

TeloSense

ACM

OPERATOR TRAINING GUIDE

Scope

This guide is intended as a training aid for safety staff members and ERT personnel. It addresses the basic functions and operations of the ACM. For a more thorough guide to maintenance, programming of slots and relays, and other technical issues, consult the full user manual provided with the instrument.

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1. Terminology

Here is a glossary of ACM terms.

Method: A method is a list of gasses in software. The method contains the information needed to identify a gas on the list. An ACM can have one or more methods loaded depending on the user's application.

Area: An area refers to the actual sample port through which a sample is drawn at the top of the ACM. A standard ACM can accommodate up to 40 areas.

Slot: A slot is a position in the scanning sequence programmed by the user. A slot is identified by a number referring to its placement in the sequence. A slot must be programmed to scan a particular **area** using a single **method**. The scan sequence can be tasked to monitor more critical areas (i.e. breathing zones) more often than less critical areas (i.e. gas cabinets). If this is the case, some of the slots in the sequence would contain identical areas. Slots can be made inactive by the user and thus skipped in the monitoring sequence.

FTIR Bench: The device that measures infrared absorption of the sample gas. FTIR stands for Fourier Transform Infrared, a technique for producing a continuous **spectrum** throughout its measurement range (400 to 5000 cm^{-1}). The bench used in the ACM is a Michelson type FTIR.

Spectrum (pl. Spectra): The pattern of absorption of infrared light produced by the **FTIR bench**.

target.exe (target): The ACM executable program invoked automatically on power up or reset of the instrument. This is the monitoring software that controls the instrument during operation.

config.dat: The editable (ASCII) data file containing hardware and software configuration information for **target**.

***.slt:** The **slot** sequence programs set up by the user. “**default.slt**” is used whenever **target** is invoked.

***.rly:** The relay control programs set up by users with programmable relays. “**default.rly**” is used whenever **target** is invoked.

2. ACM Functional Sub-systems

The ACM can be broken down into 3 major sub-systems. These are the sample flow system, the FTIR bench, and the computer system. Additionally, there are remote devices and alarm relay panels that can be used with the system as facility interfaces.

2.1 Sample Flow System

The **sample flow system** is composed of a series of tubes and valves. These control the delivery of sample air from the area being monitored to the sample cell. The sample is locked in the cell and then analyzed. After analysis, the cell is evacuated and the sample is exhausted. A bypass valve allows air from the next programmed monitoring area to be drawn through its tube during the analysis period for the current area. In this way, a fresh sample is always available for monitoring.

Every two hours, a background spectrum is taken. This involves filling the sample cell with zero gas (typically dry nitrogen). The background spectrum is used as a reference. The background function can also be performed on demand, but this is rarely necessary.

2.2 FTIR Bench

The **FTIR bench** is the instrument that obtains the infrared spectrum of the sample. IR source light is manipulated using a Michelson type interferometer. The IR beam is then passed through a window in the bench. A series of mirrors reflects the beam into the sample cell, where specific frequencies of the IR are absorbed. The beam, after traveling a fixed distance through the cell (typically 10 meters), then exits the cell. A second series of mirrors focuses the beam on the detector element. The detector produces a voltage proportional to the signal strength of the IR beam. This signal, called an interferogram, is then digitized and sent to the computer.

2.3 Computer, Display, and Keyboard

The **computer** receives the interferogram and converts it into an IR sample spectrum using a Fourier transform routine. The sample spectrum is then mathematically compared to the background spectrum generating an IR absorbance spectrum. Absorbance lines reveal the presence of chemical components in the sample. By analyzing the position and height of these absorbance lines, any chemicals in the chosen **method** (gas list) can be identified and quantified. The concentration of a selected gases are then reported on the display and a status for the gas is determined according to warn and alarm levels set by the user. If a concentration exceeds these levels, appropriate relays are triggered. The computer can be configured to store the absorbance and background spectra to disk. In order to save disk space, sample spectra can be stored under various conditions, typically only when a warn or alarm level is detected. These stored spectra are useful for data archiving or for identifying unknown gasses (requires sending the disk to TeLoSense). A keyboard and display are provided with the unit to allow for local user interfacing.

2.4 Alarm Relays

Various **alarm relay** options are available with the ACM. Power On, Malfunction, General Warn Level, and General Alarm Level relays are standard, and user programmable relays are usually added to the system. These relays can be wired to external lights and horns which serve to alert personnel in various parts of the facility that a gas leak has been detected.

2.5 Remote Terminal and Printers

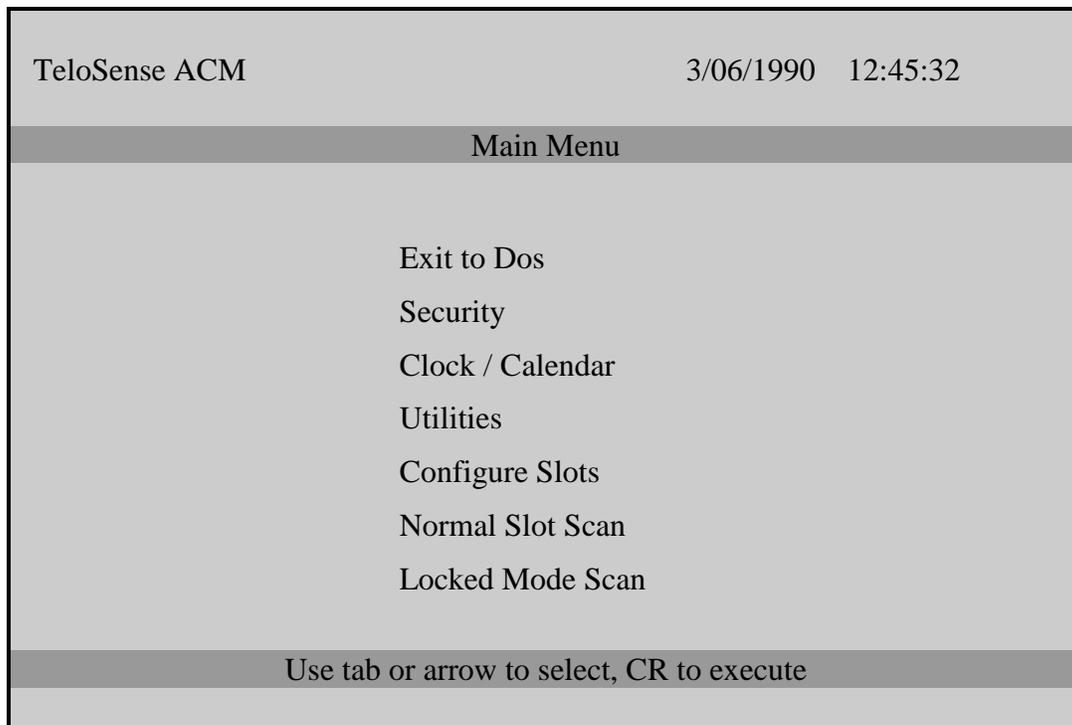
A **local or remote printer** can be used for generating hard copy reports from the ACM. The printer can be configured to output scan reports under various conditions, typically only when warn or alarm conditions occur. Shift summary reports can also be printed if desired. A **remote terminal** can also be added to an ACM giving a user control of the equipment at a location away from the instrument. Other interface options include communications through an **RS-232 port** (for use with a PLC, for instance), **and Local Area Networking (LAN)** for interfacing with other AT based monitors and computers. The LAN option also allows the hook-up of a modem for off-site control and reporting.

ACM Software

ACM operation is controlled by an executable program called **target** (target.exe). All the necessary files for running the ACM including target.exe are contained in the DOS directory C:\ACMDATA (unless the directory has been renamed by the user). When the system is powered up or reset, the computer automatically invokes target and the unit begins its user programmed scan sequence. To enter the main menu of target from the normal scanning mode, hit the escape (Esc) key.

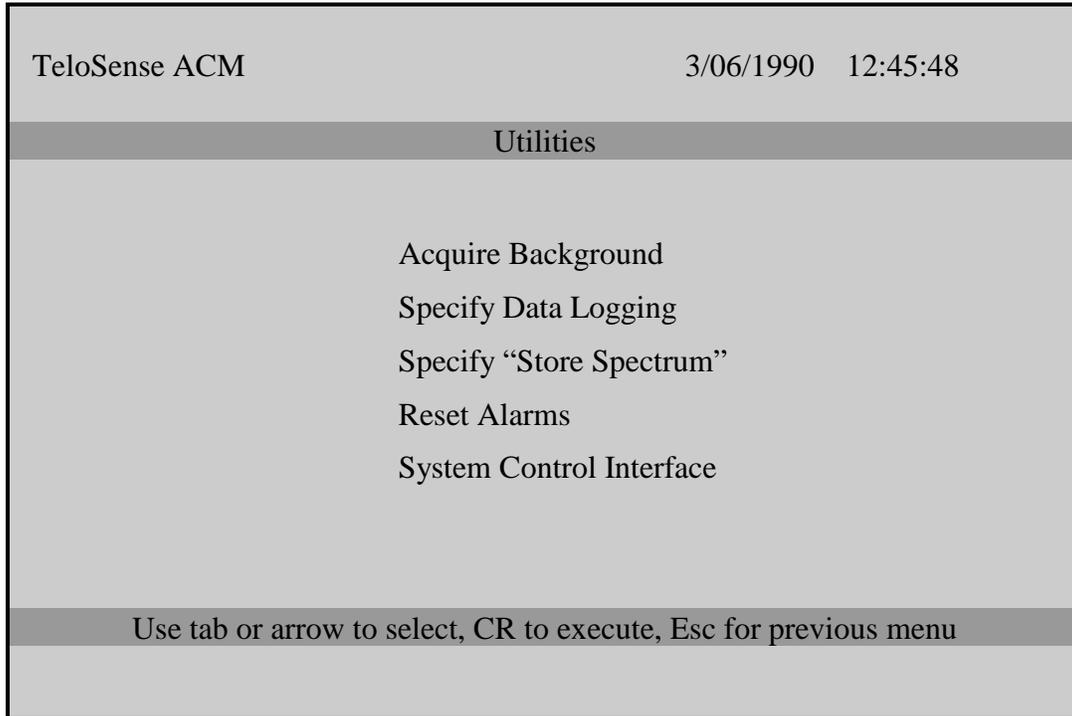
3.1 Main Menu

The **Main Menu** of target allows the ACM operator to select different operation modes and to modify some of the ACM's operation parameters. The Main Menu of target looks like this:



- **Exit to Dos** will terminate the target routine and bring up the dos prompt (C:\ACMDATA>).
- **Security** is used to enable and disable the security function, as well as to change the security password. If the security function is enabled, personnel without the password will only be able to select the Normal Slot Scan and Locked Mode Scan functions.
- **Clock / Calendar** allows the user to set the current time and date.

- **Utilities** contains a sub-menu with several selections. The utilities menu looks like this:



- **Acquire Background** is used to obtain a background spectrum. Because this is done automatically every two hours, this function is rarely necessary.
- **Specify Data Logging** allows the user to configure the printer. There are three choices available for printing scan messages. **Print all Scan Messages** will print a report for every scan. **Print only if changes occur** will print a report whenever a scanned slot has a change in concentration value for any of the gasses it is programmed to detect. **Print if WARN/ALARM condition** will print a scan report if a programmed gas is detected above the warn or alarm set points programmed for the slot. It is also possible to select **Disable printing of Scan Results**. Two other selections allow for a diagnostic printout to be either enabled or disabled. The diagnostic printout should always be disabled, as this provides unintelligible information for the user.
- **Specify "Store Spectrum"** allows the user to determine how background spectra and scan spectra will be saved to disk. Here, again, there are several choices. **Store last Spectrum** and **Store last background** can be used to store the spectrum from the last slot scanned or the last background obtained. **Enable periodic Background storage** allows the last background to be stored, while overwriting the previous one. This is normally selected. The final four choices allow the user to select the conditions under which spectra from slot scans are stored. Slot spectra are typically stored on the b: floppy drive. They are stored using a hex coded time / date stamp for a file name with ".spc" as the file extension. (The time stamp is the number of seconds since Jan 1, 1980, in hex.) **Store Spectrum for all scans** will store spectra for every slot scanned. **Store Spectrum only if**

changes will store the spectrum only if a slot shows a change in concentration for any of the gases it is programmed to detect. **Store Spectrum if Warn/Alarm only** will store the spectrum only if a programmed gas is detected above the warn or alarm set points for the slot. It is also possible to select **Disable Spectrum Storage**.

- **Reset Alarms** is used to reset latched relays. This function operates on all general and programmable relays.

The final selection in the Utilities sub-menu is **System Control Interface**. Because this function is used to specify the locations and control of remote and local peripheral equipment, it is not covered in this training.

- **Configure Slots** is used to prepare, save, and load the slot and relay programs used by the ACM. Because this programming is only necessary for system administrators, it is not covered in this training.
- **Normal Slot Scan**, the next choice in the main menu, is used to initiate normal monitoring of the programmed slot sequence. This is the default operating mode of the ACM. Within this mode it is also possible to perform a Demand Scan. This is accomplished by hitting the D key on the keyboard. The ACM will put a Request Acknowledged message and will then prompt the user for the **Area** to be scanned. Once the Area number has been entered, the ACM will scan all slots configured for that Area. A printed scan report of each slot will be generated (regardless of the gas concentrations) and the spectrum from each slot will be saved to disk. After completing the Demand Scan for the requested Area, the ACM will return to its normal slot scan. To leave the Normal Slot Scan mode, the user must hit the Esc key.
- **Locked Mode Scan** is used to monitor a single slot for a sustained period. When selected, the user is prompted to enter the **slot** number desired. A demand scan can also be performed in this mode, and the Esc key will return the user to the main menu.

3.2 System Boot Sequence

The ACM computer contains an autoexec.bat program which is automatically executed on system startup or whenever the computer is reset. This program will initiate Target software using the **default.slt** and **default.rly** configurations. It should be remembered that whenever a user is unsure how to return to the normal monitoring mode, “soft booting” the computer is probably the best way. To perform a soft boot, simultaneously hold down the Ctrl, Alt, and Delete keys.

4. ACM Displays and Printouts

The **ACM Displays** slot information upon the completion of each scan. Similar displays are generated in the locked mode, in normal slot scan mode, or when performing a demand scan. Upon completion of a subsequent scan, the display will immediately update. In order to preserve the scan information, printouts can be requested. (Printouts can be induced under various conditions as described above). Additionally, shift summary reports can be generated giving information for each slot with overall results and time weighted averages, as well.

4.1 Slot Scan Displays

The ACM **slot scan display** looks like this:

TeloSense ACM #1		3/06/1990		12:45:48	
Normal Slot Scan					
Slot # 14	Name : Breathing Zone #4	ZPD value	= -17486		
Areas : 4		ZPD location	= 4096		
Method : TELOS.MTH 5 * 20		setpoint			
Component Name	Value	Warn	Alarm	Units	Status
2. Hydrochloric Acid, HCl	0	3	5	ppm	OK
5. Ammonia, NH ₃	28	12	25	ppm	ALARM
6. Acetone	0	375	750	ppm	OK
Push ESC for Main Menu; D for demand scan					

As can be seen, the slot scan display includes a header, slot information, and slot scan data. The header consists of equipment identification and the date and time of the scan. This is followed by the mode of scan (i.e., Normal Slot Scan, Locked Mode Scan, or Fast Track Demand Scan). Below the header is the slot information containing the slot number, the slot name, and the area monitored. Two other items, the ZPD value and the ZPD location give provide information about the FTIR bench. These readings should be ignored.

The slot data is then given in a table format. The rows of the table contain the results for each gas monitored in the slot. The name and number of the gas as it appears in the method is followed by the concentration value detected in the sample. The WARN and ALARM set points are also

listed with their appropriate units as well (e.g., PPM). The final data given in each row is the gas status for the slot. This reflects whether the set points have been exceeded.

4.2 Slot Scan Printouts

Slot scan printouts are identical to their respective displays (see 4.1). Because each line printed in the scan takes a full page width to print (i.e., no margins), printer paper must be loaded so that the print head will start printing at the very left edge of the paper.

4.3 Shift Summary Reports

Shift summary reports can be generated for eight hour shift intervals. The information in these reports is broken down into two formats. The first format, titled SHIFT SUMMARY REPORT, prints a list of the gases monitored. Printed with each gas are the number of samples scanned for the gas, an eight hour TWA (time weighted average), the highest concentration detected, the time and status of the highest reading, the area, and the slot number. The second format, titled 8 HOUR AVERAGES, generates a separate report for each slot. These reports include the same information as the first, but also include the WARN and ALARM set points for each gas.

Reports can also be generated from disk using the **rptgen.exe** program in the UTILS directory. Using this function, data from the shift summary reports can either be directly printed or can be converted into Excel format for use with spreadsheet operations. Shift summary reporting must be set up in the config.dat file as specified in the ACM user manual.