.

Note that the CALL command only changes or deletes numbers from the directory. The numbers that will be used during an alarm condition is controlled by the DIR command below.

4.3 DIR (347)

The LB-100 has a directory of 16 numbers that control which phone numbers used during an alarm. The DIR command is used to give the LB-100 a list of directory positions to use during the callout sequence. The command is started by entering DIR (347) and waiting for the unit to ask "Enter Directory Number". If a

null response is entered, the unit will announce the current active directory positions. If at least one entry is made, then the old list of active directory positions is deleted and a new one is started. It is not possible to enable or disable single directory positions. The complete list must be entered with each use of the DIR command.

For example, suppose that the LB-100 is set up with 10 valid phone numbers in the directory (positions 1 through 10). The command sequence to enable directory positions 2,6,9,and 10 is as follows:

```
*DIR#                  - Start the DIR command
(unit prompts)
*2#                    -Disable all previous entries and enable
                        position 2.
*6#                    - Add position 6 to the list.
(unit prompts)
*9#                    - Add position 9 to the list.
(unit prompts)
*10#                   - Add position 10 to the list.
(unit prompts)
*#                     - A null entry completes command and
                         starts the announce sequence.

(unit says CURRENT DIRECTORY IS...2....6...9...10)
```

Note that the CALL command and the DIR command have separate but related functions. The CALL command is used to change or delete the contents of a directory position. The DIR command is used to enable a list of directory positions to be used during a callout sequence. It is possible to use DIR to enable a position that does not have a valid phone number. If this is the case, the LB-100 will simply skip that position even though the position was in the directory list. Only valid (non deleted) phone numbers are used during a callout.

4.4 DIAL (3425)

Using the command will place the LB-100 into a callout condition and allow the use of the local keypad to generate touch tone codes. This command is normally used to test the condition of the phone line by letting the unit operate as a simple phone.

Once started, the unit will remain in the phone mode until a time-out occurs or the operator enters the star * key 5 times in sequence.

5.0 ANNUNCIATOR CONTROL COMMANDS

5.1 PURPOSE

These commands control the annunciator functions of the system such as setting normally open or closed contact positions and announcing current alarms.

5.2 ACK (225)

The ACK (for acknowledge) command is used to reset the first out condition of the annunciator. When ever a new alarm comes in, the system will be in first out alarm condition until either acknowledged with this command or by a local operator with the external pushbutton. After completing the command, the unit simply says "OK".

5.3 ARM (276)

The unit has the ability to individually block alarm points so that an alarm that is causing repeated phone calls can be blocked. The ARM command is used to restore alarm status to a point that is currently blocked. The system will ask "Enter alarm number" and await entry of the alarm point to be armed. The response will be "OK" if completed or "COMMAND CANCELLED" if an input error is made.

5.4 ARMALL (276255)

This command arms all of the alarm points so that none of them are blocked (see block command). This basically enables all of the installed points as active alarm positions. The unit will respond with "OK" when complete.

5.5 BLOCK (25625)

The unit has the ability to block out certain alarm points that may be causing repeated alarms. The block command will ask "Enter alarm number" and will accept the alarm channel to be blocked. A null or incorrect entry will result in "COMMAND CANCELLED" while a valid entry will result in "OK".

5.6 FLIP (3547)

The LB-100 can accept either normally open (close on alarm) or normally closed (open on alarm) field switches on any alarm point. The FLIP command is then used to invert the setting for specific alarm points. The unit will ask "Enter alarm number" and await data entry. If a valid entry is made the unit will respond "OK". If an error is made, the unit will respond

"Command cancelled".

5.7 LAST (5278)

The unit always remembers the last alarm that caused a first out alarm condition, even if the alarm has been acknowledged to clear the condition. The LAST command will cause the system to announce the alarm that caused the most recent (or current) first out alarm condition.

This is useful if the ACK command has been used to clear the first out condition, but the operator failed to check which alarm had caused the condition.

5.8 LEARN (53276)

The unit has the ability to examine the current position of all of the alarm inputs and make these the no-alarm position. This eliminates the need to individually set normally open or closed status for every input. If the switches can all be placed in the no alarm state, the LEARN command will allow very quick setup. If most of the inputs can be placed in the no-alarm state, the LEARN command can be used followed by one or more FLIP commands to set the remaining alarm points.

5.9 LIST (5478)

LIST will cause the system to scan down the alarm table and print out any alarms that are currently active. If no alarms are active, the unit prints "no current alarms". This is a printing version of the POLL command.

5.10 LISTALL (5478255)

LISTALL will cause the printing of ALL alarm points and their current status. In place of the normal time and date, the unit prints IN ALARM or CLEAR depending on the point status. This command can be aborted at any time by pressing any key while the printing is in progress.

5.11 POLL (7655)

The unit can poll all of the alarm channels and announce all that are in alarm. The POLL command starts the unit scanning down the alarm table and will announce all active alarms. Active alarms are those that have field switches in the alarm state and have not been blocked with the BLOCK command. A momentary contact closure that caused a first out condition but then went away will not be detected by the POLL command.

The POLL command can take considerable time to complete in a large system with many active alarms. The listing of the alarms can be terminated by entering any number on the keypad. If this happens, the unit responds with "COMMAND CANCELLED".

5.12 RESET -RES- (737)

The LB-100 software provides for a annunciator RESET capability on all alarm points. When RESET is being used, alarm points are kept active until both the field contact has cleared and a subsequent RESET command is executed (or the Reset button is pressed). This allows for the capture of momentary contact operation that would be lost if that particular contact was not the first out. The unit treats the momentary closure as a valid alarm until a RESET is performed. Note that the RESET command is shortened to RES (737) for ease of use.

A RESET cannot be done while the unit is in FIRST OUT alarm mode, so a RESET normally follows an ACK command. An attempt to use the RESET command during a first out condition will cause the unit to announce "COMMAND CANCELLED" rather than the usual "OK".

The RESET feature can be disabled by installing a jumper in place of the normally open RESET push button. This jumper will cause all alarms (except the first out) to clear as soon as the field contact clears. Only currently active field contacts will be treated as alarms, and no RESET command or button presses is needed. However, momentary alarms occurring during a first out condition will not be stored by the unit.

5.13 REPORT -RPT- (778)

The RPT (short for REPORT) command is used to announce the first out alarm, if there is one. The command will cause the unit to say the first out alarm phrase or to announce "There are no new alarms". This command is useful if the operator is calling in to check on the unit or has been on line for a long time and wants to see if any new alarms have come in while the unit was in command mode.

5.14 STAT (7828)

The STAT (short for status) command allows reporting on specific alarm channels. The unit will ask for the alarm number and will wait for data entry. The unit will then announce the alarm phrase and either "OFF" or "ON", depending on the state of the alarm. The alarm condition takes into account the normally open/closed selection of the alarm as well as the block feature. If the alarm switch is in the alarm state and the point is not blocked, then it is "ON". Otherwise, the alarm is off. Note that this does not refer to the field contact position, but the alarm condition. To check the field contact position, see the

INP command.

6.0 INPUT/OUTPUT POINT CONTROL

6.1 PURPOSE

These commands are used to examine and set specific input and output points on the system. Input points are all switches connected to the unit (including annunciator inputs), while outputs are any designated output channels not associated with the annunciator logic. These are normally relays connected to the system to provide remote control via the LB-100. In systems with no local annunciator lamps, the relays normally used to drive the lamps can be used as general purpose outputs.

6.2 OUTPUT VERIFICATION

A setup parameter (number 42) is included in program versions 2.20 and later that determines if the LB-100 will require output point verification before doing any output related commands. If the parameter is non 0, then the output channel will be requested twice before any output functions are done. This will provide additional security when operating outputs on marginal phone lines. When active, the program will ask for the output channel, then ask again, before continuing with the ON, OFF, or PULSE commands. The command will only function if both entries match.

* * * I M P O R T A N T * * *

The eight (8) on-board output relays are at locations 241-248.

6.3 INP (467)

The INP (short for INPUT) command allows the status of any field contact to be examined. The unit will ask "Enter input number" and wait for the input point to be provided by the operator. If the switch is closed, the unit will respond with "ON". If the switch is open, the unit will respond with "OFF". If an error is made, the unit will say "Command cancelled".

6.4 OUT (688)

The OUT (short for OUTPUT) command is used to check on the status of any output channel (to see if it has been turned off or on). The unit will ask "Enter output channel number" and await data entry. If the output is currently active, the unit will say "ON". If the output is inactive, the unit will say "OFF".

* * * I M P O R T A N T * * *

The eight (8) on-board output relays are at location 241-248.

6.5 OFF (633)

The OFF command is used to turn off specific output channels. The unit will ask "Enter output channel" and await data entry. If a valid entry is made, the output will be made inactive and the unit will say "OK". If an error is made, the unit will say "command cancelled".

* * * I M P O R T A N T * * *

The eight (8) on-board output relays are at location 241-248.

6.6 ON (66)

The ON command is used to turn on specific output channels. The unit will ask "enter output channel" and await data entry. If a valid entry is made, the output will be made active and the unit will say "OK". If an error is made, the unit will say "command cancelled"

* * * I M P O R T A N T * * *

The eight (8) on-board output relays are at location 241-248.

6.7 PULSE (78573)

The unit can pulse any output for the number of 10 millisecond periods contained in parameter #45 by using the PULSE command. The system keeps track of the current status of all outputs, so using the pulse command (rather than a combination of OFF and ON commands) relieves the operator from knowing the current state of an output. If the output is on, the unit will pulse it off for one second. If the output is off, the unit will pulse it on for one second.

The unit will ask "enter channel number" and await data entry. If an invalid or null entry is made, the unit will announce "Command cancelled". If a valid entry is made, the unit will pulse the selected output and then announce "OK".

* * * I M P O R T A N T * * *

The eight (8) on-board output relays are at location

241-248.

Param 45 is calibrated in 10ms periods, so entering 100 in this position will cause a one second pulse to be provided by this command. A 10 second pulse will require an entry of 1000, while a 45 second pulse requires an entry of 4500.

6.8 INPUT/OUTPUT CHANNEL MAP

All input and output points used internally by the LB-100 have channel addresses just like alarm inputs and control outputs. These channel numbers are listed here for special applications that need to examine or control these points.

INPUT CHAN	FUNCTION
1-128	Normal Alarm Inputs
129	Special Location Phrase (not actual input).
228	Acknowledge Input
229	Alarm Reset Input
230	Test Button Input
231	Call Out Disable Input

OUTPUT CHAN	FUNCTION
225	Local Keypad Enable LED
226	Alarm Reset Needed LED
228	Horn Output Relay
229	Push to Talk Relay
241-248	Control Relay Outputs

7.0 PARAMETER COMMANDS

The value of the parameter may be either binary or numeric. Binary variables are either =0 or <>0, so a value of 5 causes the same result as a value of 123 or 598. Binary variables control things like local lamp and local PA enables. Numeric variables have specific values where each value causes a different response from the unit. Numerics are things like delay times and the unit ID number.

Each parameter is accessed with the PARAM (72726) command. The user then enters the parameter number, and then the new value. If a null (*#) is entered for the new value, the unit will just announce the previous value.

CONTROL PARAMETERS.

Each parameter is set or read with the PARAM command. They are listed here in numerical order, separated by general function.

7.1 CALLOUT CONTROLS

3 CALL OUT DELAY
Sets the number of seconds the unit will wait between call

out attempts. Default is 60 seconds. The time between each phone number in the call list is determined by param 43.

4 **CALL OUT WAIT**
Sets number of seconds before the first call out attempt is made. This allows for local ACK before calling out. Default value is 10 Secs.

12 **CALLOUT TIME OUT**
Sets the number of seconds the unit will wait for someone to answer the call out attempt. Default is 45 seconds.

13 **FIRST RINGBACK WAIT PERIOD**
Sets the number of seconds the unit will wait to hear a ringback tone when calling out. If heard within this time period, the unit will wait for ringbacks to stop before assuming someone has answered. If not heard, the unit does a blind callout where it keeps saying "hello" and waits for someone to type a key. Default is now 6 seconds plus the initial 2 second built in delay.

14 **PULSE - TONE DIAL SELECTION**
IF set to 0, pulse dialing will occur. If <>0, DTMF "TouchTone" dialing will occur.

18 **DIAL TONE MASK #1**
Sets a 4 bit pattern that the unit will accept for a valid dial tone. Each bit corresponds to a specific frequency detected by the call progress detector. The bits are:

BIT	FREQ	VALUE
0	350 Hz	1
1	400 Hz	2
2	440 Hz	4
3	480 Hz.	8

Normally, a dial tone consists of 350 and 440, so bits 0 and 2 are =1 to give a value of 5 (0101 binary), which is the default. Other tone combinations are possible, however depending on the telco system.

19 **DIAL TONE MASK #2**
Same as # 18, but provides an alternate dial tone detection, possible from an outside line. Default is 400Hz and 480Hz which is 1010 = 10 decimal.

23 **TOUCH TONE TIMING ADJUSTMENTS**
Lsb is the number of 10ms periods the tone is off. Msb is the number of 10ms periods tone is on. Default is 70ms on and 70ms off, or (7 * 256) + 7 = 1799.

34 **OFF HOOK TIMEOUT**
The program will monitor the overall off-hook time during all communications sessions. This acts as an overall time out with a default of 10 minutes.

36 RING BACK BIT PATTERN #1
This is very similar to the dial tone mask in parameter numbers 18 and 19, except it represents the pattern for a ring back signal during dialouts. Default is 12 (440 and 480 Hz).

37 RING BACK BIT PATTERN #2
Alternate pattern to #36 above. Either pattern will cause the unit to detect a ring back. Default is also 12 (480 + 440Hz).

38 INITIAL RING BACK DELAY
Number of seconds that program should wait after dialing to let any connect tones pass before attempting to detect a ring back. This is useful in systems that have call progress tones similar to ringback that occur as the call is being placed.

40 DIAL TONE QUALIFICATION PERIOD
Dial tones must be continuously present for this number of 10 milli-second periods before considered valid. Default is 150 (150 * 10ms) = 1.5 seconds.

41 RING BACK TONE QUALIFICATION PERIOD
Audible ringing (ringbacks) must be continuously present for this number of 10 milli-second periods before considered valid. Default is 50 (50 * 10ms) = 1/2 second.

43 SECONDS BETWEEN EACH PHONE NUMBER
While processing the call list, the system will wait this number of second between each number on the list. The default is 0 seconds, so numbers will be processed quickly. The time between call cycles on the entire list is controller by parameter 3.

44 MAX NUMBER OF CALLOUT CYCLES
To avoid endless callouts, the system can be set up to have a maximum number of callout cycles determined by this parameter. If 0, the unit will call forever. Any non zero number up to 255 can be specified.

7.2 CALL-IN CONTROLS

5 NUMBER OF RINGS
Sets number of rings to wait before the unit will answer a call. Default is 2.

21 CALL IN ENABLE
If <> 0, the unit will accept call ins. Set to 0 will tell the unit to ignore the ring indicator on in-coming calls. The default it <>0, so unit will answer phone.

7.3 PA AND RADIO CONTROLS

1 PA ANNOUNCEMENT
If <>0, the unit will announce each new alarm using the PTT output to key the PA system or radio. If =0, no local announcement is made. Default is <> 0

2 PA WAIT TIME
Controls number of seconds between local PA or radio system announcements. Default is 60 seconds.

22 PA ANNOUNCEMENT DELAY
Specifies the number of seconds to wait before making the first PA announcement. If 0, announcement is made right away. Default is 0 seconds.

7.4 ANNUNCIATOR CONTROLS

7 AUTO ACK ENABLE
If set <>0, the unit will automatically ACK any first out alarms as soon as a valid password is entered. If set to 0, the operator must use the ACK command the hard way.

9 ANNUNCIATOR SCANS
Sets number of consecutive field contact scans that the unit must see to consider a field contact in alarm. This is used to filter out noise and nuisance contacts. The default value is 2.

10 RESET CALLOUT REQUEST
IF <>0, the unit will callout whenever an alarm contact returns to normal. If 0, the unit will callout only on new alarms. Default is <>0.

11 LOCAL LAMP ENABLE
If <>0, the unit will use the local LED s like alarm point indicators. If =0, the LEDS can be used for other purposes. The default is <>0. This is NOT THE SAME as the FOLLOW parameter below.

15 FIELD SWITCH POLARITY
If =0, the unit assumes normally open contacts that close on alarm. If <>0, the opposite is true. Default is 0 for contacts that close on alarm. This only affects the initial alarm states which can be overidden by the FLIP command.

16 RELAY FOLLOW SETTINGS
This is a tough one. It represents an 8 bit pattern that controls which on-board relays will follow their corresponding alarm point lamp. A 1 in each position causes the relay to follow the lamp. A 0 will let the relay be used for other things.

For example, a setting of 3 (binary 00000011) will cause the first 2 relays to follow the alarm point indicators, including flashing as needed. A setting of 255 (binary 11111111) will cause them all to follow, while a setting of 0 will cause none of the relays to follow. Good luck with your binary conversions (available for 50 cents apiece from ART Z.).

17 NUMBER OF LOCAL BOARDS
Tells the unit how many 8 bit point groups are locally connected to the LB-100. Default is 1 for the built in 8 input points.

20 DEFAULT MESSAGE STYLE
Controls the default message style. Bit 0 =1 causes the unit to say "CHannel" before each message. Bit 1=1 causes the unit to say "NUMBER" before the point number. The default is 3, so the unit will say "CHANNEL NUMBER" before each alarm point number during announcements.

33 HORN TIMEOUT
If <> 0, this will determine the number of minutes the horn will blow on each new alarm. Default is 15 minutes.

7.5 COMMAND ENTRY SETUPS

8 COMMAND TIMEOUT DELAY
Sets number of seconds the unit will wait between key entries before timing out and terminating communications. Default is 60 seconds.

7.6 MISCELLANEOUS SETUPS

39 LED DEBUG CONTROL
The 8 LED's normally used for alarm status can be used as a debug aid by setting this param non 0. The possible values are as follows:

1. Show raw call progress tones in lower 4 bits.
   - Led 1 = 350 Hz
   - Led 2 = 400 Hz
   - Led 3 = 440 Hz (Middle A on piano)
   - Led 4 = 480 Hz
2. Show processed line status in lower 4 bits:
   - Led 1 = Ring Indicator
   - Led 2 = Touch Tone Detected
   - Led 3 = Ring Back Detected
   - Led 4 = Dial Tone Detected
3. Show incoming rings as they are counted down in binary.
4. Show Ascii value of keypresses or touch-tones

42 OUTPUT VERIFICATION
If non 0, then the program will request output channels

twice before processing output related commands. Command will proceed only if both inputs match.

45 **OUTPUT PULSE LENGTH**
The PULSE command is used to toggle an output for a number of 10ms periods specified by this parameter. If 0 is specified, the default of 100 periods (1 second) is used. This parameter affects all outputs used by the PULSE command.

46 **SECS TO WAIT BEFORE RECORDER ANNOUNCEMENTS**
When the system responds to the special 12345 access code, it enters recorder (answer machine) mode and waits this number of seconds before making its announcement.

47 **TYPE OF RESPONSE IN RECORDER MODE**
Recorder mode causes the system to announce its location phrase, then the current first out alarm. If this param is 0, the system hangs up right away. If non 0, then the system will perform a POLL command prior to disconnecting.

48 **RECORDER MODE AUTO ACK AFTER ANNOUNCEMENT**
After performing an answering machine announcement, the system will perform an alarm ACK if this param is non 0. If 0, the system will continue down the call list.

7.7 SERIAL PRINTER SETUPS

24 **SERIAL PORT 0 BAUD RATE**
Set to 300, 1200, 2400,4800, or 9600 baud. Default is 1200.

25 **SERIAL PORT 1 BAUD RATE**
Same as above.

26 **DEFAULT PRINTER PORT**
Set to 0 or 1 to indicate printer port. Default is 1.

27 **PRINTER DELAY TICKS**
To handle slow printers, the unit will delay this many 10ms periods between each character sent to the printer. Default is 3.

29 **OFF-HOOK OUTPUT RELAY CONTROL**
This parameter specifies the output relay to be actuated with ever the phone line or radio channel is being accessed. Any output relay can be specified. A value of 0 will cause this function to be disabled.

30 **PRINTER DELAY**
Number of seconds to wait for a remote printer connection in modem based systems. Default is 60 seconds.

31 **MAXIMUM SECONDS PRINTER STAYS ON-LINE**
During remote printer sessions, the program will monitor the

time connected to the remote printer and disconnect if this time is exceeded. Default is 180 seconds.

32 **MINUTES BETWEEN PRINTER CALLOUTS**
The time between printer callout attempts. Default is 2 minutes.

35 **PRINTER LIST CONTROL**
This controls the format of point listings during remote printer sessions. A value of 0 will cause only the pending alarm messages to be printed. If non 0, a listing will be produced after the pending messages. A value of 1 will cause all points to be listed (similar to listall command). A value of 2 will cause only current alarms to be listed (similar to almlist command).

7.8 NETWORK CONFIGURATION

6 **SERIAL NUMBER**
Sets an ID number that the unit will use to identify itself during remote operations. Default is 1.

28 **NETWORK CALLOUT ENABLE**
If set <>0, the unit will attempt to reach other LB-100 when calling out by using touch tone command sequence. If 0, the unit will not try network links on callout. The unit is always ready to receive network inputs. Default is 0.

8.0 LB-100 MESSAGE FORMATS

The LB-100 has a fixed number of available alarm point message strings. These strings can be empty (causing a default "channel Number" type message) or the string can contain a list of library phrase numbers. At cold start time, the first 128 are nulled out with a 255 decimal as the first and only code for each point. Each alarm point can have 10 codes, the last of which must be a 255 to mark the end of the message. Therefore, 9 phrases can be stored for each alarm point.

The message for point 129 is actually the unit location phrase. It defaults to messages 10, 254, 255 so that the unit will say "TEST INC. LB-100 Number " followed by the value stored in the unit ID parameter. You can re-program this point to be a location phrase or whatever you want.

8.1 LIBRARY PHRASES

The LB-100 has a set of required phrases that are stored in the library rom set. The first 44 are required to operate the unit, and additional message phrases are added after the required ones. Each phrase has an ID number assigned by the order it was

loaded in the rom set.

There are other phrase codes that are built into the system that are helpful in programing message strings. These are various length pauses that are explained below.

CODE	SPECIAL CODE FUNCTION
255	Stop code that indicates end of message.
254	Causes the word "number " followed by the contents of the unit ID parameter to be spoken.
253	2 second Pause
252	1.5 second pause
251	1 second pause
250	.5 second pause
249	.25 second pause
248	.10 second pause

8.2 SETTING UP THE PHRASES

The first step is deciding what phrases are needed. For example, consider these phrases:

```
Point 1     "Boiler Room High Temperature"
Point 2     "Boiler Room High Pressure"
Point 3     "Boiler room Low Temperature"
```

Example library phrases:

```
Phrase 46 "Boiler Room"
Phrase 47 "High"
Phrase 48 "Low"
Phrase 49 "Temperature"
Phrase 50 "Pressure"
```

First , we will write down the phrase codes for each point.

```
Point 1    46,47,49,255   "Boiler Room", "high", "temperature"
Point 2    46,47,50,255   "Boiler Room", "high", "pressure"
```

and so on. Note that each point ends in a 255 to mark the end of the phrase.

8.3 PROGRAMMING THE PHRASES

Once the phrase lists (or strings) are determined, we will program the unit. As mentioned, all alarm messages are nulled out with a 255 at cold start. This will force the unit to say "channel Number" followed by the point number. This may suffice for many applications. However, if custom phrases are to be installed, the SETMSG (set message *738674#) command is used. It will ask for the point to be programmed, and then accept up to 10 codes that will be assigned to that point. The phrases are entered one at a time in the usual parameter entry method. The

unit will accept up to 10 codes, and will stop when you enter 255 as a code. If all went well, the unit will recite the entire phrase back to you.

To simply check a phrase, or to cancel the entry in progress, simply enter a *# as a code. The unit will not change the present contents of the point message string and will recite the original contents.

Back to the example above. We start the LB-100 as usual, then enter *738674# to request a set message action. The unit asks for the point number, and we tell it *1# for point number one. We then enter as follows:

*46# *47# *49# *255#

This will assign the desired codes to point number 1. All points are done in the same manner. The unit should retain the programmed phrase strings as long as power is maintained on the ram.

HELPFUL COMMANDS

Several commands that are helpful in checking the messages. They are:

SAYALL (729255)	Say all of the alarm point messages. Hold a key down to stop the process.
SAYLIB (729542)	Say library phrases in order. You will be prompted for the lib phrase number to start with so you won't have to listen to all phrases. Hold a key down to cancel while it is runing.

9.0 LB-100 NETWORK SETUP

9.1 INTRODUCTION

The LB-100 network system will allow one unit to 'talk' to another unit and exchange information over the telephone line. To implement this LB-100 has a special command, SETNET (738638). This command operates much like the PARAM command except that entries range from 0-255 rather than 0-64K as in PARAM.

Another command, SETNETS (7386387) is similar except that the unit will only prompt for the first location to be programmed. After the first one, it will ask "enter new value" automatically for the next parameter until a null entry is made. This makes it easier to program lots of locations.

The SETNET value list starts with 3 entries that only appear once. The entries following the first three are groups of 4 values, one group for each network unit (or node). In order for an other unit to be able to call this unit, an entry for the

remote must appear in this table. Also, entries must be contiguous with no blank or empty spaces in the list.

The first three entries are as follows:

PARAMATER
NUMBER FUNCTION

1 ID of this unit when calling other units.
2 Number of 8 point alarm groups used by all of the network inputs connected to this unit.
3 Number of network units that will be connected.

Each remote unit will have a 4 byte entry in the network table that looks like this:

First Remote Unit Id.
Second Number of alarm points to bring in from the remote unit, starting with point #1.
Third Number of points in our alarm that precede the first alarm point from this remote. Fourth Reply code to other unit when point status is transferred. Value =0 will send a NOP, while <>0 causes this unit to ACK the other unit. A NOP will let the calliing unit proceed down it's call list and call other units.

The table below indicates the SETNET parameter number for different remote unit positions. For example, when programming the values for the third remote unit, we will use the SETNET parameters 12, 13, 14, and 15 which are the First thru Fourth values for that remote. Note that the first 3 bytes in the table control how many units and points are in the complete system, while the individual entries only control the specs for a single unit.

9.2 SETNET COMMAND PARAMETERS

	PARAMETER NUMBER			
Remote NODE	**FIRST ID**	**SECOND POINTS**	**THIRD OFFSET**	**FOURTH REPLY**
1	4	5	6	7
2	8	9	10	11
3	12	13	14	15
4	16	17	18	19
5	20	21	22	23
6	24	25	26	27
7	28	29	30	31
8	32	33	34	35
9	36	37	38	39
10	40	41	42	43
11	44	45	46	47
12	48	49	50	51
13	52	53	54	55
14	56	57	58	59

9.3 EXAMPLE

Lets set up a 3 unit network where 3 units will be calling to a single LB-100. Specs are as follow:

UNIT	POINTS	ID
Local	8	100
Rem #1	3	1
Rem #2	2	2
Rem #3	6	3

The alarm map for the main unit will look as follows:

Points	1-8	Local inputs
	9-11	Remote #1
	12-13	Remote #2
	14-19	Remote #3

The SETNET parameters must be programmed one at a time as follows:

PARAM	VALUE	FUNCTION
1	100	Local unit ID
2	2	Number of 8 Bit groups used by remote inputs
3	3	Number of remotes that will connect
4	1	Remote #1 ID
5	3	Number of points for rem #1
6	8	Offset into local alarm table
7	0	Do not ack remote #1
5	2	Remote #2 ID
6	2	Number of points from Rem #2
7	11	Offset into local alarm table (8+3)
8	1	Perform ACK on remote #2 callin
9	3	Remote #3 id
10	6	Number of points from Rem #3
11	13	Offset in alarm table (8+3+2)
12	1	Do ACK on rem #3 callins

10.0 LB-100 NOTES

The following notes may answer often asked questions on configuring and operating the LB-100.

1. Alarm point 129 is actually the location phrase that is spoken each time the unit answers or calls out. The phrase defaults to "TEST LB-100 Number" followed by the unit number set in the network parameter table (default is 1). Program

the location phrase just as any other point (SETMSG).

2. All points can be either Norm open or Norm CLosed on a point by point basis. At cold start, all points are set to NO, close on alarm. Use the FLIP or LEARN command to change the normal state of any inputs.

3. The SCAN command will adjust the number of sequential point scans that the unit will require before considering a point to be in alarm. This is used to eliminate noise spikes and other monentary closures from appearing as actual alarms. This only affects NO (close on alarm) points. Points that open on alarm always alarm immediately. Each scan is 20ms, so using to many scans may cause the unit to miss momemtary contact closures.

4. The reset push button can be wired closed to eliminate the need for resetting alarms after they clear. If left open, a RESET command or a push button will have to be used to clear any alarms after the field contact clears. Normally, leave this jumpered.

5. The fuse on the board is for field contact power that is brought out to the terminal strip. This power is monitored separately by the unit and a blown fuse will cause the unit to call out and indicate a system alarm. The fuse must be installed even if the field contact voltage is gotten from somewhere else.

6. The smartsocket battery backup device must be installed under the RAM in the first memory socket. If a smartwatch is installed, it goes under the first voice library socket (the third memory socket).

7. Printers must be RS-232 serial devices connected to either serial port. The default is port 1 (CRT port), 1200 baud. This can be changed with the PARAM command if desired.

8. The use of parameter #29, Off-Hook Relay, will allow special configuration of the communications line when the unit is off-hook. Applications include activation of amplification or attenuation equipment and miscellaneous alarm triggering.

9. Use the sensitivity setting jumpers to adjust the unit to varying phone line conditions. These affect the unit's response to call progress tones (dial tones, ringbacks, etc) as well as the DTMF Touch Tones. Refer the the layout drawing for location and positions for these jumpers.

11.0 LB-100 CALIBRATION AND COMMUNICATIONS SETUP

The LB-100 monitors the phone line for a number of special tones called call progress tones and DTMF (touch) tones. There are several adjustment in both hardware and software that allow the unit to be adapted to many different phone systems, including cellular coverage.

11.1 OUTPUT LEVEL ADJUSTMENTS

The LB-100 circuit board has 3 hardware adjustments that determine the output volume from the unit to the phone line. These control the touch tone output volume, the voice volume, and the overall volume. The goal in adjusting is to provide a signal level that is similar to that of a standard phone.

Set the overall volume pot (R8) to a middle position to start. Place unit in the DIAL command, and press touch tones. Adjust pot R3 until the tone volume is similar to that of a touch tone phone connected as an extension phone.

Use the saylib command to have the unit announce all of the library messages. Then, adjust the voice volume pot (R5) to provide the loudest, clearest voice. If set to loud, the voice will become distorted.

Further adjust the main volume pot to provide a loud, clear signal that does not distort either the touch tones or the voice output.

The on-board amplifier volume (R27) should be adjusted last after setting the overall volume level.

11.2 USING THE LEDs FOR DIAGNOSTICS

Software versions 2.18 and later can use the on-board LED display to monitor various system functions. When in debug mode, the LEDs no longer operate as alarm indicators. System parameter number 39 controls the debug function, and setting it to 0 restores normal operation.

Setting debug to 1 will cause the system to display all accesses to the call progress detector in the first 4 LED positions. The value of these LEDs is explained below. This can be used to determine the exact frequencies used by each phone system for dial tones and ring back signals.

Debug value 2 uses the LEDs to display general tone detection within the program. Each of the first 4 leds has a specific value as follows:

Led 1 Ring Indicator
Led 2 Touch Tone detected
Led 3 Qualified ringback tone detected
Led 4 Qualified dialtone detected.

Note that debug 2 is different from debug 1 because 1 shows the actual frequencies being detected at any instant, while debug 2 shows the program's call progress state including any time delays needed to qualify call progress tones. For example, Debug 2 will not show Led 3 until the dial tone has been present for the number of 10ms periods specified in parameter 40.

Debug 3 provides a down counter of the rings needed for the LB-100 to answer the phone. When the first ring is detected, the LED display is loaded with the count (in binary of course). As each ring is detected, the count (and display) is decremented. The unit will answer when the count reaches 0. This is useful to troubleshoot ring detection problems. Note that the count is displayed in binary with the most significant bit on the left, not on the right as in normal binary representations.

Debug 4 uses the LED's to display touch tone and local keypad keypresses as they are accessed by the unit. The last accessed code is left in the display. The code is the ASCII code for the character being processed. The LED display would be as follows:

CHAR	HEX	1	2	3	4	5	6	7	8	<- LED POSITION
0	30h	-	-	-	-	X	X	-	-	
1	31h	X	-	-	-	X	X	-	-	
2	32h	-	X	-	-	X	X	-	-	
3	33h	X	X	-	-	X	X	-	-	
4	34h	-	-	X	-	X	X	-	-	
5	35h	X	-	X	-	X	X	-	-	
6	36h	-	X	X	-	X	X	-	-	
7	37h	X	X	X	-	X	X	-	-	
8	38h	-	-	-	X	X	X	-	-	
9	39h	X	-	-	X	X	X	-	-	
@	40h	-	-	-	-	-	-	X	-	
#	23h	X	X	-	-	-	X	-	-	

Note that the LED's are positioned left to right, which is opposite from normal binary number representation. The least significant bit is LED 1 on the left, not on the right.

11.3 CALL PROGRESS DETECTION

Call progress tones used by the LB-100 include the dial tone and the audible ringing (ringback). The tones consist of one or more specific frequencies. The LB-100 can detect each of these frequencies separately, and uses a "bit pattern" to match tones for specific functions. These tones are somewhat standardized by

Bell as follows:

Frequency	480	440	400	350	Hz.
Dial tone	0	1	0	1	
Ringback	1	1	0	0	
Bit Position	3	2	1	0	<- Internally
Led Position	4	3	2	1	<- On display
Value	8	4	2	1	<- Mask Value per bit

This table shows the Bell standard frequencies and how they are represented in the LB-100. For example, a standard Bell dial tone consists of 440 and 350 Hz. When in debug mode, this will turn on LED's 1 and 3 (numbered left to right on circuit board). These are internally accessed as bits 0 and 2 of the call progress detector device. The decimal values for these bits are 4 and 1.

All this information is needed to set up the parameter that tells the LB-100 what tones to expect for a dial tone. By setting parameter 39 to 1, the unit will display call progress accesses on the LED's. Looking at the LED's while listening to the call will allow verification of what tones the LB-100 is hearing during various parts of a call. The DIAL command can be used to use the LB-100 as a phone to place a call. The LED's will flash to indicate the call progress tones being detected.

Many PBX and electronic phones do not use standard dial tone frequencies. By monitoring the callout, the proper bit pattern, and decimal equivalent value, for the dial tone mask can be determined from the table above. After determining the LED's that are on during a dial tone, add up the values provided to obtain the decimal value of the dial tone mask. The standard one is 350 and 440 Hz, LEDs 1 and 3, value 1 and 4, for a total of 5.

The ringback heard during a callout has a similar system but uses different tones. The Bell standard is 440 and 480 Hz, which show on LEDs 3 and 4. These have values of 4 and 8, so a standard ringback value is 8+4=12.

11.4 CALL PROGRESS TONE DURATIONS

The Bell specification for call progress codes includes both the tones required and their duration. The exact timing may vary from system to system for a variety of reasons. Electronic phones operating within a facility, and special systems such as cellular coverage often provide alternate timing for the call progress tones.

The LB-100 has 2 timing settings in parameters 40 and 41 to control the qualifying times for both dial tones and ringbacks. The value is in 10ms increments, so a value of 100 is equivalent

to 1 second. When timing the tones, the program examines the call progress tone to detect any change in the value during the entire timing period, not just at the start and end.

For example, a standard dial tone must be present for at least 1.5 seconds before becoming valid. Shorter times are used for things like busy, off-hook alarm, etc. The same is true for the ringback. So, the LB-100 allows the qualification times for these tones to be adjusted to suit each individual system. The default values will work in most cases.

Setting the dial-tone time shorter allows for a quicker callout, especially on weak phone systems. However, setting it to low will cause false dial tone detections during random voice and other line noise. The LB-100 disconnects the phone line when it detects a dial-tone at any time other than when it wants to place a call. Therefore, a low setting may produce unintentional disconnects during otherwise normal operation.

Setting the dial-tone time to long is not as much of a problem. It may prevent dialouts if there is noise on the line that momentarily clears the dial-tone detector during the timing period. It also lengthens the time that the unit can detect a disconnect if the caller hangs up without using the BYE command.

The ringback time is less critical because it is only used during callouts to detect when the phone has been answered. The worse that can happen here is that the unit will start talking to soon after hearing a false ringback.

Note that it is possible to set the dial-tone and ring-back patterns to similar values. Each one has 2 possible settings to accommodate inside and outside dial-tones. If the phone system uses the same tones for dial-tone and ringback, then the timing parameter may become critical in setting the system up to properly decode the tones. For example, an alternating dial-tone is often used in electronic systems to indicate busy on an internal line. Every system is different and will have to be understood before the LB-100 can be properly configured.

11.5 CALLOUT TIMING

Because each LB-100 installation has different communications requirments, the unit has a number of timing parameters that allow adjustment of the callout procedure. In order to adjust these parameters, it is important to understand how the unit processes callouts. The important callout parameters here are:

PARAM	FUNCTION
3	Seconds between calling cycles.
4	Seconds before the first callout attempt.
12	Seconds for overall callout timeout (each number).
13	First ringback wait period.
38	Delay to wait before checking ringbacks.

When an alarm occurs, the unit will go into an initial callout wait period determined by Parameter 4. This will allow a local operator time to ACK the unit before a callout attempt is made.

After the initial callout period, the unit will start a callout cycle. A cycle consists of attempts to reach a phone number from the active number list. This list is set up with the CALL and DIR commands. Only valid entries in the list will be processed.

A callout attempt is made on each number, in turn, until an ACK is received. The in-between call timing is controlled by Parameter 43. This provides the number of seconds that the unit will wait in between each phone number on the list. If Param 43 is zero, then the numbers are processed one after another with no wait in-between. Another parameter, number 3, controls the time between each CYCLE, not each number.

When each number is called, the unit will normally wait up to 10 seconds for a valid dial tone before calling out. This is necessary because some phone systems have significant delays when granting access to an outside line. This requirement can be overidden by using a WAIT as part of the phone number (see the CALL command).

After the number is dialed, the unit will wait a small number of seconds (Param 38) to allow line switching noise to clear. Then, the unit expects to hear "ringbacks", which is the audible ringing noise the phone makes when placing a call. The unit will wait for the number of seconds in Param 13 before going into an alternate callout mode.

Assuming that at least one ringback is heard, the unit will listen for the ringback to stop. When it ends, it means that the normal ringback silence period has occured, or it means that someone has answered the phone. The unit cannot tell which has happened without waiting for another ringback. So, during the silence, it says "Hello" to tell anyone listening that an LB-100 is on the line. If no additional ringbacks are heard in 6 seconds, the unit assumes that the phone has been answered and someone is on the line. If a ringback returns, the unit should shut up and time the next ringback.

If the first ringback was never heard, it means that the phone line is very weak (not uncommon in remote locations) or that someone answered before the first ringback occured. In this case, the unit starts to say "hello" and the location name to

allow anyone answering to enter the access code. This is called a blind callout, and is not as reliable as the normal ringback detection method but works well enough if the operators are ready for the calls.

VOICE LIBRARY LISTING FOR E:\A18VOICE\BUCHANAN.LIB
Library Output from lib file E:\A18VOICE\BUCHANAN.LIB
Prepared on 12/07/90 at 16:29:30

Lib serial Number 5 Flags = 0
Max entry is 55

Entry	DESCRIPTION	FILE	Entry	DESCRIPTION	FILE
0	ZERO	N0.4	29	ENABLED	ENABLED.4
1	ONE	N1.4	30	DISABLED	DISABLED.4
2	TWO	N2.4	31	COMMAND	COMMAND.4
3	THREE	N3.4	32	OLD	OLD.4
4	FOUR	N4.4	33	NEW	NEW.4
5	FIVE	N5.4	34	PARAMETER	PARAM.4
6	SIX	N6.4	35	CANCELLED	CANCEL.4
7	SEVEN	N7.4	36	EMPTY	EMPTY.4
8	EIGHT	N8.4	37	VALUE	VALUE.4
9	NINE	N9.4	38	PHONE	PHONE.4
10	SIGNON	SIGNON.4	39	OUTPUT	OUTPUT.4
11	READY	READY.4	40	INPUT	INPUT.4
12	OK	OK.4	41	PROGRAM	PROGRAM.4
13	ENTER	ENTER.4	42	LIBRARY	LIB.4
14	NUMBER	NUMBER.4	43	FAILURE	FAILURE.4
15	ERROR	ERROR.4	44	NO	NO.4
16	DIRECTORY	DIRECT.4	45	BUCHANNAN	BUCHAN.4
17	HELLO	HELLO.4	46	Platform	PLATFORM.4
18	GOODBYE	GOODBYE.4	47	Navaid	NAVAID.4
19	CHANNEL	CHANNEL.4	48	Light	LIGHT.4
20	ON	ON.4	49	Horn	HORN.4
21	OFF	OFF.4	50	Line Heater	LINEHTR.4
22	ACCESS CODE	ACCODE.4	51	Dehydrator	DEHYD.4
23	FIRST OUT	FIRSTOUT.4	52	Well	WELL.4
24	ALARM	ALARM.4	53	Voltage	VOLTAGE.4
25	CURRENT	CURRENT.4	54	Shutdown	SHUTDOWN.4
26	IS	IS.4	55	ESD	ESD.4
27	COMMUNICTIONS	COMUN.4			
28	CALLOUT	CALLOUT.4			

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