Honeywell

Universal Station Specification and Technical Data

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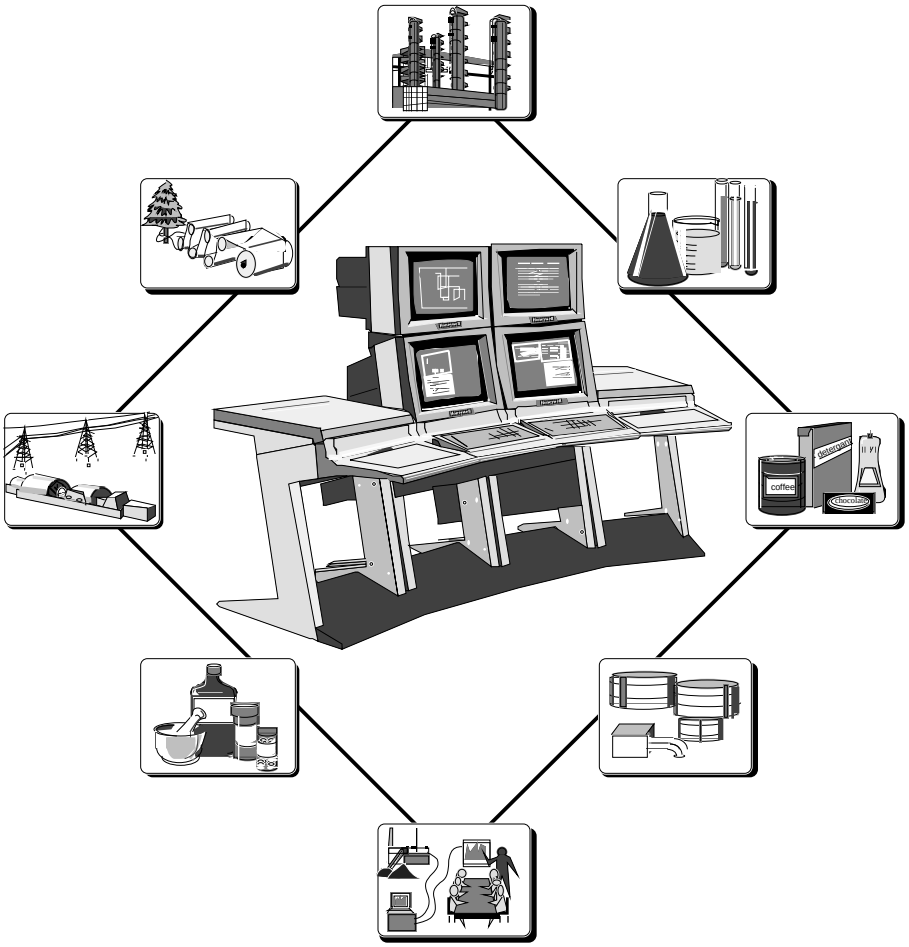

Total Plant

TDC 3000X Universal Station Specification and Technical Data

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Introduction

This publication defines the significant functions of the TDC 3000X Universal Station, which is the primary human interface in the TDC 3000X system.

The Universal Station (US) is one of the modules on the Local Control Network (LCN). As Figure 1 indicates, the Universal Station communicates with other modules on its own LCN, with modules on remote LCNs through the Network Gateway, with process-connected devices on Universal Control Networks by way of the Network Interface Module, and with

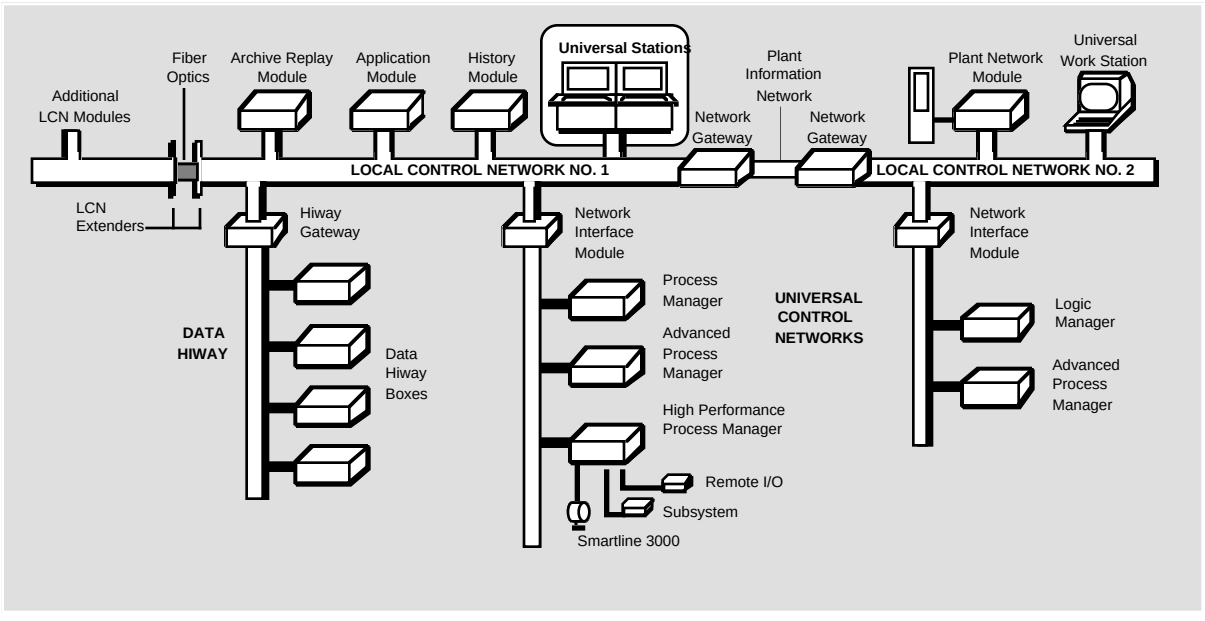

Figure 1 — TDC 3000X Architecture with Universal Stations

process-connected boxes on the Data Hiways by way of the Hiway Gateway.

The Universal Station, shown joined with a peripheral table in Figure 2, provides comprehensive facilities for the process operator, process engineer, and maintenance technician by providing them with a **universal window** to the process and system so each particular function can be accomplished. By having the operating, engineering, and maintenance functions available from a universal window, the Universal Station is capable of meeting the needs of the three primary users:

- **For the process operator**, the Universal Station provides a universal window to monitor and manipulate the process and system in real time, and to retrieve historical data.
- **For the process engineer**, the Universal Station provides a universal window to configure the system database, build graphic displays, and prepare Control Language (CL) programs.
- **For the maintenance technician**, the Universal Station provides a universal window to monitor system performance and to diagnose system failures.

Universal Stations and associated peripheral devices can be grouped together to form an integrated Operator Console. The console provides a comfortable, friendly work station that ensures maximum efficiency and minimum user fatigue. Regardless of the number of Universal Stations in an Operator Console, and the mix of options chosen, the operating procedures for the system remain the same.

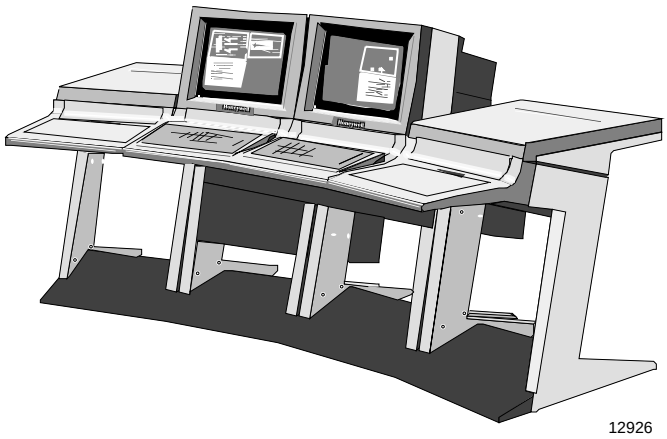

Figure 2 — Universal Station

Functional Description

The following are the major functions of the Universal Station:

- For the **process operator**;
  - Monitor and manipulate both continuous and discontinuous processes or portions of a process, using standard displays or custom graphic displays.
  - Annunciate and handle process, sequence, and system alarms and operator messages.
  - Display files.
  - Display and print process histories, trends, and averages.
  - Display and print reports, logs, and journals.
  - Monitor and change status of system equipment in the control room and near the process.
  - Load other system modules with operating software and databases from a History Module, cartridges, or floppy diskettes.
- For the **process engineer**;
  - Build the process and system database, graphic displays, and reports.
  - Prepare, edit, and compile Control Language programs.
  - Load operating software and databases from a History Module, cartridges, or floppy diskettes.
  - Load Honeywell-supplied software updates.
- For the **maintenance technician**;
  - Diagnose problems in the LCN-based modules, Universal Control Networks, Data Hiways, and process-connected devices.
  - Display and print relevant information that is required during troubleshooting.
  - Display and print system hardware information; for example, board revision numbers.

Communicating with the Process and the System

The process operator, process engineer, and maintenance technician can communicate with the process and the system. They can view the displays and make entries by using a keyboard or by selecting a target on the screen, depending on the operation that is to be performed.

The Universal Station displays are designed to present information to the user in the best possible way. A combination of techniques, ranging from traditional bar graphs to contemporary pattern-recognition designs, is used to accomplish this goal. Many displays have both dynamic and interactive areas. Dynamic areas contain information that is periodically updated or have graphic elements whose attributes may vary with the associated process values. For example, the color of a numeric or bar representation of a process value on a graphic display may change to red when the value reaches an alarm condition. Interactive areas accept entries from the keyboard or from targets on the display.

All displays except the user-built displays, where the user defines the data organization and display interrelationships, are standard displays that have predefined formats and interrelationships. The standard displays available for each type of user differ, because information needs are not the same. Operators, for example, need displays that help to monitor and control the area of the process that each one is responsible for. Engineers, on the other hand, need displays that help to build graphic displays and construct reports. Maintenance technicians need displays that are a guide through the diagnosis of a problem. Figure 3 shows the types of displays that are available at the Universal Station.

In general, there are three ways to call up a display:

1. Use preassigned keys on the keyboard,
2. Use user-configured keys on the keyboard,
3. Select a target on another display.

A number of keys on the Operator's Keyboard and the Engineer's Keyboard directly call up displays. Some keys call up displays that are independent of what currently appears on the screen; others call up displays that are associated with the current display. A minimum number of keystrokes is required to call up a display. Frequently used displays can be assigned to one of the user-defined function buttons on the Operator's Keyboard, so they can be called up with a single keystroke.

The cross-screen invocation feature of the Operator Console allows the user to call up various displays on the Universal Stations from any one keyboard and to move a display from one Universal Station to another in the same console.

Entries can be made through the Operator's Keyboard or Engineer's Keyboard, depending on the function that is to be performed.

Optional peripherals such as the cartridge drive, printer, trackball, mouse, touchscreen, and Trend-Pen Recorders allow the user to perform functions that are related to the process and the system.

Cartridge drives are used to load LCN modules with databases, to load operators' and engineers'

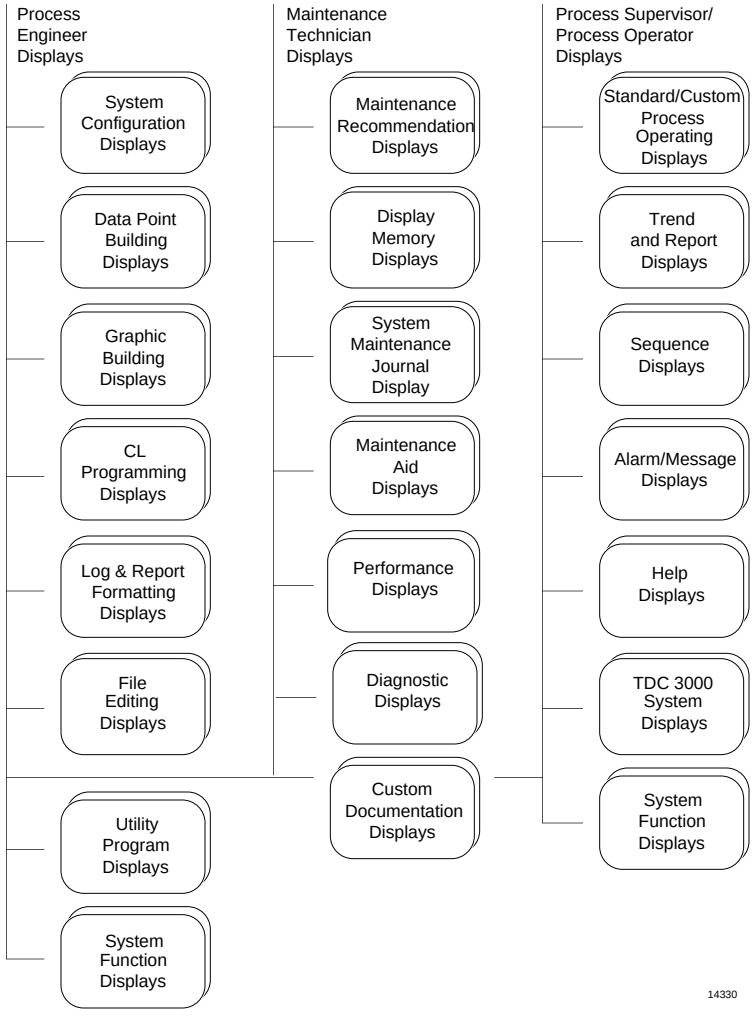

Figure 3 — Displays Available for Each Type of User

software into Universal Stations, to load Honeywell-supplied software updates, and to save data generated by the process engineer and by the system itself.

The printer can be used to print copies of logs, reports, files, trends, journals, displays, and records of process, system, and sequence alarms. The printer also provides full-graphics screen copies for the station to which it is connected.

Trend-Pen Recorders can provide a printed copy of continuous real-time trending for selected process variables.

The mouse, trackball, and touchscreen provide a convenient means of quickly repositioning the cursor on the CRT screen for selecting and activating targets.

Operational Security

Access to Universal Station functions is restricted by a keyswitch. Three levels of access are determined by the type of key inserted and the keyswitch position as follows:

1. **Operator Level** — permits a process operator to monitor and manipulate process parameters during normal operation, but does not permit changes to sensitive process parameters.
2. **Supervisor Level** — permits authorized personnel to alter certain configured process parameters and also permits all functions allowed at the Operator Level.

3. **Engineer Level** — permits a process engineer to perform all the process and system functions.

A fourth level of access (view only) can be configured. This level of access can call up displays to monitor the process and the system, but does not permit any data entry.

Over 30 functions are configurable into 1 of the 3 primary levels of access described above. This includes such functions as the following:

- Save and restore databases of process-connected devices.
- Load the database of an LCN module.
- Start up and shut down LCN modules.
- Enable/Disable history collection.

Another security check occurs whenever a process operator makes an entry. The system checks each entry to make sure it is the right type (alpha, numeric, etc.) and conditions are correct for the operation. If the entry is invalid, an audible error tone is generated and an appropriate error message is displayed in the operator-error field of the screen.

Process Operating Functions

The process operator has access to all data needed for normal operation of the process, at several levels of detail. This data, on current and past continuous and discontinuous processes, is gathered from system sources.

The displays available to the process operator range from a broad overview to the most detailed information at the data-point level.

Using graphic displays, standard operating displays, and alarm displays, the operator can efficiently monitor and manipulate the entire assigned area (that portion of the process plant controlled by that operator). Process-history functions such as logs and trends are also available.

The displays available to the operators can logically be divided into three major categories as described below. Displays belonging to these categories are discussed in detail on the following pages.

Plant Process displays, which are concerned with monitoring and controlling of the process, allow the operator to do the following:

- Monitor and control continuous and discontinuous processes.
- Change process parameters, control modes, sequence-execution states, and sequence-execution modes.
- Monitor process trends.
- Handle process alarms, sequence alarms, and operator messages.

TDC 3000^X system displays, which are associated with the performance of the TDC 3000^X system hardware and software, allow the operator to do the following:

- Observe the status of LCN modules (including other Universal Stations), Universal Control Networks, Data Hiways, and process-connected devices.
- Reassign Universal Stations, areas, units, and peripherals.
- Load databases of LCN modules and process-connected devices.
- Handle system alarms.
- Initiate on-demand checkpointing.

System function displays allow the operator to do the following:

- Select reports and histories for viewing and printing.
- Review data-point assignments of modules, process-connected devices, and units.
- Review titles of displays, reports, and logs.

- Perform Overview and Group edit functions.
- Initiate other system functions.

Plant Process Displays

The hierarchy of the process display types is shown in Figure 4. Included are Honeywell-provided standard displays as well as user-built graphic displays. These displays provide information to the process operator and permit changes to parameters in the process area for which the operator is responsible. The terms area, unit, group, and detail refer to increasing levels of detail as follows:

- **Area Displays** summarize the operating condition and trends of the data points that make up the area assigned to the station.
- **Unit Displays** summarize the operating condition and trends of the discontinuous and continuous operations in the units (subdivisions of areas) assigned to the current area.
- **Group Displays** show values and status for up to 8 data points that form a group, display trends within the group, or present status and sequence information for process modules.
- **Detail Displays** present all of the operating parameters and limits for individual data points and process modules.

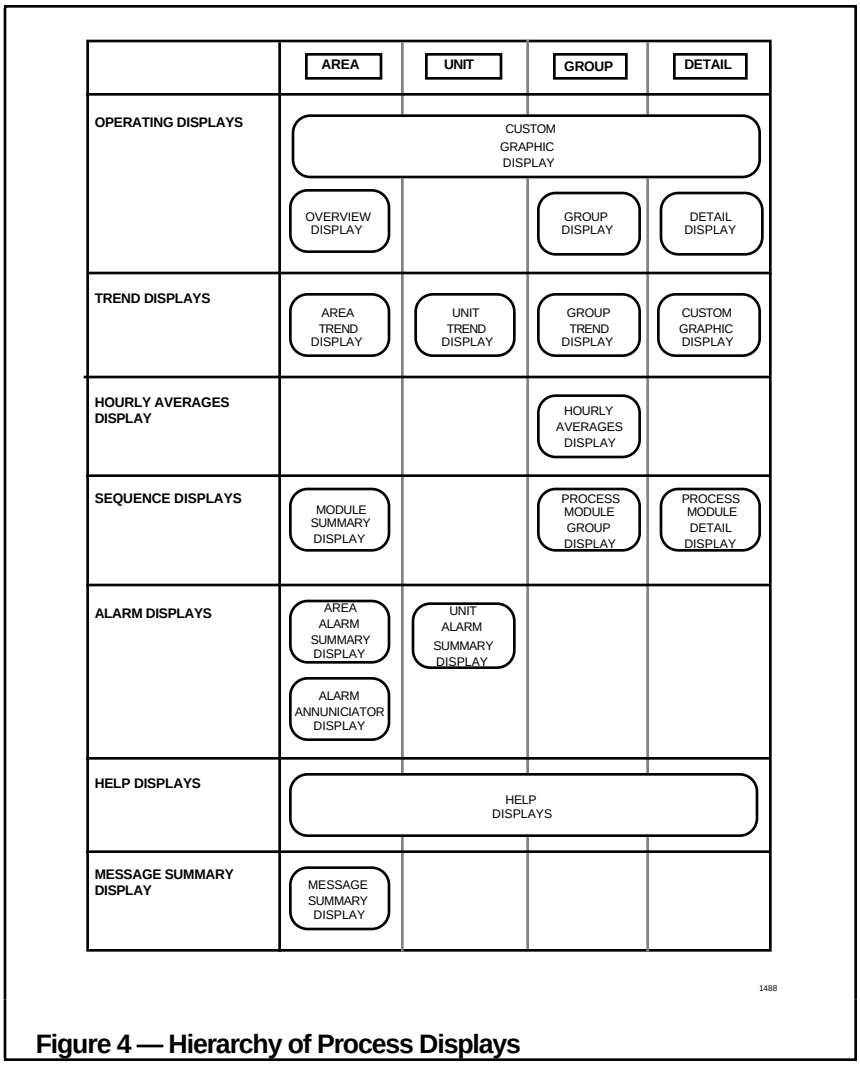

Figure 4 — Hierarchy of Process Displays

Operating Displays

The primary operating displays include the Group, Detail, and user-built Graphic Displays. An Overview Display is also available.

Up to 400 operating **Group Displays** can be defined, each of which can contain parameters and action targets for up to 8 data points. A given data point can appear in any number of groups. See Figure 5.

The **Detail Display** presents detailed information for a single data point (Figure 6).

Perhaps the most powerful of all operating displays are the **Custom Graphic Displays** (Figures 7 and 8), which are designed by the user and, therefore, can be based on concepts and practices that are unique to the user's plant. They can contain graphic, textual, behavioral, and trend information and represent a whole area, a unit, or a single point. Graphics can be linked to many of the standard process displays and can themselves have targets that allow cursor selection of other graphics or standard displays.

They can be used to make changes in process parameters, they can be used for control, and alarms can be displayed in a variety of ways. Because they can be stored on History Modules, cartridge disks, and floppy disks as well as in Universal Station memory, the total number of Graphic Displays that are available to the operator can be virtually unlimited. In addition, Graphic Displays can be duplicated on separate HMs, providing disk redundancy for critical displays.

The Group and Detail Displays show parameters and permit operator actions. The Group Display shows information for up to 8 points.

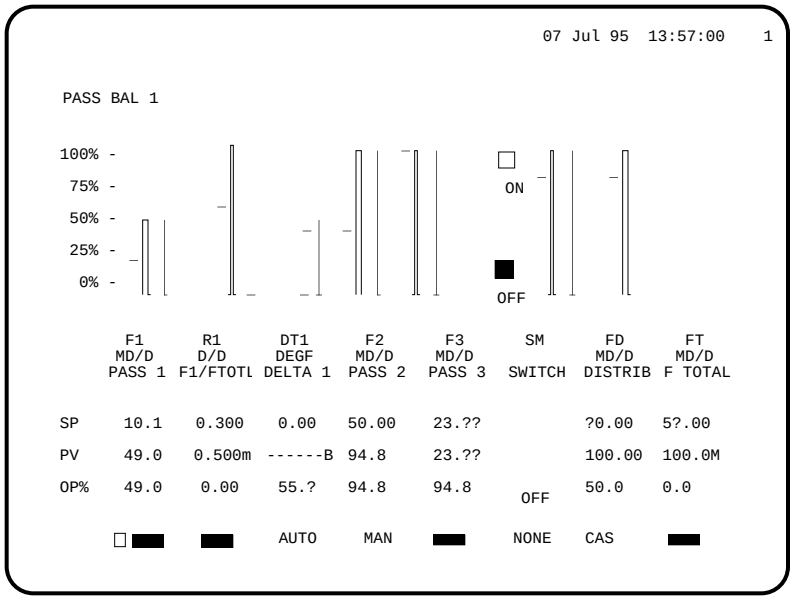

Figure 5 — Group Display

The Detail Displays show more detailed information for a single data point or process module than is available on the Group Display. A Detail Display may consist of several pages of information.

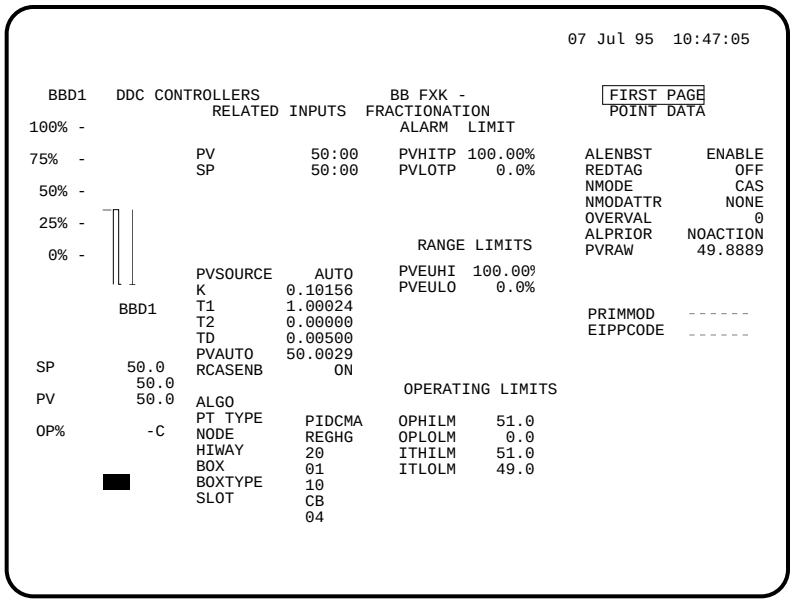

Figure 6 — Detail Display

Graphic displays can be built so that the operator can monitor and manipulate the process directly from them. Both continuous and discontinuous processes can be managed from graphic displays. Basically, any data point parameter or sequence can be monitored and manipulated from any graphic display.

Graphic behaviors such as blinking, color changes, bar graphs, appearance of subpictures, and numeric values can be controlled by parameters of data points. Additionally, process alarms can be acknowledged from graphic displays.

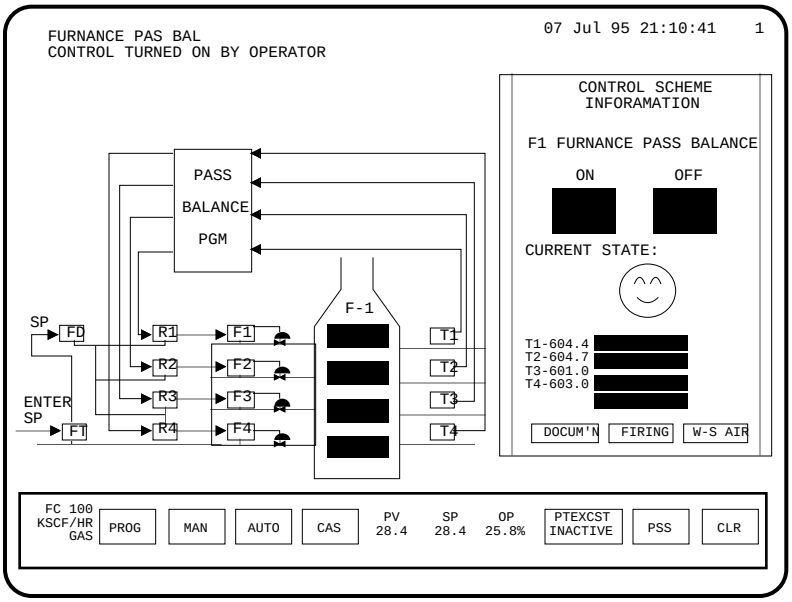

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Figure 7 — Graphic Display

The ability to bring another live display into a designated area within an existing graphic display is another convenient feature available for use on graphic displays. These process-related displays can include key information such as trends, process curves, batch totals, recipes, averages, operator messages, alarm handling information, and efficiency calculations. This feature allows the operator to bring up this other process-related data without switching to another graphic. The Trend Display in the illustration at the right is such an overlay and can be deleted by the operator at will.

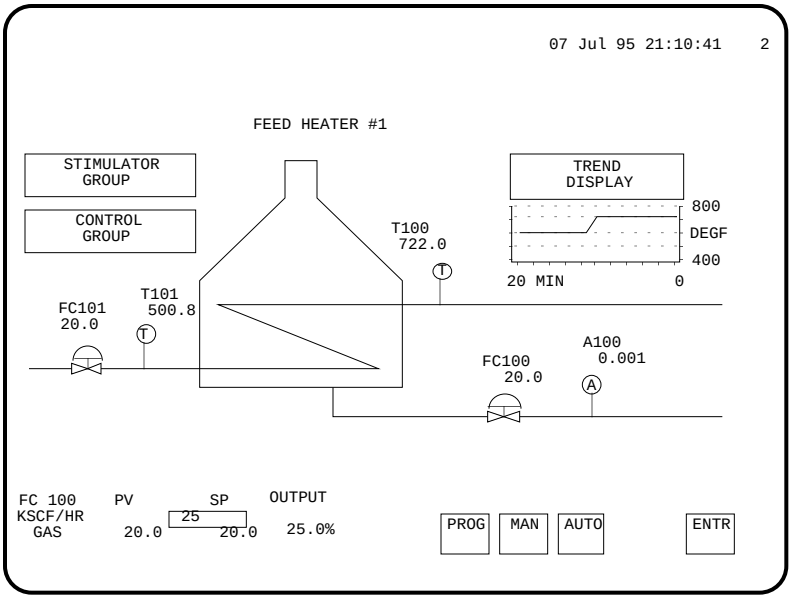

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Figure 8 — Graphic Display with Trend Overlay

The **Overview Display**, while not required for running the system, can be useful for some applications. It presents information in condensed form for any combination of up to 36 operating groups. Analog data points are represented as vertical lines, the length and direction of which indicate the polarity and magnitude of deviation from the desired operating values. For counter-input points, the current mode of the counter is shown, and for digital points an indication is present only when in alarm.

Trend Displays

Trend Displays augment the operating displays by graphically presenting the recent history of key operating variables in trace form. The Area and Unit Trend displays (see Figure 9) are nearly identical in appearance, each showing the history of up to 24 parameters that have been specified by the process engineer during system configuration. Group trends (Figure 10) for up to 8 parameters can be displayed or printed as continuous trends or trend history over a user-specified time period. The Group Display trends have many useful operator control features, including eight time-window selections (X-axis), automatic data source selection, history time-window step-back, and Y-axis scaling.

Hourly Averages Display

Like the Group Trend, the Hourly Averages Display (Figure 11) is directly associated with each Group Display. It provides a list of process variable averages for all points in the group on display when the request is made.

Sequence Displays

The operator can use the Module Summary Display, the Process Module Group Display, and the Process Module Detail Display to monitor and manipulate Control Language sequence programs that execute in the process modules. The Module Summary Display is a multipage display that summarizes the current status of process modules and sequences for up to 105 process modules. The Process Module Group Display is the primary way the operator can manipulate the sequences associated with the process module and change the status and parameters related to a process module. The operator can also view, acknowledge, and confirm messages from those sequences.

The Process Module Detail Display is a multipage display of status and sequence information for a particular process module. Page 1 of the display also lists predefined messages for the operator, which are issued by the sequence program. Other parameters, status indicators, and process-connected device variables such as flags, numerics, and timers can be changed from the remaining pages of the display. Control Language programs, which contain the primary and secondary sequences, can be loaded into the system by using a separate page of this display.

The Area Trend and Unit Trend Displays present historical data for process variables (PVs) of up to 24 analog data points. These displays contain 12 sets of axes; each set of axes shows 1 or 2 trends. When two trends appear on one set of axes, the trends are shown in different colors. The time bases can be configured for 2 hours or 8 hours.

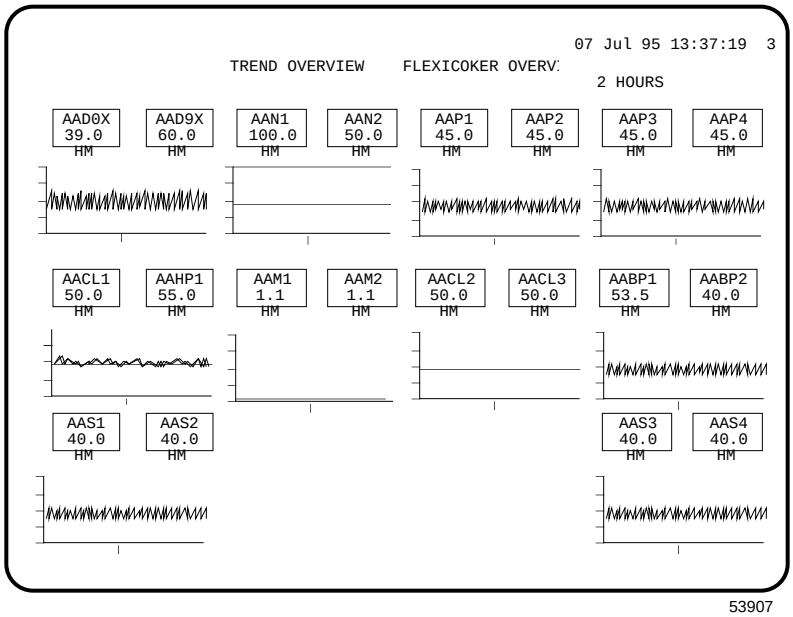

Figure 9 — Area Trend Display

The Group Trend Display replaces the bar-chart portion of the Group Display when the operator selects the trend function from the Group Display. The group trend portion initially presents historical data for up to eight PVs in the group, then continually updates the traces from the right margin. These trends are shown on one or two axes of up to four trends each. Each trend is shown in a different color. Operator control of trends include:

- Eight time-window (X-axis) selections
- Automatic data source selection with source indication
- Manual source change for each trace
- Time window step-back/forward through available history
- Variable (Y-axis) scaling

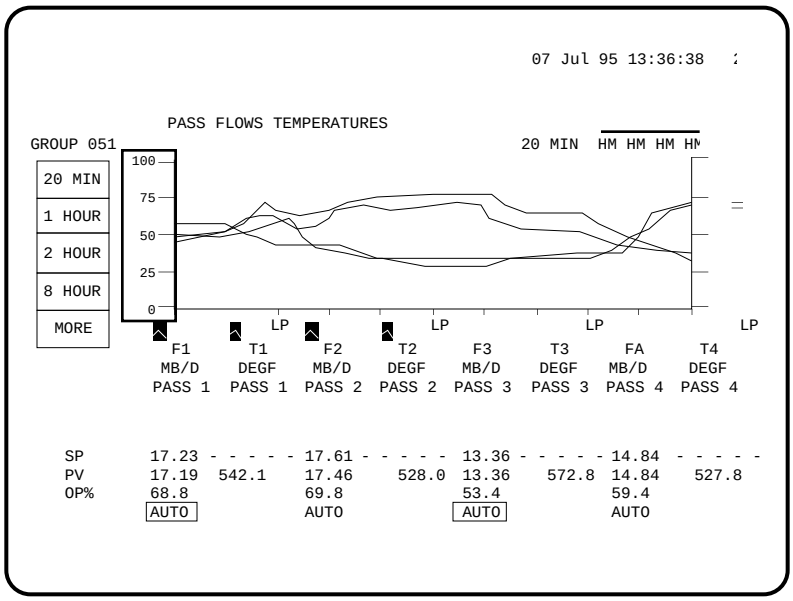

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Figure 10 — Group Trend Display

The Hourly Averages Display, like the Group Trend Display, is called up from a Group Display. The Hourly Averages Display replaces the bar-chart portion of the Group Display with a list of the average PV values for the last 8 hours of each data point on the Group Display.

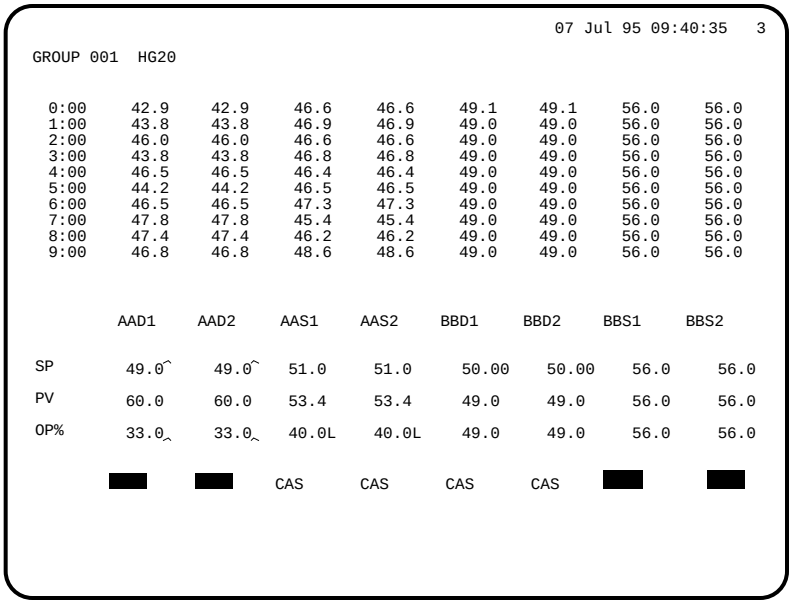

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Figure 11 — Hourly Averages Display

Alarm Displays

Alarm displays are used in conjunction with the alarm-annunciation mechanisms in the Universal Station to notify the operator of alarm conditions that can cause a process upset. The operator is notified of **plant process alarms** (caused by abnormal or important events and conditions in the process) and **TDC 3000X system alarms** (caused by a failure in an LCN module or in a process-connected device).

Process alarm conditions are assigned one of seven priorities as shown in Table 1.

Alarms are collected in the appropriate Unit Alarm Journal in a History Module, if a History Module is present. The number of alarms saved in the History Module is specified by the engineer.

When an alarm occurs, the following takes place:

- The ALARM SUMM key on each Operator's Keyboard in the appropriate console begins to flash. Other keys can be assigned to light, to indicate the unit in which a process alarm occurs. Alarm contacts close to activate one of three external, user-supplied annunciators or other devices.
- The alarm message is stored in the Unit Alarm Journal (if a History Module is present), printed on the assigned printer at the console, and entered (flashing) in the appropriate alarm displays.
- Flashing of an alarm in the displays continues until acknowledged, and the ALARM SUMM key flashes until all alarms have been acknowledged.
- The alarm indications remain until the alarm condition is corrected.

There are three alarm displays available. The **Area Alarm Summary Display** and the **Alarm Annunciator Display** are described in Figures 12 and 13. The **Unit Alarm Summary Display** is similar to the Area Alarm Summary Display and lists up to 100 of the most recent alarms of all priorities for a given unit. The operator can acknowledge alarms and call up other Unit Alarm Summary Displays, from either of these displays, by using the annunciator boxes as targets. There are up to 36 Unit Alarm Summary Displays, 1 for each unit configured.

Help Displays

The Help Display feature allows the user to build displays that provide assistance to the operator. These displays can be assigned to standard process displays and are accessed by the operator by pressing the HELP key. A Help Display can be any of the standard displays or a user-built display that might contain special operating instructions.

Table 1 — Alarm Priorities

Priority Level	Universal Station Action	History Module Action
Emergency	Display and print alarms	Journal
High	Display and print alarms	Journal
Low	Display and print alarms	Journal
Journal	None	Journal
Printer	Print Alarms	None
JNL Print	Print Alarms	Journal
No Action	None	None

Message Summary Display

The operator can observe, acknowledge, and confirm messages issued by the Control Language sequence programs through the Message Summary Display. This display has up to 4 pages and is a listing of the 96 most recent Control Language messages that have been issued to the operator. The listing is in reverse chronological order, with the most recent message at the top of the list. Each message contains a message-status character, the time of the message, a unit identifier, a point identifier, and the message text. The message-status character indicates actions that the operator must perform, such as acknowledge and confirm the message.

TDC 3000X System Displays

The system displays show the assignments and status of the modules on the LCN and the process-connected devices on the UCNs and Data Hiways and provide the means to define and change assignments or change the status. The **System Status Display** (Figure 14) is called up by pressing the **SYST STATS** key. Most other TDC 3000X System Displays can be accessed through targets on this display.

System Status Display

The System Status Display provides detailed status information for each node on the LCN. In addition, the display provides an easy method of loading any combination of LCN nodes as well as loading a pre-configured list of nodes. Support is also provided for customizing the System Status Display. The display can be customized to display one to five pages of information and can also be customized on a console by console basis.

The Area Alarm Summary Display lists up to 100 of the most recent emergency-priority and high-priority alarms that are detected in an area assigned to the Universal Station (which stores up to 600 such alarms). Twenty such alarms can be listed on each of five pages of this display. This display contains options for filtering and sorting by alarm priority, freezing, horn suppression and alarm disabling. In addition, all units assigned to the station are represented at the bottom of the screen by targets for calling up the **Unit** Alarm Summary Displays.

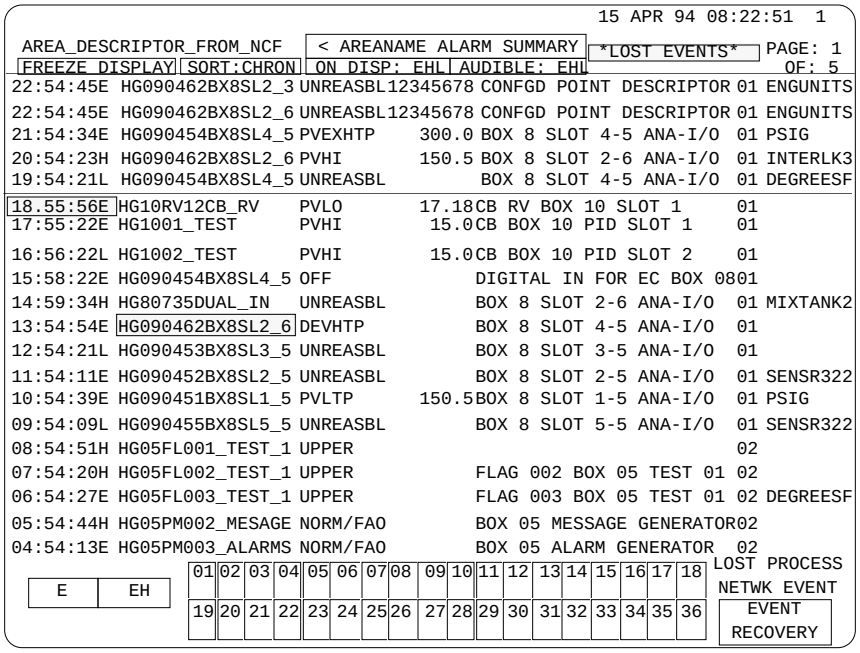

Figure 12 — Area Alarm Summary Display

The Alarm Annunciator Display is a user-configurable display that looks like and operates much like a conventional annunciator panel. This display has 60 annunciator boxes that are used to indicate process alarms on points assigned to the boxes (up to 10 points per box). By using an annunciator box as a target, the user can immediately call for displays associated with an alarm. The display, above the annunciator boxes, also lists the five most recent emergency-priority alarms. In addition, like the Area Alarm Summary Display, there are targets at the bottom of the screen for calling up the Unit Alarm Summary Displays.

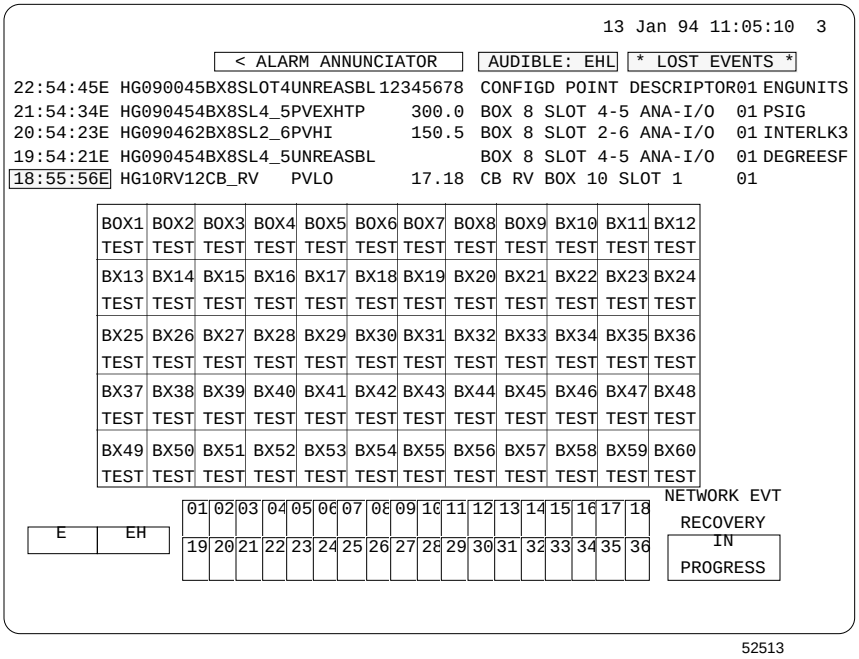

Figure 13 — Alarm Annunciator Display

The System Status Display provides the status of each module on the LCN, including other Operator Consoles, and the status of each Universal Control Network and Data Hiway in the system. This display also acts as a system-display menu by providing targets for accessing all modules and Process Networks. In addition, there are targets on this display for switching from one LCN cable to the other.

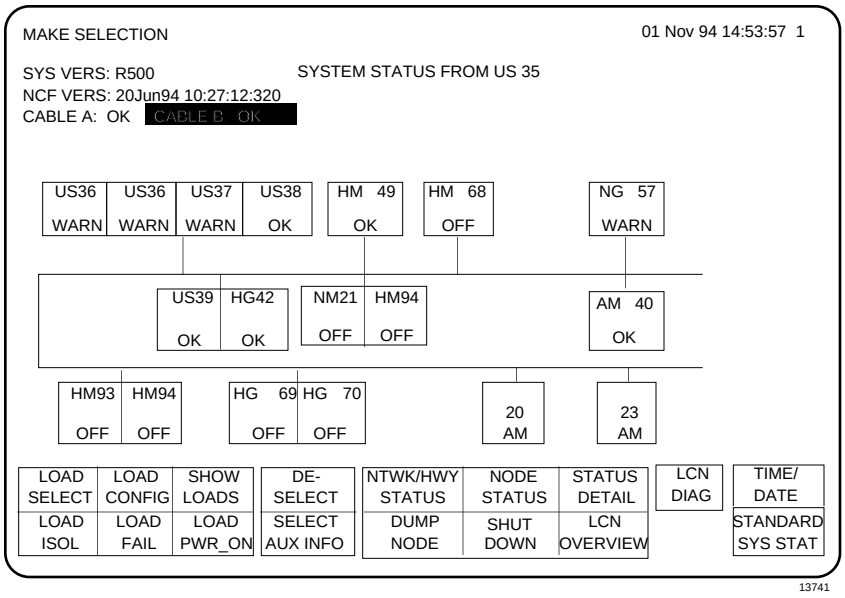

Figure 14 — System Status Display

Console Status and Assignment Display

The current status and assignments of Universal Stations and peripherals at the local console is shown on the Console Status and Assignment Display. It is through this display that station-function changes are initiated. Other functions and data include:

- Universal Station assignments for the local console
- Peripheral-status information for the local console
- Unit assignments
- Maintenance recommendations
- Time and date changes
- Changes to levels of access

Unit Assignment Display

Through the Unit Assignment Display, which is accessed by a target on the Console Status and Assignment Display, the operator can assign process units to the station's process area. Data points in any process unit can be viewed on the screen of any Universal Station in any console, but data points can be manipulated for only units assigned to that station's area. The Unit Assignment Display lists the unit identifier and assignment status for each unit in the assigned area. Alarms can be disabled or inhibited on a unit basis.

LCN Module Status Displays

The operator can monitor and change the status of the modules on the LCN through the module status displays. A status display is provided for each type of LCN module. (As an example, all History Modules in the system are listed on one status display.) Each display lists the module address and current status. From an individual module status display, the operator can restart modules, shut down modules, load another personality, and perform database save/restore functions.

UCN Status and Detail Status Displays

The UCN Status Displays and Detail Status Displays allow the operator to monitor and manipulate Universal Control Networks and process-connected devices, and to monitor the status of the UCNs and devices. A display is provided for each UCN and process-connected device in the system. The **UCN Status Display** shows the current UCN status, the current NIM status, and the current status of all process-connected devices on a selected UCN. The **PM /APM/HPM Status Display** shows the detailed status of a selected Process Manager and its complement of I/O processors.

From these displays, the operator can perform functions such as switching to a backup UCN; issuing commands to process-connected devices; saving/restoring the database of devices; and downline-loading devices.

Hiway Status and Box Status Displays

These displays, while differing in format, perform most of the same functions for the Data Hiways and connected boxes that the UCN Status and Detail Status Displays perform for the UCN.

System Function Displays

The System Menu Display (Figure 15) gives access to four types of System Function Displays:

- Organizational Summaries
- Reporting Functions
- Overview and Group Edit Functions
- System Functions

Organizational Summary Displays

Organizational Summary Displays, accessed through the Organizational Summary Menu, allow the operator to easily determine data point assignments, data point use, and title assignments as described in the following paragraphs.

Unit Point Summary

The Unit Point Summary Display is a listing of the data points in a unit. The listing consists of more than one page and includes the hardware locations of the data points.

For each data point, the display lists the point ID, point descriptor, group display number, and hardware location.

Hiway Box Point Summary

This display provides the operator with a listing of all data points in a Data Hiway process-connected box selected by the operator. The data point listing is arranged in slot/subslot order beginning with slot 1, and uses the point ID, point descriptor, unit name, and group display number to describe the data point. A display, which can consist of more than one page, is provided for each process-connected device.

Point Usage List

This display lists the references in the area where the selected data point is used. The references consist of unit assignment, module address, box/slot/subslot address, group displays, trend displays, logs, and printed trends.

Point Attribute Summary

The Point Attribute Summary Display is a menu for selecting one of many displays, each of which is dedicated to an operator selected set of up to 4 data point attributes. Each display is a snapshot of all the data points in a unit or area that have that particular set of attributes (for example, all disabled or inhibited alarms for a unit) at the

The system function displays are accessed through these targets on the System Menu Display. They provide summaries of several types of information about the process-point assignments, event histories and journals, historical data, and reports that are available from the system.

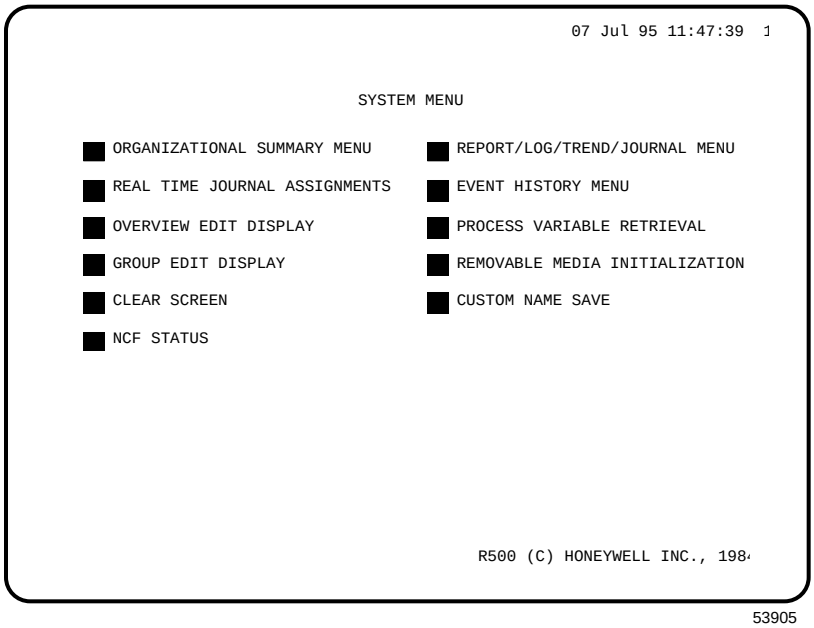

Figure 15 — System Menu

time the operator requests the display.

LCN Node Point Summary

This display provides the operator with a listing of all data points in the selected LCN module. The data point listing contains the point ID, point descriptor, unit name, group display number, and address. A display, which can consist of more than one page, is provided for each LCN module.

UCN Device Point Summary

This display provides the operator with a listing of all data points in a UCN device selected by the operator. The data point listing shows the point ID, point descriptor, unit name, group display number, module, and slot number to describe each data point. A display, which can consist of more than one page, is provided for each device.

UCN Device Module Pt Summary

This display provides the operator with a listing of those data points in a Process Manager's Process Manager Module or I/O Processor selected by the operator. Like the Device Point Summary above, the data-point listing displays the point ID, point descriptor, unit name, group display number, module and slot number to describe the data point. A display is provided for each selected module, and can consist of more than one page.

Title Summary

There are title summary displays for Area, Unit, Group, Unit Trend, and Schematic/FFL titles. A separate display is provided for each title type. The Schematic Title Summary Display lists the titles for those graphic displays stored within the Universal Station memory, and also lists the pathnames (which identify the storage devices) for all files in which graphics are stored.

Reporting Function Displays

These displays allow the operator to print or display a variety of logs and journals as follows.

Report/Log/Trend/Journal Menu

Logs, trends, journals, and reports are accessed from the Report/Log/Trend/Journal/ Menu Display. This display lists logs, journals, printed trends, and reports that have been configured or built for the area assigned to the Universal Station. From this display, the operator can print or display any log, trend, journal, or report and can also change the printer assignment. There can be a combined total of 100 logs, trends, journals, and reports in each area, with a maximum of 1000 points contained in all logs for an area.

A **log** is a set of historical values for a specified set of data-point parameters. Logs can be included in reports or called up individually through the Report Menu Display. If a History Module is present, extended logs consisting of point-PV histories can be printed. If a History Module is not present, basic logs, which consist of a limited number of log types and historical values, are available. Logs can be printed in a vertical format or a horizontal format. In addition, the Free-Format Log Builder can be used to build free-format logs.

PV Trends for up to 8 points can be printed as continuous trends from the Group Display or as trend history over a specified time interval. Historical trends can be included in reports or can be directly called up from the Report/Log/Trend/Journal/ Menu Display.

The types of events that can appear in **journals** are process alarms, operator process changes, operator messages, sequence-of-events, system-status changes, system maintenance recommendations, and system errors. These events can be printed as they occur, can be included in reports, or can be called up from the Report/Log/Trend/Journal/ Menu Display.

A basic **report** can consist of the report-header information and one or more logs, printed trends, or journals. All reports for the area assigned to the console are configured in advance by the process engineer.

Event History Menu

Histories of process-related and system-related events are retrieved through the Event History Menu Display from historized journals. This display allows the operator to call up a history of events such as process alarms, operator process changes, operator messages, system-status changes, system maintenance recommendations, system-error messages, sequence-of-events records, and UCN/hiway device events.

Process Variable Retrieval

Histories of process variables for particular data points can be retrieved through the Process Variable Retrieval Display from historized point-PV data. This display allows the operator to display or print process-variable histories, including the current value or minute data, and hourly, shift, daily, and monthly averages. The lengths of these histories depend on the start/stop times and dates that the operator enters.

Real Time Journal Assignments

The Real Time Journal Assignments Display can be called up to retrieve the listing of all real-

time journal assignments that are configured for the area assigned to the Universal Station. The operator can activate or suspend the real time output of any journal from this display as well as change a journal's print assignment. Each entry in the display lists the journal type and printer identifiers.

Overview and Group Edit Functions

Overview Edit Display

The Overview Edit display has two purposes: First, to show whether the overview information is presented as normal, suppressed, or deleted for all the configured overview display elements. Second, to allow the operator to change the current display state for any or all of the configured overview display elements from this display.

Group Edit Display

From this display, the user can temporarily reconfigure groups within the area known to a console. Group titles can also be changed. The supervisor can change any group, while the operator is permitted to change only 10 free-use groups.

System Functions

Clear Screen

Selection of this target clears the Universal Station screen.

NCF Status

A display showing the operational status of each LCN node is invoked with this target.

Removable Media Initialization

This target selects the function that writes format information on new disk cartridges and floppy diskettes.

Custom Name Save

This target, which appears only when the US keyswitch is in the SUPVR or ENG position, initiates the saving of the system's custom data definitions on the History Module, cartridge disk, or floppy diskette.

Process Engineering Functions

The process engineering software enables the Universal Station to provide a user-friendly environment for the process engineer to build or modify, all or any part of, the database needed by the TDC 3000^X system to meet its established objectives. An Engineer's Keyboard is required. A sophisticated forms-management capability is provided that simplifies information entry. This capability provides easy-to-use, preformatted video-display forms to enter information for the building functions.

A Help facility is available to assist the process engineer as information is entered during the building of system structures such as points, displays, and reports.

The process engineer can do the following engineering-related functions:

- Configure the system database
- Build data points
- Build graphic displays
- Prepare, compile, and link Control Language programs
- Build logs and reports
- Edit files
- Use utility programs
- Call up System Function Displays

Configuring the System

Configuration data entry-related tasks are initiated through the Engineer's Main Menu (Figure 16). This display allows the process engineer to select from several groups of activities when configuring or reconfiguring the system.

1. **Network Configuration** activities include naming units, areas, and consoles; defining modules on the Local Control Network; and allocating space on the History Module for storage of data volumes. Network Configuration establishes places of residence for the data points to be built.
2. **UCN/Hiway Configuration** activities include assigning interface modules to each Universal Control Network and gateways to each Data Hiway, defining the devices on the UCNs and hiways, and defining the types of modules or slots within those devices.
3. **Point Building** activities include defining names and parameters of process data points that are to reside in UCN devices, hiway boxes, Application Modules, and Computer Gateways. Point Building provides data points to be used by system functions that are used to build the process-operations database.
4. **Function** activities include building custom graphics, free format logs, and history groups; specifying actions that function buttons cause; retrieving specified data from system devices and manipulating it for display in a desired format; and using the Area Database activity to configure process areas. Configuring a process area consists of such actions as configuring standard operating displays, assigning logs and reports to printers, and creating an area configuration file. The Area Database activity provides the process operation environment within which the process operator

These engineering-related functions are accessed through the Engineering Personality Main Menu Display, which can be called up from the Engineer's Keyboard at any time if Universal Personality software exists in the Universal Station. Following the selection of a function, the Universal Station provides the process engineer with access to the various features of that function.

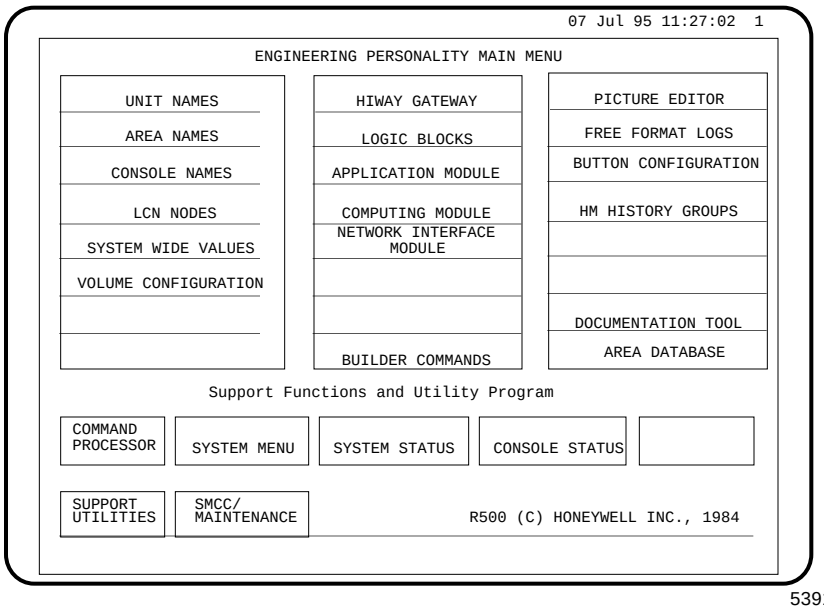

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Figure 16 — Engineer's Main Menu

monitors and manipulates the process.

5. **Support Function** activities support the above groups of activities, as necessary. Support Functions include command processor operations such as copying files, creating program source files, and building CL message libraries; system menu operations such as checking how data points are distributed in the system; system status operations such as checking status of modules; and console status operations such as checking the status of Universal Stations and Universal Work Stations.

The forms-management capability of the Universal Station plays a significant part during configuration by presenting the process engineer with preformatted displays into which configuration information is to be entered. These preformatted displays also list alternative values that can be entered into the form by selecting a target associated with the desired value. In addition, most entries have reasonable default values that can be accepted without further action by the engineer.

Building Data Points

This function uses the Data Entity Builder (DEB) to build, modify, or delete data points. A data point is a database structure used by the system to represent such entities as a physical input or output or a control calculation. The process engineer can select from two modes for building points: in the first mode, the engineer enters the information to build the data points; in the second mode, called *exception building,* data points are automatically built from files that contain previously defined data points, with the engineer entering only the information that differs from that in the original points.

The engineer can also create a template for a data point of a certain type. These templates contain specified default values for the parameters. Once created, users can modify copies of the templates to easily create other data points with slightly different parameters. The back-build feature of the Data Entity Builder is also used to review and modify data points in the system.

Building Graphic Displays

The process engineer uses the display-building function provided by the Picture Editor to create dynamic process-graphic displays. The Picture Editor allows the engineer to create, modify, and delete pictures by working with the picture itself. Thus, the process engineer can quickly and easily build powerful interactive custom displays without resorting to programming languages. The process engineer can use standard characters or addressable dots to build graphic displays. Figure 17 shows the working format provided by the Universal Station through which graphic displays are built.

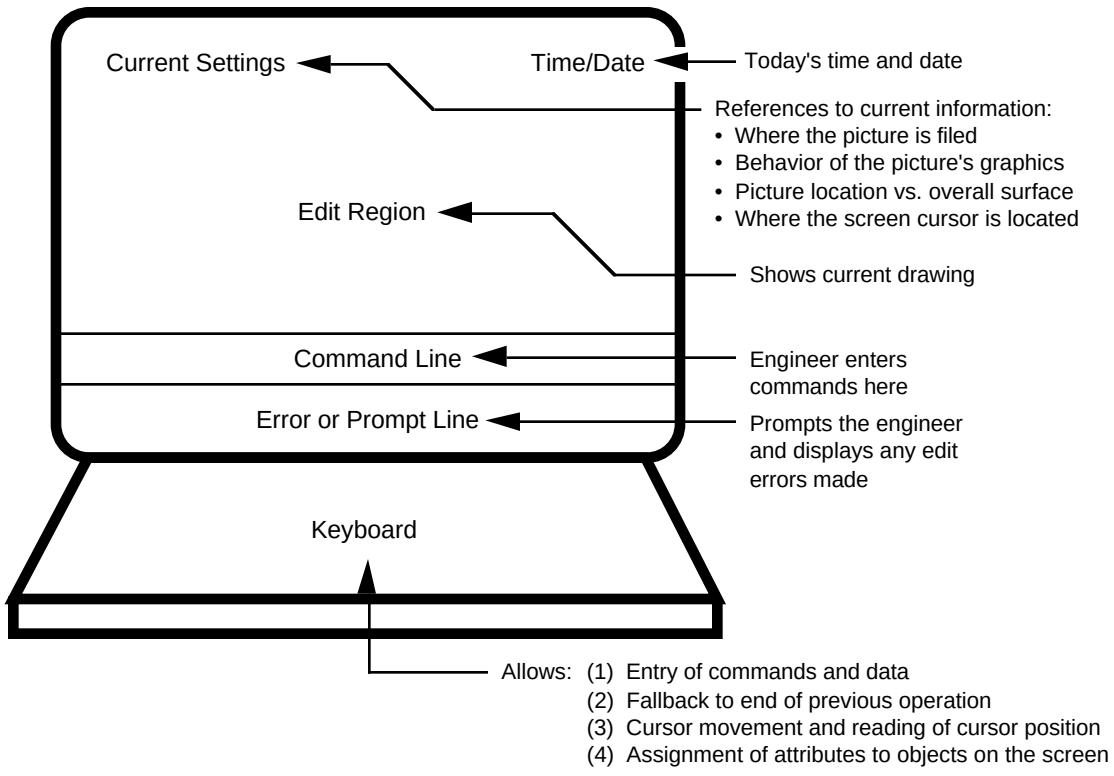

Figure 17 — Working Format for Building Graphic Displays

Key features of the Picture Editor are as follows:

- **Line Drawing**–Lines can be drawn between any two points on the picture. This allows the process engineer to easily build representations of pipes, lines, etc.
- **Polygons**–Realistic representations of plant equipment such as valves, pumps, and vessels can be constructed. Both filled and wire-frame polygons are supported.
- **Display of Process Variables**–The value of a process variable can be represented in numeric form, with textual information such as data-point descriptions.
- **Bar Graphs**–Process variables can be represented as dynamic bar graphs. Both horizontal and vertical bars of any length or width are supported.
- **Behavior of Display Objects**–The color, blinking, and intensity of objects in the display can be controlled, based on the value of the process variable. This allows abnormal conditions in the process to be represented by a corresponding change in a graphic display. For example, a blinking red pump might represent an alarm on that piece of equipment.
- **Subpictures**–Once a picture has been built, it can be added to any other picture as a subpicture. Thus, the process engineer can construct an image of an object such as a pump or valve only one time and quickly add it to a picture. The subpicture can be added to a picture, or many pictures, as required. This eliminates drawing the same subpicture over and over again. The subpicture can be added with its behavior intact, or the process engineer can choose that the subpicture has the same behavior of the picture to which it is added. The process engineer can also modify parts of the subpicture's behavior after it is added to the picture. For some subpictures, the engineer can specify that a particular data point provides the value that is to be displayed. To make the subpicture more flexible, the engineer can add the parameters that are to be

displayed rather than the particular value.

- **Scaling of Graphics**–A graphic can be scaled when it is built or when it is added to a display. A process engineer can build detailed graphics as a large image and later shrink them to the desired size, or modify the size when adding them to a picture. Thus, a subpicture of an often-used item, such as a pump, can be built in one size and added to several displays in different sizes.
- **Interactive Displays**–The touch-target capability of the Universal Station allows the process engineer to create pushbutton keys by drawing them as touch targets on a display. These serve as function keys that call up related displays and allow changes to process variables. The keys are supported by the keyboard and optional touchscreen, mouse, or trackball.

Preparing, Compiling, and Linking Control Language Programs

This function allows the process engineer to use the Universal Station to prepare, compile, and link Control Language (CL) programs. Control Language programs allow the process engineer to define custom-control action in an Application Module (CL/AM), to define sequence programs for a Process Manager (CL/PM), Advanced Process Manager (CL/APM), High Performance Process Manager (CL/HPM), and Multifunction Controller (CL/MC), and to define custom data segments for the Application and Computing Modules.

Control Language is a process-oriented language, designed for process and application engineers. With Control Language, engineers can solve process problems, even if they are not experienced software engineers. Control Language is most beneficial when used to implement small process programs that require unsophisticated calculations. High-level programming languages are used in host computers to implement larger or more complex programs.

The following are some of the features of Control Language:

- Step-oriented sequence structure that consists of primary and secondary sequence programs.
- Process-related language statements such as assignment, control, delay, communication, and termination.
- A set of useful arithmetic, logical, logarithmic, and trigonometric operators.
- Branch-on-condition statements.
- Operator messages.
- A powerful abnormal-condition handling capability.
- Easy ways to establish operator communication.

These features make it easy for a process engineer to translate a process control scheme into a Control Language program. A Control Language Compiler/ Linker is provided in the Universal Station.

The process engineer can also use the Universal Station to test Control Language programs to ensure that the programs are operating properly before linking them to data points that are in service.

Building Logs and Reports

The engineer specifies the content and output schedule for preformatted logs, journals, and printed trends. He also can define specialized log formats by using the Free-Format Log Builder.

Specified logs (both preformatted and free-format), journals, and printed trends can be combined into reports. These reports are scheduled independent of the print frequency for the included items.

Editing Files

This function allows the process engineer to use the Text Editor to build and modify files. It offers screen-editing functions that include copy, move, and character-string search.

Using Utility Programs

The process engineer Universal Station software provides access to utility programs to do the following:

- List volumes and files
- Format/initialize cartridge disks, floppy diskettes and History Module-volume names
- Save/restore files
- Save/restore continuous history
- Copy, verify, delete, print/display, and rename files.
- List the names of items with specified connections to other items in the database.
- Query function for all point data bases.

Calling Up System Function Displays

When the Universal Station is loaded with the Universal Personality software, all operator and engineering functions are accessible at any time. When the universal personality is in use, an operator or supervisor has read-only access to engineering functions, while still being denied change privileges because of the keyswitch lock-out.

Maintenance Functions

When faults occur in a TDC 3000^X system, they are typically isolated by built-in tests and diagnostics

that are executed during startup, restart, and on-process operation. (During on-process operation, the tests and diagnostics are executed in the background mode in each module.) The fault is usually isolated to an optimum replaceable unit (ORU), and a maintenance recommendation is issued. ORUs are replaceable assemblies that provide the best trade-off between the cost of the ORU and the cost of attempting to isolate problems to a smaller part of that ORU.

If a Universal Station is loaded with the Universal Personality software, the System Maintenance Menu (Figure 18) is available. This menu allows the maintenance technician to perform the following functions:

- Call up maintenance recommendation displays
- Call up related displays
- Call error detail of a failed node

Maintenance Recommendation Displays

Through the Maintenance Recommendation Displays, the maintenance technician can review all active maintenance recommendations and related error information.

One of these displays is used to initiate the error collection and analysis cycle of the On Process Analysis (OPA) program that resides in the History Module. During this cycle, the reported errors are correlated according to the devices in which they were detected, and any resulting maintenance recommendations are printed on the Real Time Journal and added to the maintenance journals.

Calling Up Related Displays

In addition to the maintenance recommendation displays, the maintenance specialist can call up related displays to obtain the following information:

- Memory contents of an LCN module.
- Maintenance journal activities selected by combinations of time, event type, and module type or address.
- Memory contents of a selected process-connected device.
- Error history of an LCN module.
- Current revision status of hardware/firmware.

Calling Error Detail of a Failed Node

This display allows the detailed inspection of the last error logged in a failed LCN module's memory, as long as its LCN interface still functions.

Process-Connected Device Status Displays

In addition to those displays available through the System Maintenance Menu, detailed hardware information can be accessed through device status displays, such as a Process Manager Detailed Status Display, a Logic Manager Detailed Status Display, or a Hiway Box Status Display.

The maintenance technician uses the Engineer's Main Menu to call up the System Maintenance Menu Display. The targets on the screen can be used to call up other functions and displays to enable an analysis of system failures to be made.

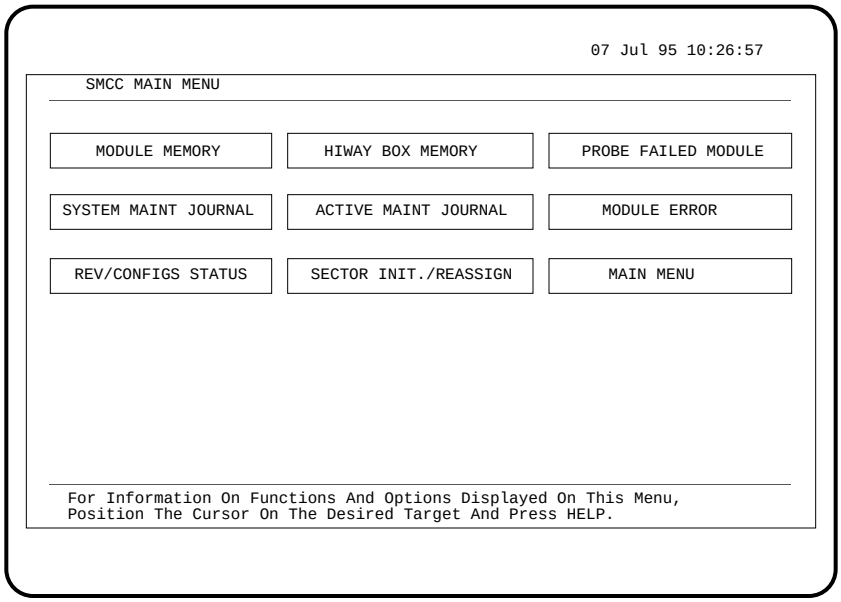

Figure 18 — System Maintenance Menu

Physical Description

The Universal Station is available in two versions. One is a classic designed furniture module (see Figure 19) that encloses a 48 cm (19 in.) high-resolution color CRT, an Operator's Keyboard, and an electronics module. The second version known as the "Ergonomic" version, has updated, ergonomically designed styling and utilizes a 53 cm (21") high resolution CRT (see Figure 20). A number of optional peripherals and accessories are available, as described under Universal Station components .

Universal Station Components

Groups of Universal Stations can be clustered into a TDC 3000X Operator Console, as shown in Figure 19 and with additional CRTs mounted in an upper tier as illustrated in Figure 20.

The Operator Console has been designed as an integrated work place to support all the devices that process operators require to efficiently do their jobs. The console is a flexible and configurable system of housings

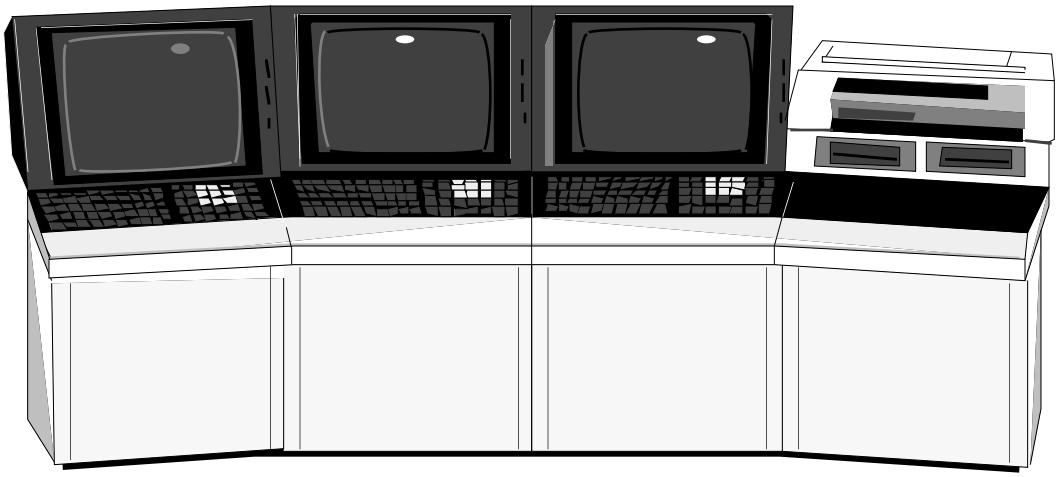

Figure 19 — Operator Console (Classic Furniture) 1574

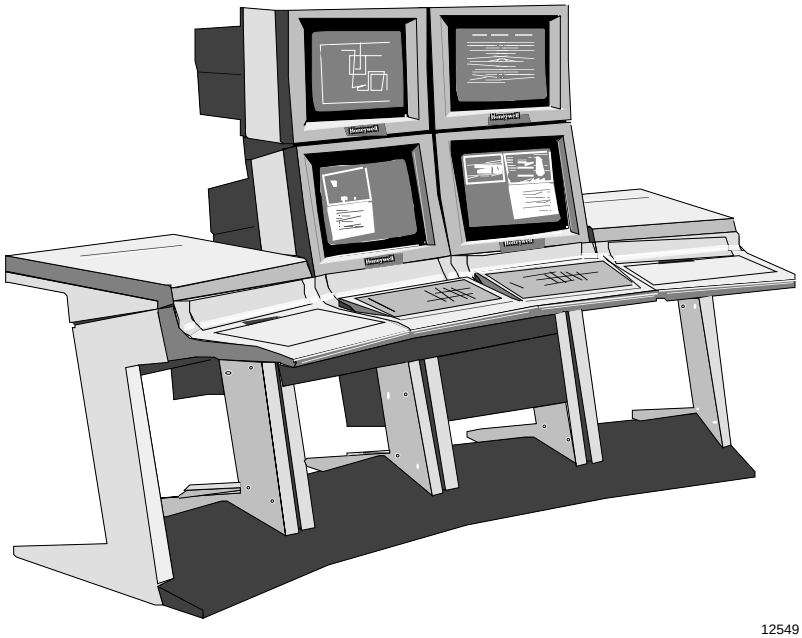

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Figure 20 — Operator Console with Upper Tier (Ergonomic Furniture)

for the CRT, keyboards, electronic modules, and peripheral devices such as disk drives, printers, trend-pen recorders, and other auxiliary equipment.

The console has been designed to provide the operator with optimal viewing of the CRT screen, and interaction with the screen and keyboards. The profile of the console has been designed to permit viewing of the surrounding control room from a seated position.

The console requires a minimum of valuable control-room space. Regardless of the number of Universal Stations in an Operator Console and the mix of options chosen, the operating procedures for the system remain the same.

The Operator's Keyboards are spill-proof membrane keyboards with touch-keys that provide audible feedback when a key is pressed.

The keys are organized to make the operator's demands for information and interaction with the process as quick and as easy as possible. The keys on the right are grouped by related functions. Functions of the 86 keys on the left are defined by the process engineer during system configuration. Some keys incorporate software-controlled red and yellow Light Emitting Diodes (LEDs) that can be used to prompt the operator or to indicate function status. Forty of the keys on the left have LEDs which can be configured to reflect the process alarm status of points or units. Some keys are also color-coded for easy recognition. The keyboard provides an audible warning if the operator makes an invalid keystroke, or when more than one key is pressed at the same time.

Electronics Chassis

The Universal Station is equipped with a dual-node chassis which can contain two nodes (for example, two independent Universal Stations) in the same chassis. The chassis contains a fan assembly and two power supplies independently furnishing power to each of the nodes.

Operator's Keyboards

The Operator's Keyboard is supplied in one of two different keyboard layouts.

The QWERTY arrangement, shown in Figure 21, has the alpha keys arranged like those on a standard typewriter keyboard. The alphabetic arrangement, shown in Figure 23, has the alpha keys arranged in ABC fashion.

Engineer's Keyboards

Figure 22 illustrates the "roving" keyboard which can be plugged into any of the stations. It includes a standard QWERTY typewriter keyset, a separate numerical keypad, cursor and tab-control keys, special-function keys, and 17 function keys that, when used together with the SHIFT and CTL keys, provides 51 virtual function keys. These 17 keys are configurable using the standard US button configuration function; therefore, like the configurable keys on the Operator's Keyboard, they can be assigned by the user to perform any desired existing function. The roving keyboard can be unplugged and removed from the Universal Station when not needed.

The Ergonomic Console version of the Universal Station can optionally be equipped with the Integrated Keyboard (IKB). The IKB combines an operator's keyboard and an engineer's keyboard in an ergonomically designed package. In addition to providing the same functionality as the operator and engineer keyboards, the IKB

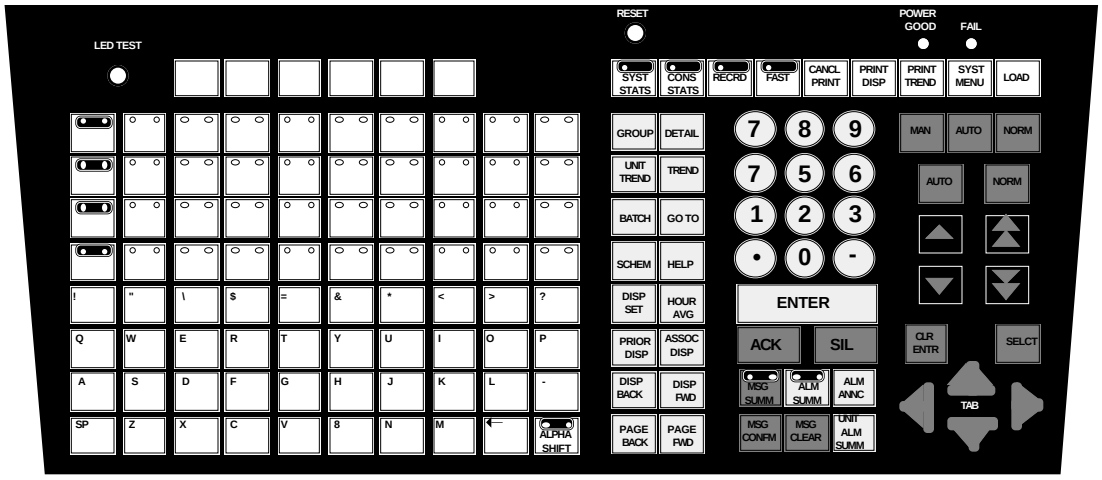

Figure 21 — Operator's Keyboard with QWERTY Layout

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contains five additional buttons for invoking standard displays and an optional fixed trackball. (See Figure 24)

Pointing Devices

A **touch screen** is a time-saving option available for the Universal Station. When equipped with this option, the CRT has a touch screen cursor positioner, which is a sensor frame that is placed around the face of the CRT and is mounted flush with the enclosure. Finger positioning at any location on the screen causes the cursor to move to that location. If a screen target exists there, "selection" of that target will occur when the finger is withdrawn.

Instead of the touch screen, the Universal Station can be optionally equipped with a "**trackball**" for positioning the cursor on the screen. When present, the trackball is located in front of the Operator's Keyboard, and can be quickly repositioned to either the right or left side of the surface for the convenience of each individual user. The Ergonomic version at the Universal Station also supports a mouse.

Removable Media Drives

The Universal Station can be equipped with one or two **Cartridge Disk Drives** . The disks are $5^1/_4$ inches in diameter, and each has a data-storage capacity of 35 or 150 megabytes.

Mounting locations integral to the console furniture, and within easy reach of the operator, are provided.

Hard Copy Printers

Two **dot-matrix printers** are available. Both are tractor-feed devices, and can provide the screen-print function.

One model is capable of printing 132 ASCII characters per line at a speed of 250 characters per second, while the other has a printing capacity of 136 characters per line at a speed of 400 characters per second. They can be conveniently located on a console table top, as illustrated in Figures 19 or on printer pedestals.

Trend Recorders

Trend Pen Recorders providing up to 8 Pens for each Universal Station can be mounted in a console extension above the CRT in full view of the operator.

Network Extenders

The Universal Station accommodates a **Local Control Network Extender (LCNE)** or a **Local Control Network Fiber Link (LCNFL).** These devices are for use with fiber optic cables, and are described in the *Local Control Network Specification and Technical Data.*

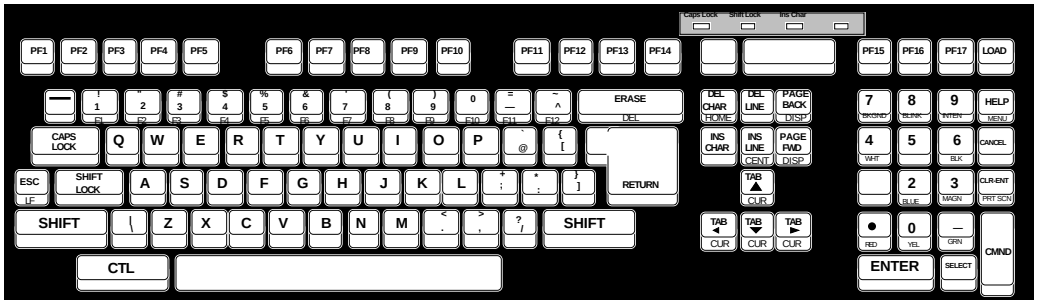

Figure 22 — Roving Engineer's Keyboard

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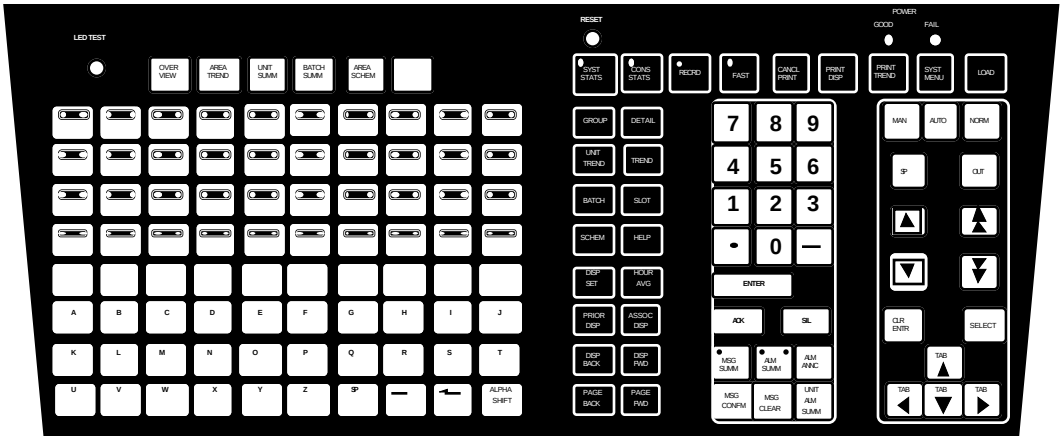

Figure 23 — Operator's Keyboard with Alphabetical Arrangement

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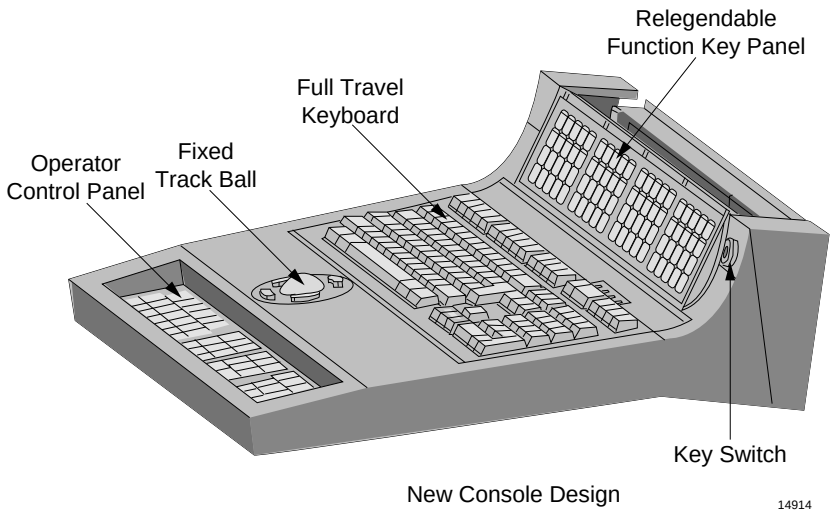

Figure 24 — Console Design Integrated Keyboard

Universal Station Specifications

Physical Characteristics

Approximate Dimensions

Classic Furniture	Height (with Upper Tier)	144 cm (57")
	Width	68 cm (27")
	Depth	121 cm (48")
Ergonomic Furniture	Height (with Upper Tier)	163 cm (63.7")
	Width	61.5 cm (24")
	Depth	118 cm (46")

CE Conformity (Europe)

This product is in conformity with the protection requirements of the following European Council Directives: 73/23/EEC, the Low Voltage Directive, and 89/336/EEC, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed.

Deviation from the prescribed procedures and conditions specified in the installation manuals may invalidate this product's conformity with the Low Voltage and EMC Directives.

Product Classification	Class I: Permanently mounted, permanently connected Industrial Control Equipment with protective earthing (grounding). (EN 61010-1-1993)
Installation Category	Category II: Energy-consuming equipment supplied from the fixed installation. Local Level Appliances and Industrial Control Equipment . (EN 61010-1-1993)
Pollution Degree	Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (IEC 664-1-1992)
EMC Classification	Group 1, Class A, Industrial, Scientific and Medical (ISM) Equipment. (EN55011-1991; Emissions)
Method of Assessment	EMC: Technical Construction File (TCF) LVD: Technical File (TF)

Power Options

Electronics Module, CRT, Keyboards, Disk Drives	Printer
Voltage:	
Universal AC Input: 102-264 Vac (Autoranging)	120, 220 Vac +10%, -15% 240 Vac +6%, -15%
Frequency:	
47-63 Hz	47-63 Hz

The Universal Station's Electronics module operates without disruption through an interruption in the ac voltage of up to 40 ms duration.

Universal Station Specifications (continued)

Operating Characteristics

Display Call-Up Times: (Assuming the system is configured for full optimization; see the *Engineer's Reference Manual* for configuration guidelines)

– Primary Operating Displays	**68020**	**68040**	
Group	1.2 Seconds	1.0	
Alarm Summary	1.4 Seconds	1.0	
– Graphic Displays			
US -Resident Displays	2 Seconds	1.0	(About 250 parameters per graphic display)
HM-Resident Displays	3 Seconds	2.0	(About 250 parameters per graphic display)

Capacities

– Point Detail Displays	All points in the system
– Operating Group Displays	450 (400 standard + 50 Process Module Groups)
– Graphic Displays	Limited only by available storage capacity, including US, HMs, cartridge disks, and floppies

CRT Resolution	640 x 448 pixels

Cartridge Disk Drive

Capacity	35 or 150 Megabytes (5 1/4" cartridge disk)
Data-Transfer Rate	5.33 m bits per second
– Seek Time	25 ms average
– Latency	12.5 ms average

Matrix Printer Printing Speed

– Low speed model	250 characters per second
– High speed model	400 characters per second

Configuration Capability

Maximum number of consoles per LCN	10
Maximum number of stations per console	10

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