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SSI Applications Manual

SSI Technician's Terminal Logger Recorder (TTLR) User Guide

Endorsement, Authorisation and Issue Record

For endorsement, authorisation and issue record for this document, please refer to the SSI Applications Manual Contents, NR/L2/SIG/17002

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1 Introduction

1.1 Purpose and Background

This document is the User Guide for the Technician's Terminal Logger Recorder (TTLR), the PC based replacement for the Penny and Giles (P&G) tape logger and the VT100 terminal.

NOTE During the P&G replacement programme, TTLR was defined as Technician's Terminal Logger Replacement, this is now superseded by the current definition.

PC technology permits usage of magneto-optic (MO) removable storage media with far greater capacity than P&G quarter inch tape (QIC). The TTLR replicates all the functionality offered by the P&G and VT100 terminal and offers a number of enhancements. The TTLR also provides greater versatility, improved reliability and simplified maintenance.

1.2 Compatibility

- The user interfaces with the Technician's Terminal (TT) via the keyboard, on-screen menus and the printer are unchanged.
- Two MO discs provide the recording media, and the recorded data structure with hourly files and four tracks per drive remains unchanged.
- Existing cables between the TT and P&G require replacement to accommodate the 9 way 'D' type connectors required to connect the two RS232 serial ports to the PC.
- The protocol and message structure between the PC and TT are unchanged.
- Certain keys on a Windows 'QWERTY' keyboard are incompatible with the PC Logger and require suppression before installation. Failure to do so could cause data to be lost indefinitely – See section 1.3.2. (Note: this is a task for the installer/supplier, not the user).
- The logger program is incompatible with "smartdrive". Where this instruction is in the autoexec.bat file supplied with the logger program then it must be disabled. See section 1.3.3. (Note: this is a task for the installer/supplier, not the user).

1.3 Hardware and Logging Media

1.3.1 PC and Monitor

The PC is IBM compatible, suitable for light industrial use, and is equipped with two MO drives for TT logging purposes. It also has a CDROM drive and a 3.5 inch floppy disc drive to facilitate program loading; these are not required in normal use. The PC has a 10Gbyte hard drive (minimum) with suitable partitioning and a 600MHz (minimum) processor. The monitor is of standard design suitable for connection to a PC. Further details are given in section 2.

1.3.2 Incompatible Keyboard Keys

Standard Windows 'QWERTY' keyboards have some keys that are incompatible with the TTLR program and require suppression. If these keys are not suppressed then their use will cause the TT to cease sending data to the TTLR **indefinitely** and all data will be lost until the escape or return key is pressed. No warning of this will be given!

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The keys that require suppression by the installer/supplier (not the user) before installation are:

F11, F12, Windows keys (there are usually two), Context Menu key, Pause key, 5 on the numeric keypad with number lock off

These keys can be suppressed easily by inserting a piece of insulating material between the electrical contacts inside the keyboard.

Keys that do not require suppression are:

Esc, F1 to F10, Print Screen, Scroll Lock, Numbers 0 to 9 (except for 5 on the numeric keypad with num lock off), Punctuation keys, =, -, #, /, \, Insert, Home, Page Up, Page Down, End, Delete, Alt Gr, Ctrl, Caps Lock, Arrow keys, Indent key, Enter, Alt.

1.3.3 "Smartdrive" Suppression

This instruction shall be carried out by the installer/supplier of TTLR equipment before it is brought into use. The logger program has its 'own' autoexec.bat file and does not use the autoexec.bat file supplied with the PC. If the autoexec.bat file supplied with the PC logger program contains a "smartdrive" instruction then this must be suppressed. (Note that this is not the autoexec.bat file supplied with the PC which could have smartdrive and which should not be disabled). Disabling "smartdrive" can be done easily by using the DOS editor to open the autoexec.bat file supplied with the logger program and ensuring that there is a "rem" instruction before the line containing "smartdrive". Failure to suppress "smartdrive" will lead to serious problems in operational use and loss of data.

"Smartdrive" may already be suppressed in the supplied software, if not, suppression can be carried out by editing the autoexec.bat file on the floppy disc used to load the TTLR program or by editing the autoexec.bat file in the root C directory after the TTLR program has been loaded as follows:

- Remove any write protection on the autoexec.bat file supplied with, or used by, the TTLR Program. This could include software write protection, which can be removed with the "attrib -r autoexec.bat" command in DOS, or it can be removed with Windows Explorer (highlight autoexec.bat, right click, click on properties and remove write protection).
- With the DOS editor**, open the autoexec.bat file supplied with the logger program. (To open the DOS editor type "edit autoexec.bat" at the DOS prompt).
- Put a "rem" command in front of the line containing **smartdrv**.
E.g. rem C:\DOS\SMARTDRV.EXE
- Save the change and exit the DOS editor
- Replace the write protection ("attrib +r autoexec.bat" in DOS) as required
- If the change is effected in a PC root directory it will be necessary to reboot the PC.

NOTE Alteration of the autoexec.bat shall be undertaken by the expert installer/supplier PRIOR to use by the maintainer.

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1.3.4 Logging Media

The TTLR program allows logging to any suitable media; those provided are magneto-optic (MO) discs. MO discs offer far superior data storage capacity compared to QIC tapes, protection against corruption or accidental damage and long term stability of recorded data. The recommended MO discs are 3.5 inch with a capacity of 640Mbytes. (See section 3).

1.4 Installed Programs

1.4.1 TTLR Program

The TTLR is loaded with a purpose designed functional program to provide data logging facilities replicating as closely as possible those provided by the P&G, as well as emulation of the VT100 terminal. This functional program is designated SSI4308-XX where SSI4308 is the program identifier and XX is the version label. This is in accordance with standard SSI program identification.

1.4.2 Graphical Replay Program

The PC may also be loaded with a Graphical Replay (GR) program to allow replay of recorded data. Replay of stored data is not possible when the PC is in the data logging mode and should be used only when the PC is not connected to an operational TT.

The TTLR and GR software do not interact, are mutually exclusive and the GR program can be used only when the PC is off-line from the logging function. However, the GR could be used on any suitable PC separate from TTC and TTLR usage.

Further description of the GR program is outside the scope of this document.

1.4.3 Operating Systems

The operating system required for the TTLR program is MS-DOS version 6.22.

The GR program requires a Windows operating system. This operating system is provided in a separate drive partition on the hard disc.

Only one of the two operating systems - Windows or MS-DOS - can be active at any one time; therefore the PC can be used for logging data as a TTLR or for Graphical Replay but not both at the same time.

For further information on operating system requirements see:

- SSI Graphical Replay User Guide SSI8009
- PC and Monitor Requirement Specification (Section 2.4).

2 PC & Monitor Procurement

2.1 Space Envelopes and Site Surveys

Installation details and site surveys. Before ordering any equipment take careful note of the installation details given in section 4.2. A site survey to establish that the equipment to be procured will fit into the space available in the TT rack is essential.

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2.2 Equipment Room Monitors

Investigations have shown that the Technician's Terminal (including the monitor) in Signalling Control Centre (SCC) equipment rooms are often protected by a 6 Amp NIT (or TIA) fuse in the 110 Volt supply. It has also been shown that the surge current on switch-on and on de-gaussing from modern, colour CRT (Cathode Ray Tube) monitors will very often cause the 6 Amp NIT (or TIA) fuse to fail.

Consequently, CRT colour monitors must not be used in SCC equipment rooms where the supply is protected by a 6 Amp (or less) NIT (or TIA) fuse and Liquid Crystal Displays (LCD) type monitors must be used instead.

*****WARNING: Do not use CRT colour monitors with the TTLR in the SCC equipment room; use LCD type colour monitors only.**

2.3 Data Analysis Monitors

Monitors used for data analysis outside the equipment room, supplied with power from the 230 Volt 'mains' supply, can be either CRT or LCD monitors.

2.4 PC and Monitor Requirement Specification

The PC and monitor have been specified in a requirement specification, (SAO-SSI-TT(V1)-RS-3), which must be used when procuring equipment.

2.5 PC Procurement

The requirement specification for the PC and monitor will allow equipment to be purchased from suppliers who specialize in industrial PC equipment. However, care must be exercised before ordering.

It has been found that not all suppliers are fully conversant with the fine details of MO discs and drivers. Difficulties can be expected if suppliers with little or no experience are approached.

For the development of the TTLR close co-operation and consultation has taken place with Industrial Computers Limited (ICL) (formerly **Ibus**) for the supply of suitable PC equipment correctly set up for the needs of the TTLR using MO discs. It is advised that this is the preferred supplier.

The PC can be ordered by quoting reference SAO-SSI-TT(V1)-RS-3.

The recommended PC supplier's details are:

Industrial Computers Limited (formerly Ibus UK Ltd)

Units 3&4 New Bury Park

Marsh Lane

Easthamptnett

West Sussex

PO18 0JW

Tel +44 (0) 1243 380 780

Fax +44 (0) 1243 538 035

www.industrial-computers.com

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2.6 LCD Monitor Procurement

LCD type colour monitors (15 inch minimum recommended) must be used in the equipment rooms where the TT is protected by a 6 Amp NIT fuse (see section 2.2). The specification is defined in SAO-SSI-TT(V1)-RS-3.

LCD type monitors can also be used with the TTLR for data analysis.

LCD type monitors can be obtained from any approved supplier.

NOTE Some LCD type monitors may require the PC to have a Windows based operating system installed – these will not be suitable as the TTLR program uses a DOS operating system.

2.7 CRT Monitor Procurement

17 inch (recommended minimum) CRT or 15 inch (recommended minimum) LCD type colour monitors can be used with the data analysis equipment so long as the CRT does not use power derived from the 110 Volt signalling supply (see section 2.2). Specification details are given in the requirement specification, (SAO-SSI-TT(V1)-RS-3). CRT monitors can be obtained from any approved supplier.

3 MO Equipment Procurement

3.1 MO Discs and Drivers

3.1.1 MO Drivers

The MO software drivers must be capable of reading and writing to 640Mbytes, 2048 bytes per sector, 3.5 inch MO discs. These are defined in the PC requirement Specification (see section 2.4) and should be loaded by the equipment supplier; no user action should be necessary.

With the correct drivers loaded the PC will be capable of reading MS-DOS formatted MO discs with a storage capacity of 640Mbytes (see also section 3.1.2).

3.1.2 MO Disc Capacity

The system has been tested with 640 Mbyte discs and **it is recommended that only 640 Mbyte 2048 bytes per sector discs are used for data recording.** Discs with lower capacity shall only be used in an emergency.

NOTE Do not mix discs of different storage capacities or bytes per sector in operational use. Mixing discs of different capacity on the TTLR can cause the program to halt with loss of data; disc corruption is also possible. (See also sections 11.1 and 13).

3.1.3 Low Level Pre-formatted Discs

The MO discs must be low level, pre-formatted for MS-DOS. Catalogues may not specify MS-DOS formatted but do specify Mac formatted, presumably assuming that by default the non-specified disc is for MS-DOS (or Microsoft Windows) applications.

NOTE Mac formatted discs are totally unsuitable.

3.1.4 Stockists of MO Discs

MO discs are readily available from information technology (IT) equipment stockists. Stockists include: Misco, Global and PC Business World.

A specialist supplier of MO discs is: **ImageStore Limited**, ImageStore House, Ecchinswell Road, Kingsclere, Nr Newbury, Berkshire, RG20 4QG

Tele: 01635 297297 Fax : 01635 298603 www.imagestore.co.uk

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MO disc purchase requisitions must specify: magneto-optic, re-writable 3.5 inch discs, 640Mbytes capacity, 2048 bytes per sector, pre-formatted for MS-DOS.

3.1.5 Manufacturers of MO Discs

All MO discs are manufactured to a common standard. Various makes can be used including Sony and TDK, but see section 3.1.2 on disc capacity.

4 Transportation and Installation

4.1 Safe Transportation

Eject discs before transportation. It is essential that all removable recording media, particularly MO discs, are ejected before transporting the PC. MO drive heads are free to move until the discs are removed and in this condition shocks can damage the MO read/write laser diode. Good practice is to routinely eject all discs before turning the PC off.

4.2 Installation

The PC should be mounted in the TT 19 inch rack in place of the P&G. A 2U or 3U high PC is preferred with a depth of no more than 36cms; however, in practice this is unlikely to be achieved. A 4U high PC will be acceptable, with a depth not exceeding 48cms, **provided that it is determined beforehand by a site survey (see section 4.3) that there is sufficient space available in the TT rack to accommodate the new equipment. (See also section 6 for power/current requirements.)**

4.3 Site Survey

Before installation a site survey should be conducted to determine:

- That there is sufficient room in the TT rack including an allowance for cables and plugs at the rear of the PC (see section 4.2).
- That there will be sufficient electrical sockets available (see section 6)
- The length of cable required (including mains, RS232 and keyboard)
- Surge and spike suppression requirements (see section 4.6)
- That the TT is isolated from other signalling equipment (and thus other signalling equipment is isolated from the TT) by a suitable fuse in the 110 Volt supply
- That if this fuse should rupture during the TTLR installation process other signalling equipment will remain fully operational
- That, as a precaution, the fuse in the 110 Volt supply can be replaced quickly and easily on the day of installation should this be required.

4.4 Cabling

The two cables from the TT to the PC will require re-termination or replacement at the PC to accommodate the 9 way 'D' types. Further details are given in section 9.

The PC connects to the monitor by a VGA cable.

4.5 Operating Voltage

It is recommended that the PC and monitor should be able to operate from both 110 Volts and 230 Volts. It is increasingly common for auto ranging power supplies to be

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fitted to industrial PCs and monitors but sometimes a switch has to be moved to the correct position to select the correct voltage **before** power is applied.

4.6 EMI Supression

The MO media offer robust protection against corruption and the PCs are well protected against the effects of radiated electro-magnetic interference (EMI) – provided that the door to the PC is kept tightly shut.

However, electrical surges and spikes on cables leading into the PC, such as the mains lead, RS232 lines to COM 1 and COM 2 and keyboard cable, may cause corruption of the data on the MO discs. It is therefore advised that these lines are suitably suppressed. It is also recommended that care is taken not to cause surges and spikes on the power supply to the TTLR while it is actively logging. Such surges can sometimes arise when the TT is turned on and off.

In areas that are potentially 'electrically noisy', surge and spike suppression is essential.

Recommended surge suppression:

- A mains distribution board with surge suppression for the 240 Volt feed to the PC and monitor. The surge suppressor should be rated at a minimum of 90 Joules energy absorption between the Live and Neutral conductors. In locations where significant EMI could be experienced then a higher rating should be considered.

A visual means of indicating that the surge protection is operational is considered essential.

A mains switch on the distribution board, particularly if it is touch sensitive, is undesirable due to the risk of accidentally switching the equipment off.

An in-built circuit breaker in the distribution board is also undesirable for similar reasons.

A THERMAL FUSE/CUT-OUT IN THIS DISTRIBUTION BOARD IS ESSENTIAL.

- Ferrite surge suppression, fitted as close to the PC as possible, on the mains lead to the PC. The ferrite surge suppressor should be rated at a minimum of 100Ω from 50 to 500MHz. A TDK ZCAT3035-1330 available from Dexter Magnetic Materials is suitable. This device will clip onto cables of diameter up to 13mm and should be fixed by means of a Network Rail approved cable tie, using the built in lug.
- Ferrite surge suppression, fitted as close to the PC as possible, on the two RS232 lines to the PC and the keyboard input to the PC. The ferrite surge suppressor should be rated at a minimum of 80Ω from 50 to 500MHz. A TDK ZCAT2035-0930A available from Dexter Magnetic Materials is suitable. This device will self-clamp onto cables of diameter 6 to 9mm.
- Surge suppression on the monitor VGA cable (usually standard fitting on purchased VDUs)
- Screened RS232 cables with metal hoods - see section 9.1 for further details

NOTE Electrical interference could corrupt data on the MO discs. Surge suppression is recommended. On mains distribution boards fitted with surge suppression a thermal cut out and a

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visual means of indicating that the surge protection is operational are essential. Conducted EMI can be expected from the TT computer when power is applied or removed.

4.7 Labelling of MO Drives, Cabling and I/O Ports

It is **essential** that all MO drives, cables and I/O ports are clearly labelled and identified.

The PC MO drives must be clearly labelled and colour coded in accordance with the details given in section 12.2.1.

The PC COM 1 and COM 2 ports must be clearly labelled in accordance with the details given section 9.

The 2 x RS232 cables for connecting the PC to the TT must be made and clearly labelled in accordance with the details given section 9.

If the TTLR is used with a conventional tape analysis program then a RS232 cable will be required to connect the TTLR PC to the PC with the tape analysis program. Ensure that this cable is made and clearly labelled in accordance with the details given in section 17.

5 Equipment Details

5.1 Description

The PC is IBM compatible, suitable for light industrial use, and is equipped with two MO drives for TT logging purposes. It also has a CDROM drive and a 3.5 inch floppy disc drive to facilitate program loading; these are not required in normal use. The PC has a 10Gbyte hard drive (minimum) with suitable partitioning and a 600MHz (minimum) processor.

The monitor for use in the equipment room is a 15 inch (recommended minimum), colour, liquid crystal display (LCD), usually with Thin Film Transistor (TFT) technology. Outside the equipment room a 17 inch (recommended minimum) colour cathode ray tube (CRT) monitor can be used. Both monitors are of standard design suitable for connection to a PC. Further details are given in the Procurement Specification (see Section 2.4). The LCD monitor may have a small, separate external voltage converter from 230/110 Volts AC to ~18 Volts DC. However, wherever possible a monitor with a built-in voltage transformer is preferred.

5.2 Overall Dimensions

The PC in the equipment room will be mounted in the TT 19 inch rack in place of the P&G. The LCD monitor will be mounted on top of the TT rack. Comparative dimensions are given in the following tables. VT100 terminals (e.g. Cifer or Wyse) can not be used.

	P&G Logger	ICL PC	Remarks
Height	~13cms (~3U)	~18cms (~4U)	Allow extra 5cms (approx.) at rear for plugs and cables
Depth	~36cms back to flange	~48cms back to flange	
Width	To suit 19 inch rack	To suit 19 inch rack	

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	VT100 Terminal Typical envelope	LCD Type Monitor Typical envelope	Remarks
Height	~33cms	~40cms	LCD is colour with a 15 inch diagonal. Cifer is monochrome with a 12 – 13 inch diagonal
Depth	~28cms	~20cms	
Width	~32cms	~38cms	

Do not use colour CRT monitors with the TTLR in the equipment room where the TT supply is protected by a 6 Amp NIT fuse (or less); only low surge current LCD type monitors must be used.

6 Power Supply Considerations

6.1 Access to Mains Power

In the TT equipment rack, access is required to two mains power sockets, standard IEC flat pin, at 230 Volts fed from the SCC Uninterruptible Power Supply (UPS). (See section 4.6).

6.2 Current Loading

The TT rack is often fed with 110 Volts to an auto transformer and stepped up to 230 Volts.

The feed to the transformer would be at 110 Volt from the SCC UPS with a separate 6 Amp NIT fuse.

Equipment at 230 Volts	TT with P&G Configuration Typical Amps rms	TT with TTLR Typical Amps rms
VT100 terminal (TTC use)	0.3 (max)	
LCD terminal (TTC use)		~ 0.1 (specified)
P&G (TTC use)	0.5 (max)	
Printer (dot matrix) (TTC use)	0.3 (max)	0.3 (max)
ICL PC (TTC use)		0.4 (measured)
Modem (TTC use)	0.05 (max)	0.05 (max)
TTC	0.4 (measured)	0.4 (measured)
Additional Cifer terminal	0.3 (max)	0.3 (max)
Additional modem	0.05 (max)	0.05 (max)
<u>TOTAL</u>	<u>1.9</u> (max allowable is ~2.2)	<u>1.6</u> (max allowable is ~2.2)

From the above table it can be concluded that the fusing arrangement and allowable current are sufficient for the proposed installation. However, for fusing and surge

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current reasons as outlined below **an LCD type monitor must be used with the TTLR in the equipment room.**

Surge Current: Surge current to the TT must not exceed the NIT (or TIA) fuse 6 Amp rating, requiring use of a LCD type monitor rather than a CRT. However, it is considered essential that **the maintainer has spare 6 Amp NIT (or TIA) fuses for the 110 Volt supply.** The maintainer shall verify that a blown NIT (or TIA) fuse can be quickly and easily replaced should this be required. Laboratory investigations have shown that the surge and steady state current demands will be within the SCC limits for the TT.

7 Program Installation, Uninstallation & Configuration

7.1 Installation

The TTLR program is designated SSI4308-XX, where XX is the version number (e.g. A1). The TTLR may be supplied with the program already installed and configured. Where this is not the case the following steps should be taken:

- a) Turn on the PC and boot into the MS-DOS prompt C:
Note that if the logger program is not installed the PC will boot into the C directory automatically by default.
If the logger program is installed the PC will boot automatically into the logger program. The logger program should be exited as described in section 7.2.
This will be required if the TTLR program requires updating with a new version.
- b) Insert the supplied installation floppy disc containing the program and set up parameters
- c) Type A:SETUP (not case sensitive) and press the enter key
- d) Follow the on-screen instructions for installation
- e) Following installation remove the floppy disc when prompted to do so on-screen
- f) Reboot the PC and wait
- g) The program will boot automatically into the logger program without further user intervention with the default configuration parameters set.

If the PC is not connected to a TT the VDU will show a blank screen except for the program identification in the bottom right hand corner, e.g. SSI4308-A1. Further confirmation of program installation can be obtained by pressing ALT-F10 will reveal the set up menus (not required at this stage)

The PC is now ready for the logging and video terminal emulation functions, i.e. to replace the P&G and the video terminal (see section 11).

The program will remain on the PC when power is removed and will automatically boot into the logger program without user intervention when power is restored.

In exceptional circumstances configuration parameters can be altered as detailed in section 16.10. However, this should seldom be necessary.

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NOTE Altering the Configuration menu will cause the program to terminate and the logging discs to be ejected. Do not use during operational use or logging data will be lost! Apart from configuring for tape replay or possibly copying logger tapes to MO discs, (followed by re-configuration for the normal logging operation), the configuration menus should not be altered.

7.2 Uninstallation

NOTE If it is intended to move the PC or remove power (i.e. switch off) it is essential that the MO discs are removed beforehand. Failure to do so could cause serious problems and could damage the MO drives. (See also sections 4.1 and 13.8).

To uninstall the program and return the PC to a standard set up the following steps should be taken:

- a) If the PC is to be used for other purposes disconnect the PC from the TT
- b) Turn on the PC and wait until the logger program is operational in the Normal Operating mode (see section 12). When the PC is not connected to the TT but is in the Normal Operating mode the VDU will show a blank screen except for the program identification in the bottom right hand corner, e.g. SSI4308-A1.
- c) Exit the logger program into MS-DOS using option F7 from the logger suspended menu as detailed in section 16.8. After exit from the logger program the MS-DOS prompt C: or C:\logger is displayed .

*****WARNING:** Before using the uninstallation disc it is essential to exit the logger program as detailed in sections 12.4 and 16.8. Failure to do so could render the computer inoperable! DO NOT SPAWN A DOS PROMPT – this will not suffice – exit from the logger program using option F7 as detailed in section 12.4 and 16.8 is essential.

- d) The keystroke sequence for an orderly exit from Normal Operating mode (i.e. the logger program) is:

ALT-F10 (press simultaneously)

F7

(follow the on-screen instructions then)

F7

(Follow the on-screen instructions and the program will terminate in an orderly fashion ending with an MS-DOS prompt)

- e) Following exit from the logger program and the appearance of the MS-DOS prompt, insert the supplied installation floppy disc containing the program and set up parameters
- f) Type A:UNINST (not case sensitive) and press the enter key
- g) Follow the on-screen instructions to uninstall the program
- h) Following uninstallation of the logger program remove the floppy disc when prompted to do so on-screen
- i) The PC now has a standard set-up, including the start-up parameters it had before the logger program was installed, and is available for other uses

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8 MO Disc Formatting

8.1 Outline

When MO discs are purchased they will already have a low level format suitable for MS-DOS and Microsoft Windows applications (although this may not be realized by the supplier, see section 3.1.3). However, they will need a high level format on-site before use with the TTLR. (Corrupted discs will also need reformatting as outlined in section 20.1).

The TTLR provides for two methods of applying the high level format, one from Windows NT, where this is available and one from within the TTLR program. Of the two, the one using Windows NT is convenient to use but the high level format facility from within the TTLR program can also be used without difficulty if required (see sections 8.3 and 16.5).

NOTE Pre-format discs before first use. *It is essential that MO discs are pre-formatted with a high level format after purchase and before first use. It is possible to format discs from within the logging program but this will cause a suspension of logging and could lead to loss of data.*

It is advisable to pre-format a good supply of discs before use and to ensure that there is always a working TTLR available to perform this function as required.

8.2 Formatting From Windows NT

MO discs can be easily formatted with Windows NT in a few minutes using a High Level (or Quick) format. Low Level Format should not be required except for heavily used or damaged discs. (see section 16.5). Configuration for 640 Mbyte discs is carried out as follows:

- a) Select **Windows NT non-VGA mode** on PC power up by pressing **Enter** (beware time out !)
- b) Press CTRL-ALT-DEL when requested and when a "Password" is requested press **Enter** (or enter the password if one is required)
- c) When NT has completed boot-up put the MO disc into an MO drive
- d) Select **START; Programs; MO Utilities; MO disc formatter**
- e) Select target drive depending on the drive with the MO disc
- f) Select **Yes** in reply to "format now" question
- g) For format type select **Floppy type**
- h) Volume label is optional and can be ignored
- i) Select **Quick** format and **FAT 16**
- j) Select **Format**. (Select **Commit Changes Now** if asked.)
- k) Select **Yes** to "all data will be lost". Disc format will take about 5 seconds.

NOTE Do NOT use any other format facility available with Windows – these will appear to work but will give rise to anomalous results including loss of logged data.

8.3 Formatting From the Logger Program and MS DOS

When formatting MO discs with the logger program, the Data Analysis PC with MO drives should be used.