G E T T I N G S T A R T E D

Auslog Digital Logging System

AUSLOG PTY LTD

First Edition A March 1994 94 03 30

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MESSAGE

Auslog is a manufacturer of geophysical borehole logging equipment to coal miners, mineral explorers, groundwater consultants, geotechnical engineers and management authorities.

Services provided by Auslog include;

- Manufacture of geophysical borehole logging equipment
- Sale of geophysical equipment
- Rental of geophysical equipment
- Contract logging services
- Training
- Log transcription services
- Geophone repair facility
- Software development

Auslog Pty Ltd was incorporated in August 1990 and is a wholly owned subsidiary of Velseis Pty Ltd. Auslog operates from company owned premises at Sumner Park, Brisbane, Australia and consists of an administration centre, fully equipped electrical and mechanical production and workshop facilities.

Auslog is dedicated to constantly improving and adding new equipment to its product range and undertakes the bulk of R & D completed in-house. To this end, Auslog invites all users to offer suggestions as to how they would like current Auslog equipment modified or upgraded and what new tools should be added to our product range.

Your suggestions are welcomed.

Yours faithfully

Managing Director

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WELCOME

Welcome to the Auslog Borehole Logging System which puts essential and meaningful information into the hands of miners and explorers. The Auslog System provides a unified borehole logging technology to carry out exceptionally detailed and varied geophysical surveys.

The Auslog System is extensive. It provides a range of logging tools to complete a wide range of geophysical measurement tests.

The Auslog System is complete. It provides a comprehensive range of support equipment to ensure effective use of the logging tool.

The Auslog System is simple to operate. It provides the essential logging control software to ensure confidence by the operator of complete and precise results.

The Auslog System is analytical. It provides powerful processing software to analyse logs to provide the most effective results.

Where do I start

This book is the best place to start. Its your basic instructor for learning to use Auslog borehole logging systems. It will provide you with an overview of the system, some of the tools it incorporates and basic principles in the use of the software.

This book has four sections:

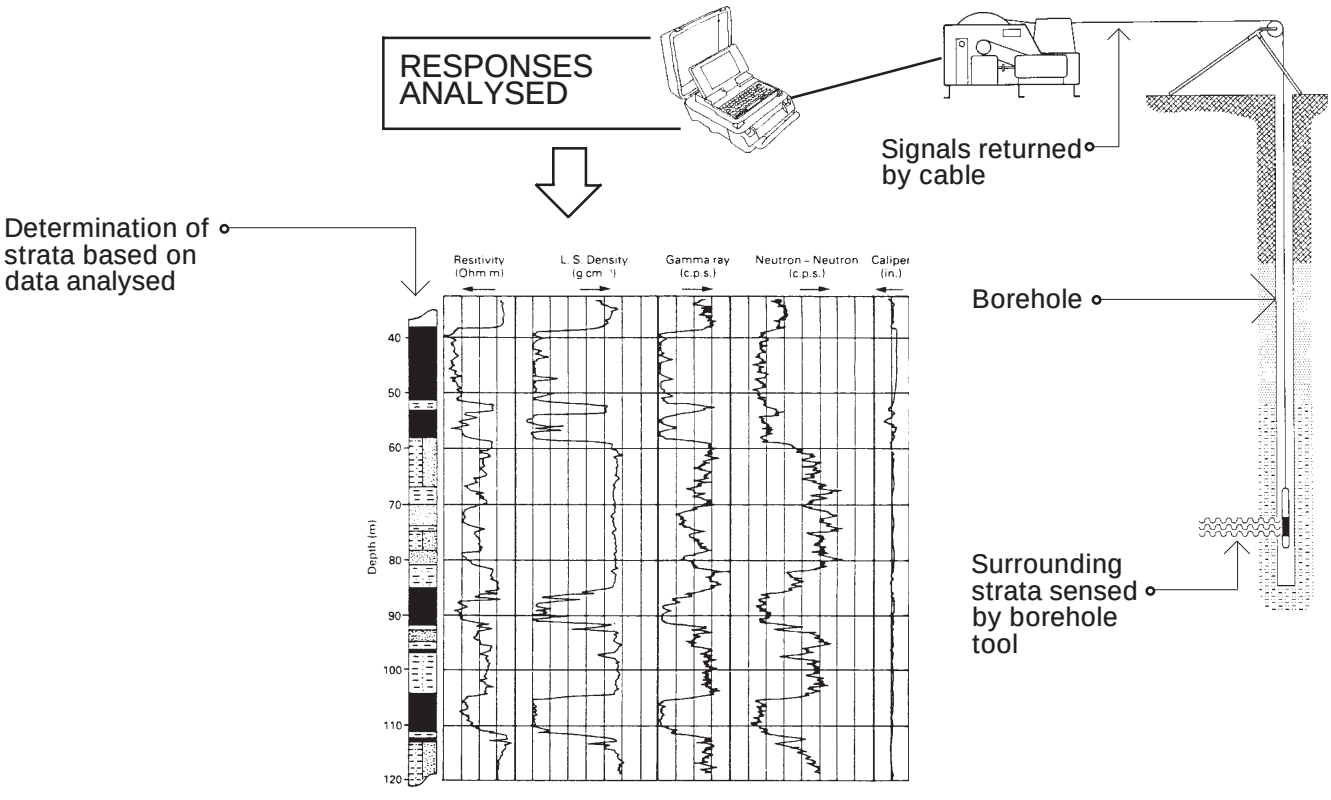
1. INTRODUCTION TO LOGGING
2. BOREHOLE INSTRUMENTS AND EQUIPMENT
3. SETTING UP EQUIPMENT
4. DLS PROGRAM SOFTWARE OVERVIEW

Each section will detail important concepts and assist in quickly finding important information. Please read each section before commencing on the individual user manual.

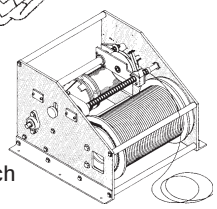
INTRODUCTION

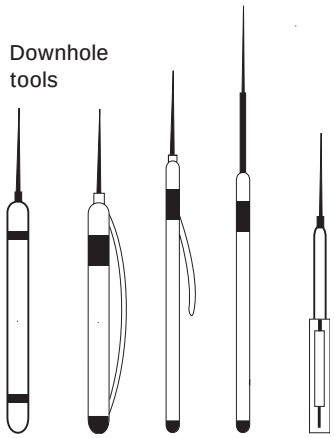
Geophysical borehole logging is one of the major investigative methods used today by a wide spectrum of the minerals industry: mining, exploration, groundwater and geotechnical. The basic principle is the analysis of data recorded by one or more tools run within the borehole.

A number of different tools are available, with responses related to a variety of physical properties of the strata surrounding the borehole. These responses are recorded in digital form, processed in appropriate fashion, and analysed to provide useful information on such strata properties as geological character, depth and thickness, density, electrical resistivity, moisture content, and fracture intensity.




Digital Logging System


Winch


Downhole tools

There are three major components of a geophysical logging system:

1 The surface electronics package: this consists of a computer for data acquisition display and control; the digital logging interface; a printer to produce hard copy records; and winch control;

2 The winch and cable: these are available in a wide variety of sizes and specifications to suit different applications, borehole depths and tool configurations. Important ancillary aspects of this component are the number of conductors in the cable; the depth encoding; and the slip-ring assembly which permits data acquisition continuously while the winch is operating;

3 The downhole tools, which vary from single parameter measurements in smaller portable systems to multiplexed units sensing several parameters simultaneously, in larger systems.

Parameters which may be measured include:

1 Geometric: depth, thickness, attitude

2 Nuclear: natural gamma radiation
induced gamma-gamma to determine density
induced neutron-neutron to measure porosity
elemental analysis

3 Electrical: naturally occurring SP voltages
electrical resistivity
electrical conductivity

4 Borehole: diameter, caving
inclination
drilling fluid properties

5 Sonic: strata velocity
porosity

6 Magnetic susceptibility:
magnetic properties in base metal exploration

7 Visual: videocamera images of borehole walls and casing

Obviously, units such as the downhole videocamera may be applied in a wide variety of situations where visual inspection of borehole conditions is appropriate. Other tools may have a less obvious but more specific application.

For example, the measured density of coal seams may be related to the quality of the coal, especially its ash content. Sonic velocity of strata is usually a good indicator of rock strength, important in engineering studies of proposed mines. Electrical resistivity values often provide an important guide to the potability of underground water.

The following table sets out in a concise manner, a summary of those logging techniques most suited to particular applications.

APPLICATION CHART

APPLICATION	TOOLS															
	NATURAL GAMMA	CALIPER	SP/SPR ELECTRIC	RESISTIVITY	DENSITY	NEUTRON	FLOWMETER	FLUID RESISTIVITY	TEMPERATURE	CASING COLLAR LOCATOR **	FLUID SAMPLE	SLIM WALL LOCK GEOPHONE ***	WATER LEVEL INDICATOR	AUSCAM	MAGNETIC SUSCEPTIBILITY	DEVIATION
GROUND WATER (ALLUVIAL)	1	2	1	1	3	2	3	2	2	2	1	2	1	2	N/A	N/A
GROUND WATER (CONSOLIDATED)	1	2	1	1	3	2	1*	1	1	2	1	2	1	2	N/A	N/A
GROUND WATER (HARD ROCK)	1	2	1	1	1	2	1*	1	1	2	1	N/A	1	2	2	2
COAL (LIGNITE)	1	1	2	3	1	2	3	3	3	N/A	N/A	N/A	2	3	N/A	N/A
COAL (BITUM)	1	1	3	3	1	3	3	3	3	N/A	N/A	2	N/A	3	N/A	N/A
MINERALS (HARD ROCK)	1	2	3	2	2	3	3	3	3	N/A	N/A	N/A	N/A	3	1	2
MINERALS (ALLUVIAL)	1	2	2	3	3	3	3	3	3	N/A	2	N/A	2	3	N/A	N/A
ENGINEERING	1	1	2	3	1	2	2	3	3	N/A	N/A	2	2	2	N/A	2
ENVIRONMENTAL	1	2	2	1	2	2	3	1	1	N/A	1	N/A	1	2	N/A	N/A

1 = ESSENTIAL 2 = HIGHLY RECOMMENDED 3 = OPTIONAL N/A = NOT RECOMMENDED

* ARTESIAN ** FOR CASED HOLES *** SEISMIC SURVEYS

BOREHOLE EQUIPMENT

The principle areas of operation of the Auslog Borehole Digital Logging System are:

1. Program and Control Centre
2. Winch Equipment
3. Borehole Tools

1 Program and Control Centre

Auslog provide four models of the program control centre which cater for most situations in borehole survey applications.

1. Vehicle mounted
2. Mobile unit
3. Portable unit
4. ENVIROLOG ONE - a fully integrated winch and control centre.

2 Winches

The winch range caters for all methods and types of survey and includes:

- large and small vehicle mounting
- portable models
- motor drives: electric, AC, DC, and hydraulic
- hand cranked

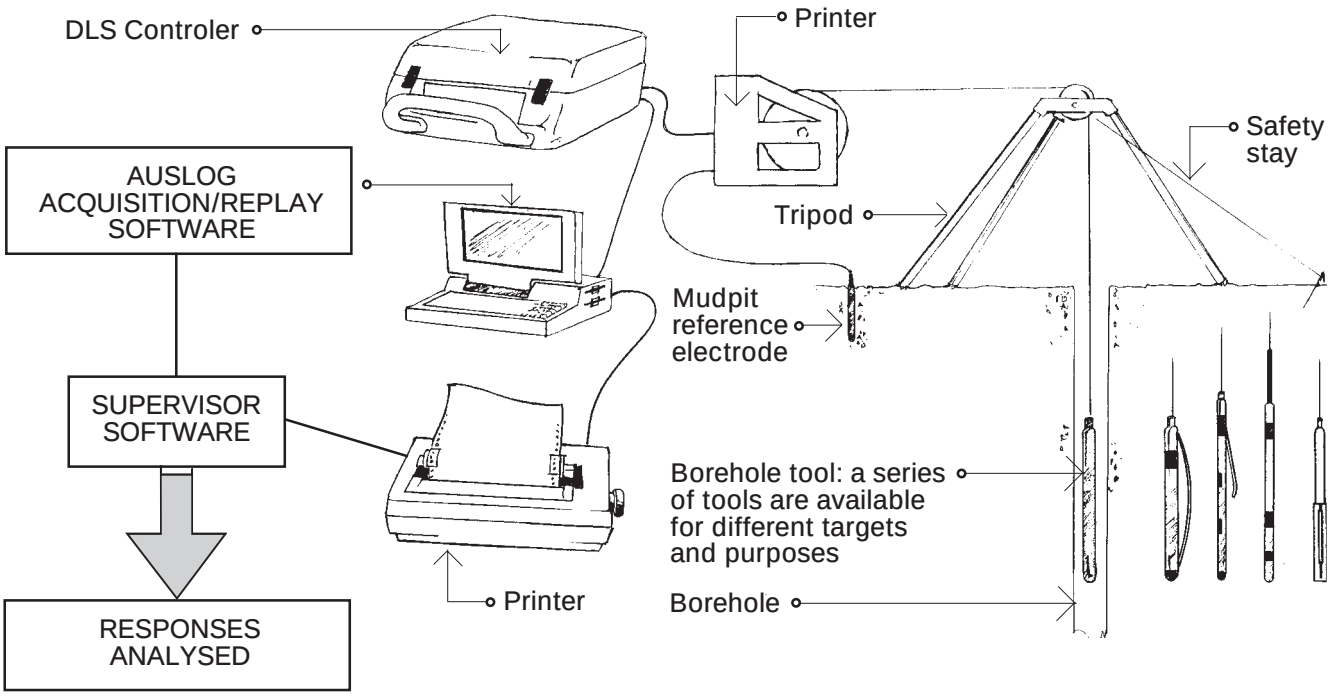
Features include: precision depth measuring system, electronic logging direction and speed sensing, automatic cut out on electric models and standard logging speeds.

3 Borehole Tools

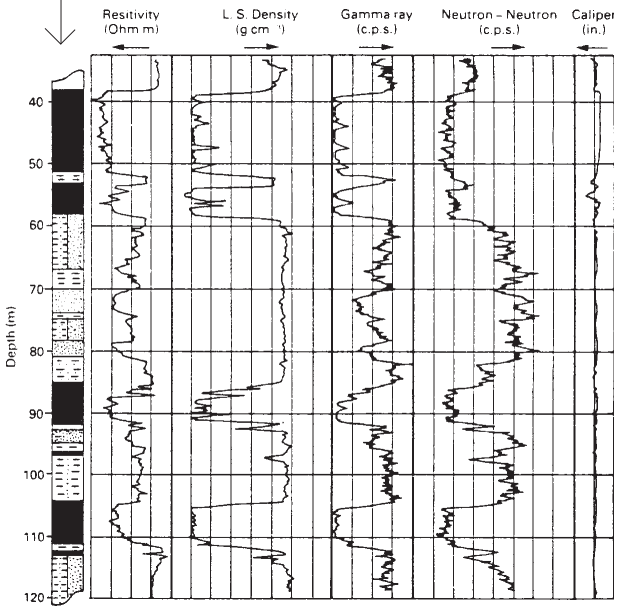
There is a large range of borehole instruments from which to select for various targets and purposes. The tool selection will vary depending upon the application for which the survey is being undertaken.

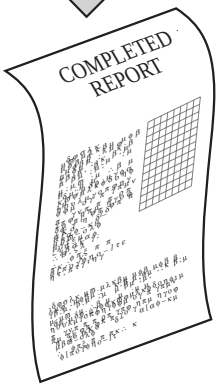
Many of the borehole tools can incorporate multiple sensors which allow several measurements to be carried out simultaneously. Logging time when using these

AUSLOG BOREHOLE DIGITAL LOGGING SYSTEM



Determination of strata based on data analysed





FINAL REPORT

USING EQUIPMENT

multiplex tools is therefore considerably reduced.

OVERVIEW

1. Locate and secure winch

2. Position and secure tripod

3. Position DLS controller, computer and printer if required

4. Connect all cables

5. Unpack tool and connect to cablehead
* WARNINGS for radioactive material

6. Power up system

7. Logging

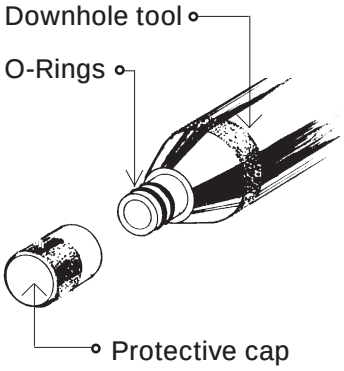
8. Packing up
* WARNINGS for radioactive material

1 SET-UP OPERATIONS

These 'set-up' instructions are of a general nature, differences may be encountered between models.

Set the winch on a firm base, at a convenient distance from the borehole. Connect to the recording unit, and plug in the mudpit electrode if electric logging is to be carried out. Connect to power supply.

Ensure that proper earthing for electric logging is obtained by inserting the mudpit



electrode into a well-agitated mixture of moist soil (or drilling mud) in a small depression nearby.

NB. For electric logging operations ensure the winch is located on dry ground or on a base insulated from wet ground.

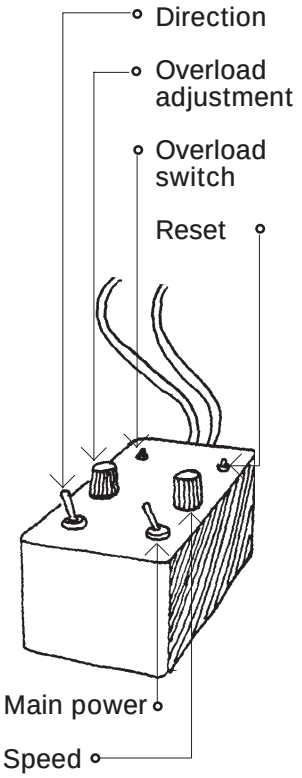
Set up the tripod assembly over the borehole. Unwind sufficient cable from the winch drum (keeping some tension on the cable) to reach tripod PLUS an additional two (2) metres. LOCK the winch handbrake.

Remove the protective cap from the logging tool, apply a small amount of silicone (e.g. Lubriplate) grease to the threads and O-rings, and screw the cablehead connector onto the downhole tool. Hand tighten the joint, and tape up with electrical insulating tape (to prevent the access of grit etc. into the joint). DO NOT overtighten the joint, since adequate protection against the ingress of borehole fluids is provided by the O-rings.

Always visually inspect the condition of the O-rings on the tool or cablehead, for dirt and for signs of deterioration due to age and wear. Replace as necessary. Inspect the condition of the cable near the cablehead, and reterminate if badly kinked or worn. Be especially careful with broken strands of wire.

Finally, lower the logging tool into the borehole, passing the cable over the grooves in the pulley. Unclean cable can decrease the accuracy of the depth counter by the build up of dirt, grease and mud soils, and reduce the life of the cable.

Set up procedures must be performed with due attention to minimising the possibility of kinking the cable, especially when the weight of the tool is taken on a twisted cable.



Example: 240v AC Speed Control

Treat the cable with care, kinks severely reduce the life of the cable.

Adjust the position and orientation of the winch and tripod to ensure that the downhole tool is located centrally in the casing. Release the hand brake and let out or wind in sufficient cable so that the cablehead is at the reference position. Reapply the handbrake, and set the zero reference on the winch depth and the logging computer to zero (note that the replay software will automatically compensate for the lengths of different tools).

2 LOGGING OPERATIONS

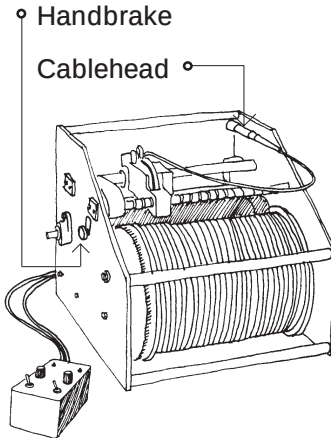
These operations should be carried out in accordance with the procedures specified in the Operating Manual for individual downhole tools.

Take special precautions when radioactive sources are involved. (See attached "Radiation Safety Information".)

In general, follow the procedures outlined below to ensure reliable operation of the winch speed control:-

a. Ensure that the main power switch is OFF

b. Turn the speed control fully anti-clockwise to the OFF position



c. On winches fitted with overload cutout control, turn the overload cutout control fully clockwise to minimum cutout sensitivity

d. Set the direction switch to Down (if it is required to log on the borehole)

e. Turn the main power switch to ON

f. Release the hand brake

g. Turn the speed control until the required descent speed is obtained

h. At the completion of descent, apply the handbrake and return the speed control to the OFF position

i. When the logging system has been properly set-up for logging, and the ascent operation is ready, repeat steps "c" to "g" with the exception that the direction switch is set to UP, and the Cutout sensitivity should be set by trial and error to a reasonable position.

   It is unlikely that the winch will have sufficient power to break the cable, but it may damage the cablehead if this is worn or in poor condition. Insufficient cutout sensitivity may also result in the downhole tool becoming stuck fast in the borehole, whereas a more sensitive operation may result in tight a position in the borehole being easily cleared.

   Do not rely on the power of the winch to clear obstructions in the borehole. If a tight location is reached, slacken the cable and use low power or even manual manipulation to carefully pass the obstruction.

j. At the completion of the logging operation, halt the winch when the cablehead is visible at the reference elevation, apply the handbrake and turn the main power switch to OFF. Note any discrepancy in the hole depths shown on mechanical and electronic depth counters. A large value may be an indication of mechanical wear, the build up of dirt, etc.

3 PACKING UP

At the completion of the logging operations, the equipment should be disassembled generally in the reverse order of the set-up operation.

Note: Aspects of Radiation Safety.

Apply the handbrake with the downhole tool at the top of the borehole. Remove the tool from the borehole, remove the cablehead connector, and immediately place protective caps on the tool and on the cablehead. Release the handbrake and wind the spare cable back onto the winch drum.

Take care not to KINK the cable during these operations.

Apply the handbrake during transportation and storage of the winch: it is important to maintain some cable tension so the laying remains neat.

4. EMERGENCY RETRIEVAL

In the event of a power, motor or gearbox failure.

a. Apply the handbrake to hold the winch drum in position.

b. Emergency retrieval instructions vary between models, refer to specific section in winch manual for instructions.

RADIATION SAFETY INFORMATION

1. Stay as far away from the RADIOACTIVE source as possible at all times.

2. When you must be close to a source, ensure that the time taken is minimised.

3. Store the source storage container a minimum of seven (7) metres from any working area.

The radioactive sources used in the Auslog Neutron and density tools are comparatively high in strength sources in terms of human safety. Proper safety precautions must be strictly followed to prevent any health hazards. If the basic radiation safety rules are followed, however, it is not much more hazardous than working with electricity. One of the chief distinctions is that, unlike electricity, the radiation passes through the body without any immediate sensation. Herein lies the greatest potential hazard, the lack of discomfort could cause the unwary person to tend to forget the possible danger and fail to observe reasonable precautions.

FAMILIARITY BREEDS CONTEMPT. . . . . SO BE CAREFUL!

For complete rules governing radioactive material in your geographical location, check with your management or the local public health agency.

The following basic safety rules are based on guidelines that have been established by the Department of Health, Queensland, Australia. Follow these rules! They are designed for your protection.

1. KNOW YOUR JOB:
   If in doubt as to the safety of the job, consult you supervisor.

2. FILM BADGE:
   Know and respect the standard symbol designating any radiation hazard (in magenta or purple on a yellow background). Do not enter an area marked with the warning sign unless you are authorised to do so. ALWAYS WEAR A FILM BADGE when you intend to work with radioactive sources.

   NOTE that a special badge is required to sense neutron flux. The standard

gamma-ray sensing TLD badge is not sufficient.

3. HANDLING RADIOACTIVE MATERIAL:
   Use any special equipment provided for handling radioactive materials. Tongs and remote manipulators will make it possible to move radioactive materials without getting too close to them. Never handle radioactive materials unless you know that it is safe to do so. Use special shielding where necessary.

4. THE IMPORTANCE OF CAREFUL AND NEAT OPERATIONS:
   Be as neat and careful as possible while performing your work. Carelessness or untidiness while working with radioactive materials can result in danger to yourself and to your fellow workers.

5. FIRES:
   In case of fire in an area containing nuclear materials, follow exactly the instruction given for extinguishing it. Water may be dangerous under some conditions.

6. SMOKING AND EATING:
   To avoid swallowing radioactive or poisonous materials, smoke and eat only in authorised areas and only after washing with soap and water.

7. STICK TO APPROVED OPERATIONS:
   Never try any stunts or experiments with radioactive or nuclear materials; they might result in injury to yourself or others.

8. TRAINING:
   If you are responsible for the safety of others, explain the rules simply and clearly so that they cannot be misunderstood and then make sure that each man understands and follows them and then see that no short cut is taken.

9. FOLLOW BASIC SAFETY RULES:
   If you and each of the others follow these basic rules, the chances of injury to yourself or anyone else will be reduced to the minimum.

10. If a radioactive source is lost in hole, immediately advise the field office management and the relevant government authority.

11. READ MANUALS:
    A comprehensive manual "Procedures of Safe Handling of Radioactive Sources" is supplied with every tool utilising a radioactive source that is supplied by Auslog.

DLS PROGRAM SOFTWARE OVERVIEW

Conventions

Throughout this section, the following conventions are used to distinguish elements of the text:

bold	Used for commands, options, switches, and literal portions of syntax that must appear exactly as shown.
italic	Used for filenames, variables, and placeholders that represent the type of text to be entered by the user.
SMALL CAPS	Used for keys, key sequences, and certain acronyms.

Hardware Requirements

- IBM PC Compatible
- 640k RAM
- One floppy and one hard disk
- Standard US ASCII keyboard
- CGA, EGA or VGA graphics screen
- One serial port
- One parallel port (if printer output required)

- Printers All Epson LQ series printers
  Kodak Diconix D180
  HP Laserjet Plus
  Others on request

MS DOS 3.0 or later

Computer System Overview

Auslog software complements the Auslog Borehole tools and equipment to provide a powerful logging system capable of acquiring precise and detailed information.

Features of the Auslog software:

Convenience:

- Logs are recorded in MS DOS format.
- Software is IBM compatible.
- Software can be copied onto an office based computer for further processing and use of playback options.
- Up to twenty (20) pages of comments may be included with each log.
- Logs can be displayed using catalogue-selectable parameters.
- Complete header data are recorded with each log so that the operator can record all relevant borehole information such as drillhole specifications in each log.
- Both 'quick-look' or high resolution prints may be selected.
- Over 100,000 metres of logging data may be stored on a 20 megabyte hard drive using typical acquisition parameters.

Data:

- Only raw data are recorded.
- Raw data can be stored on the hard disk for subsequent replay, processing or transfer to floppy disk for storage.
- Raw unprocessed data are stored independent of any filters used during logging. This means that data may be reprocessed at any time with different filters to achieve a more detailed analysis of the collected data.
- Binary data storage results in compact files for maximum use of disk storage space. Utilities to convert the binary data to ASCII format for use by other programs are available.

Analysis:

- Logs recorded from the same drillhole may be merged to produce a COMPOSITE LOG.
- Comparative plots of like logs from a number of different drillholes can be produced.
- Data may be scanned to obtain optimum replay scales. Default logging and replay scales can be set.
- Software automatically depth corrects for the different positions of the sensors in each log.
- All depth and amplitude scales and filters are continuously variable during either logging or playback.

- Logs may be reviewed in real-time either on the computer monitor screen or on a hardcopy produced by the printer or plotter.
- Data sample intervals within the drillhole may be selected on the basis of either depth or time increments.

- VIEWLOG - Borehole Log Editing System. Auslog software is compatible with the Viewlog software, a PC based interactive borehole logging data processing package.

Versatility:

- The system may be variously specified to accept a number of different analog, pulse and digital signals from a large range of downhole tools.
- Custom software may be designed to suit individual client requirements.
- The digital logging system, and the typical acquisition computer used by many clients, require a power supply of 12 volts DC or as specified, providing a highly portable system for use in remote areas.

Installing Software

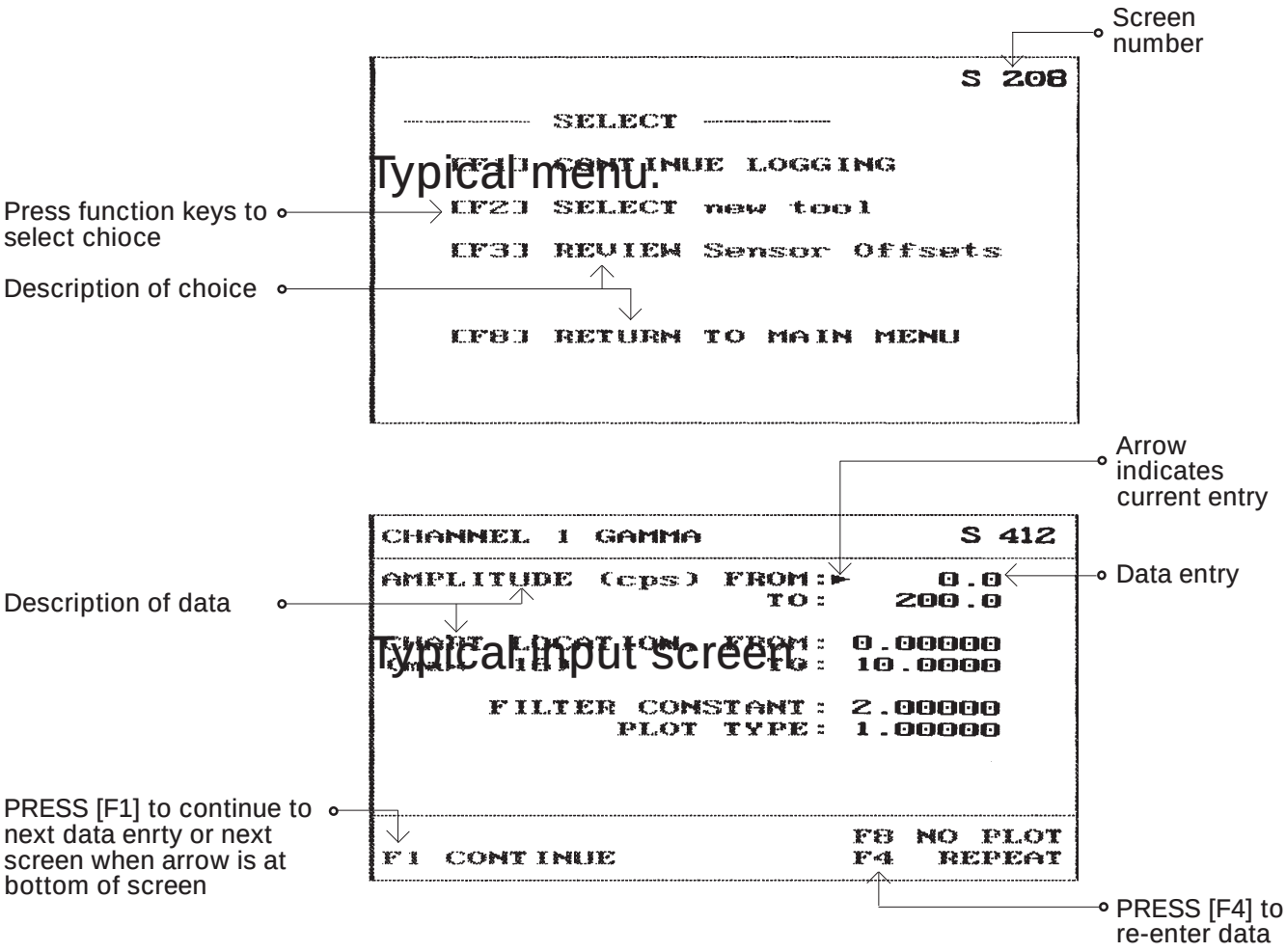
Auslog software is distributed on a single 720k 3.5 inch diskette. This format is compatible with most computers on the market today. Should you require diskettes of a different format please advise Auslog.

Installation on a computer with a hard disk.

It is important that you only run Auslog software from working copies rather than the original disk. Disks can get damaged in many ways. Use only working copies and store the originals in a safe place.

The following procedure creates directories and copies all necessary Auslog software files to your computer.

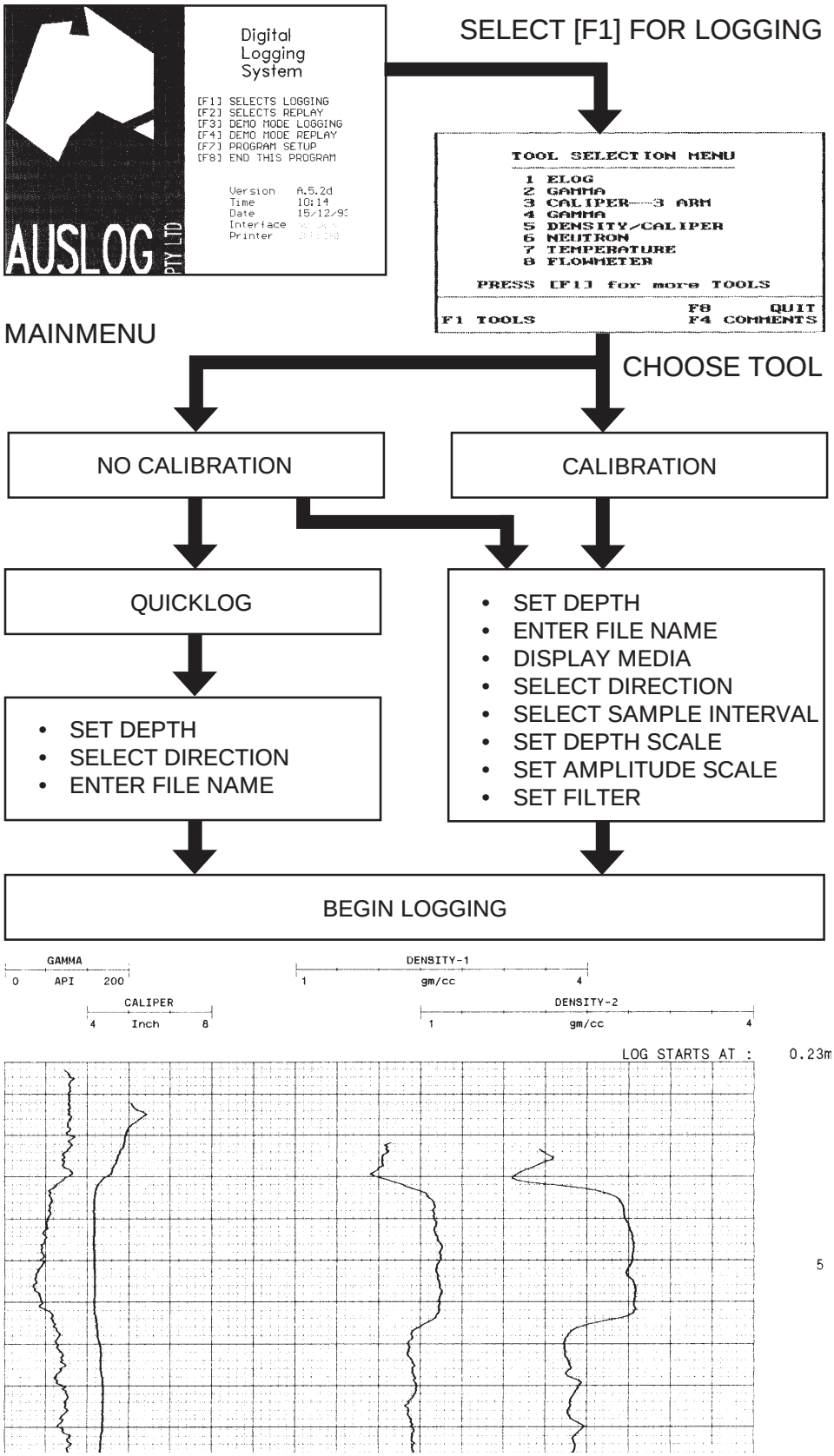
1. Turn on the computer.
2. Insert the Auslog software distribution disk in drive A: (or B:)
3. At the C:> prompt, type A: (or B:), then press RETURN
   This switches you to the disk drive containing the distribution disk.
4. At the A:> prompt, type install C then press RETURN
   Install creates the directory named AUSLOG and the subdirectories DEMO and LOGS before copying files. As the system copies files from the distribution disk to these directories, the filenames being copied appear on the screen. When all the files are copied, the DOS prompt C:\> appears.
5. At the C:\> prompt, type ALOG then press RETURN to start the program.



Data management

The AUSLOG software will by default place all logging data in the directory C:\AUSLOG\LOGS.

Logging operation flow chart.



GLOSSARY

A

Active • Describes a screen that is selected; the screen to which the next keystroke or command will apply

B

Backup • To make a copy of a file or disk for safekeeping.

Backup disk • A copy of any disk you make using the Diskcopy, Copy, or Backup commands.

Boot • To start up your computer, or to restart it, loading the DOS operating system.

Boot disk • A floppy disk which caries the DOS system files and is able to upload DOS from a floppy drive when starting the computer.

C

Choose • To perform an action that carries out a command in the menu or dialog box. To make a choice among actions listed in a menu or dialog box. Done by pressing a key or clicking a mouse. See also Select.

Command • A program that tells MS-DOS how to do a specific task. See also Menu.

Command prompt • The MS-DOS command prompt appears on the screen as the default drive letter followed by a greater-than (>) sign. The command prompt lets you know MS-DOS is ready to receive a command.

D

Disk • See Floppy disk; Fixed disk.

Disk drive • A piece of hardware attached to your computer. Typically, a disk drive is either a floppy or fixed disk drive. You insert floppy disks into floppy disk drives. Floppy disk drives are commonly referred to as drive A and drive B. Hard disk drives are usually built into the computer and are referred to as drive C. Your computer manual should tell you how your drives are labelled.

Disk Operating System • A group of programs that act as a translator between you and your computer. MS-DOS is a disk operating system. See also Operating system

E

Envirolog One • Auslog's portable borehole logging system consisting of a fully integrated winch and control centre.

F

File • A collection of related information. A file on a disk can be compared to a file folder in a desk drawer. For example, a file folder named friends might contain the names and addresses of your friends. A file on a disk could contain the same information, and could also be named friends. Programs are also stored in files.

Filename • The name of a file. MS-DOS uses specific file naming conventions: a filename can be from one to eight characters in length and can have an extension of up to three characters separated from the filename by a period (.). An example of a complete filename is BORE_102.X-B. See also Filename extension.

Filename extension • An addition to a filename. Extensions begin with a period and contain from one to three characters. Most application programs supply their own extensions for files they create. For example, all AUSLOG data files use a filename extension of .?-B. See also Filename.

Fixed disk • Sometimes called the hard disk, it is built into the computer. A fixed disk can store much more information than a floppy disk, and the computer can retrieve information from it faster.

Floppy disk • Used for storing programs and files. In this documentation, the term floppy disk includes 3.5-inch as well as 5.25-inch floppy disks.

H

Hard disk • See Fixed disk.

Hardware • The equipment that makes up a computer system, not to be confused with the programs, or software.

M

Menu • A listing of available commands. You use a command from the menu by selecting the designated key adjacent to the command description.

Mudpit • A small depression near the borehole, containing a mixture of moist soil (often drilling mud), which is used to earth an electrode for calibration of borehole tools.

O

Operating system • A group of commands that translate your commands to the computer, helping you to perform such tasks as creating files, running programs and printing documents. See also Disk operating system.

P

Print • A command that activates your printer.

Probe • See Tool.

Prompt • A symbol that usually consists of a default drive letter (usually A, B, or C) and a greater than sign.

S

Sondes • See Tool.

T

Tool • An instrument attached to a cable, which transmits data to a computer on the surrounding geological strata, as it is passed up and down a borehole.

Tripod • A frame incorporating a pulley located over a borehole, which supports and guides the cable.

W

Winch • A hand or mechanically powered device used to release or wind up the cable attached to the borehole tool.

ACKNOWLEDGEMENTS

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