Advant OCS®
with MOD 300™ Software

November 1999

Product Guide

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Use of **DANGER**, **WARNING**, **CAUTION**, and **NOTE**

This publication includes, **DANGER**, **WARNING**, **CAUTION**, and **NOTE** information where appropriate to point out safety related or other important information.

DANGER Hazards which could result in severe personal injury or death

WARNING Hazards which could result in personal injury

CAUTION Hazards which could result in equipment or property damage

NOTE Alerts user to pertinent facts and conditions

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all **DANGER**, **WARNING**, and **CAUTION** notices.

TRADEMARKS

NOTICE

CE MARKING

This product meets the requirements specified in EMC Directive 89/336/EEC and in Low Voltage Directive 73/23/EEC.

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Chapter 1 System Architecture

1.1 Introduction

The Advant OCS (Open Control System) with MOD 300 Software is an integrated and distributed open system for process automation. It consists of a family of computer and microprocessor based units operating on a communication network. These combine effectively to form powerful systems which can be used in applications ranging from small machine control to total, plant-wide automation.

The Advant OCS offers effective solutions for the main components of automation:

Process Control

with a wide range of modular control, from smaller installations, to advanced logic and regulatory control supporting thousands of I/O channels per subsystem with full redundancy.

Operator Interaction

by means of man-machine interfacing with advanced operator workplaces featuring the latest technology in user interfacing. New technology, such as RISC-based workstations, now provides the computing power to make the Advant OCS system open and user-friendly. High resolution monitors and a modern graphics building package increase operator recognition and response to display objects. The Advant OCS system uses open systems standards such as the X Window System, OSF Motif, TCP/IP, UNIX, and SQL database access.

System Engineering

is supported by engineering workplaces and software packages for tasks such as configuration, documentation and fault tracing. Off-line engineering as well as on-line configuration are fully covered. The system also features a self-contained interactive documentation package.

Information Management

is supported by powerful functionality providing the right information for decision-making. An open platform allows for inclusion of standard or proprietary applications, e.g. for production planning, optimizing control or administration. True plant-wide information integration capabilities are obtained through the use of open technology, including TCP/IP, SQL and the X Window system.

Batch Control

is provided through standardized, ready-to-use functions for control of different types of batch processes. Batch functions efficiently manage recipes, materials, storage locations, production orders and processing equipment to provide intelligent batch process material routing, process supervision and reporting.

Communication

between major subsystems occurs on the Distributed Communications Network(DCN), with specialized interfaces catering to a wide range of open integration requirements, and communication stations for connection to external computers and communication networks, as well as connecting control networks to the plant network.

The DCN is a redundant, high-speed, token-passing ring based on the IEEE 802.5 standard. A deterministic communications network, the DCN provides robust timely communication, and prevents data collisions that can slow down other network types during major process upsets. Fiber Optic DCN is available for applications requiring isolation, longer transmission distances or protection in hazardous areas.

For interconnection of Advant Station 500 Series workstations, as well as communication with external computers, the TCP/IP protocol is used for tasks such as display transfer, X window access, data base networking using SQL*Net, and file and subsystem back up.

1.2 System Concept

1.2.1 Introduction

The system philosophy of the Advant OCS with MOD 300 Software can be summarized by these key tenents:

- Integration
- Distribution
- Reliability
- Openness
- User friendliness
- Expandability
- Investment Security

The following sections provide details of how these tenets are realized in the Advant OCS system.

A typical system configuration is shown in Figure 1-1.

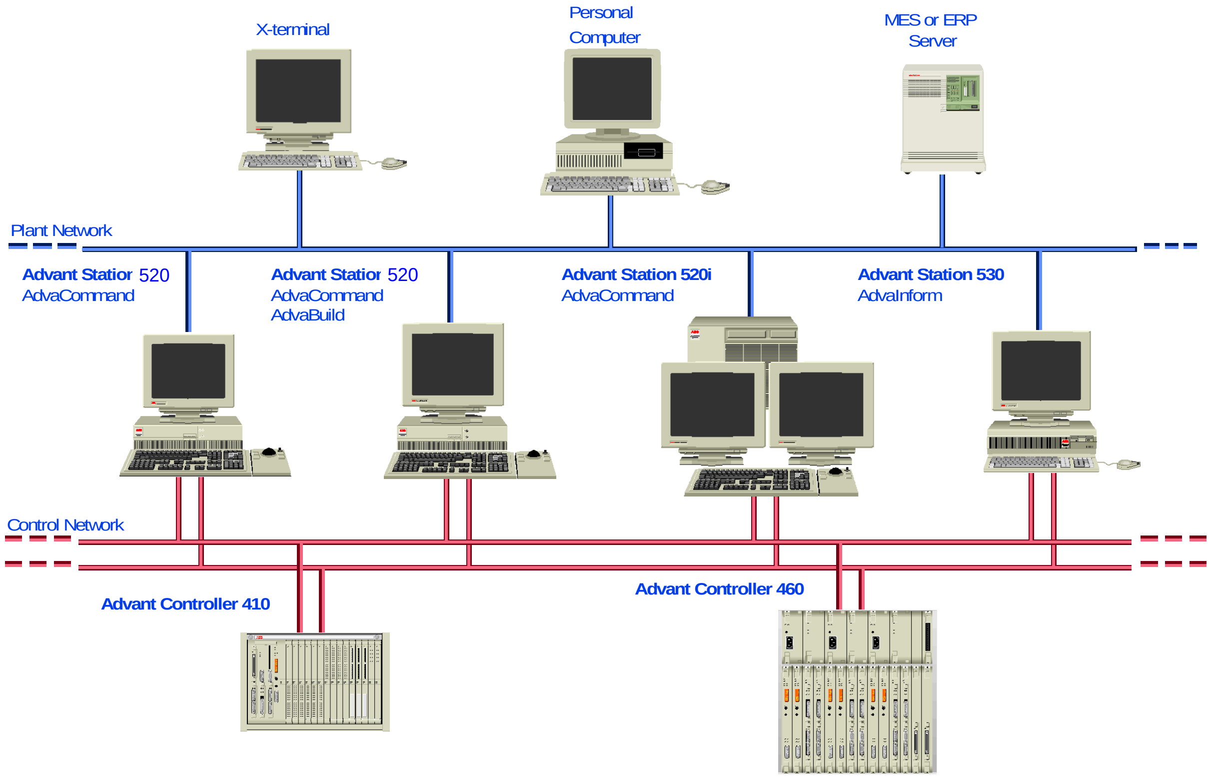


Figure 1-1. System Architecture

1.2.2 Integration

The basic principles of the Advant OCS concept for industrial automation are functional, structural, and informational integration.

- Functional integration means that the same system and concepts are used in a uniform manner for all kinds of control including logic, regulatory, supervisory, and batch control.
- Structural integration means that all stations, from controllers close to the process to advanced operator workplaces for central control, are part of a system which is expandable step by step, from small scale to plant-wide automation.
- Informational integration means that the automation system is seen as an integrated part of the total computing environment at a plant. Thus, information can easily be shared and distributed between all parts of an operation.

1.2.3 Distribution

The Advant OCS consists of controller subsystems, operator workplaces, engineer stations, and information management workplaces. The real-time process database is entirely distributed to the controller modules. These modules are functionally complete and able to perform logic control, regulatory control and advanced calculations. This ensures that all processing and control can be performed immediately and the data will not have to be sent elsewhere for processing and return with the result. Consequently, the control system can be structured according to the process requirements without restrictions imposed by limitations in the control system. The result is a “clean” structure with a high degree of integrity.

The operator workplaces provide efficient plantwide operations by managing information in a consistant easy-to-use manner. The operator workplaces provide these features in one of the most powerful operations and information management systems available today. Simplified operations are provided through a universal interface for the system. The operator only needs to specify the tag name of a device or loop to obtain information from anywhere in the system. Integrated information management results in superior information retrieval, reporting and analysis. In addition, increased process operational reliability is achieved in the Advant OCS system through the use of advanced system security, user accountability, redundant functions and advanced diagnostic tools.

The engineering workplaces are designed to provide the configuration of a distributed control system and perform the associated engineering tasks required in an automation project. The Advant OCS engineering workplace promotes efficiency in project engineering, and is also suitable for maintenance and documentation on site, through the use of advanced engineering tools.

The information management workplace database is accessible throughout the system, in exactly the same manner as the real-time process database, allowing for powerful information integration. In addition, there are services providing access to data in any computer, connected to the plant network and offering SQL services, as if the data were shared in the local database. In a similar manner the complete real-time process data base is accessible from the plant network via standard SQL services.

Data Base Manager

A portion of the system database and the Data Base Management System(DBMS) resides in every node of the system. As a result, the system is a masterless system in which no single failure can impact total system operation. In addition, it uses a single, integrated database approach. Engineering effort is therefore simplified, and operator errors are avoided due to duplicate references to a single tag.

The DBMS surrounds and protects the database while providing functions for information access. With the Data Base Manager, you do not need to know the location of data or any data access or organization technique to retrieve its value. You can retrieve all database information by simply requesting the tag and attribute you desire.

1.2.4 Reliability

Advant OCS equipment is characterized by high reliability and availability and is designed to work in industrial environments. However, despite all reasonable precautions, malfunctions can occur. That is why the components and functions of the system are monitored automatically and continuously and any faults or problems reported.

In some cases, extremely high availability is required from the control system. To meet such requirements, critical parts at all levels of the system can be redundant, increasing availability. In controllers, the controller(CPU and memory), I/O channels, communication units, and power supplies can be redundant. A redundant communication network is available to maintain communication at all times, even if individual subsystems drop out.

1.2.5 Openness

The use of both domestic and international open technology and standards ensures that the Advant OCS provides powerful, yet easy-to-use, openness.

- **TCP/IP Network**- a network which connects to the Advant OCS, and allows interface to host computers, personal computers, terminals, and other plant control systems.
- **Structured Query Language (SQL)-** a standard for accessing information from databases using standard commands. Through SQL, the Advant OCS can provide and access data from external computers. This means that any information that is accessible via SQL can be integrated into process displays or be used in control programs.
- **X Window System** - a protocol allowing users to interface with applications in other computers from windows in the Advant OCS. This can be used to give the operator access to circuit diagrams from an engineering workplace or to an expert system for process optimization by simply opening a window in the operator workplace.
- **OSF/Motif** - a standard defining how window applications are to interact with users. In Advant OCS, displays and dialogs are based on OSF/Motif, whenever possible. This results in a consistent and easy-to-use operator interface.

1.2.6 User Friendliness

The Advant OCS has been designed with the end user always in mind. It is a dedicated automation system meaning that users do not have to be computer experts to use it. Instead they can concentrate on specifying and implementing the control schemes in a familiar manner, to produce quality products at the lowest possible cost.

The user interface is consistent throughout the product range. This improves the learning curve, even if the range of duties given to the operator is expanded. It is always easier to make the right choice rather than the wrong one.

Engineering is done by configuration instead of programming. Graphically represented function blocks manage the most demanding control tasks, and process graphics are created using the most modern tools available.

The DCN is self-configuring. The user only has to connect the stations together physically, while the system itself maps out the topology of the network and establishes the required communication paths through it. This is particularly important for large systems and when expanding existing installations.

1.2.7 Expandability

To safeguard investments for Advant OCS in the future, ABB has a long-term commitment to compatibility. The system enables users to start with small-scale control systems and later expand them step by step into systems covering the whole plant, or even multiple plants.

This expansion process is possible without modifications to the existing equipment, except for the additions necessary to connect to, and communicate with, the new equipment. The system design permits on-line addition of new subsystems with no disruption to either the process or system communications. The user needs only to configure the new displays required in the operator workplace and define the signals in the existing controllers, which are to interact with the new subsystem. The communication functions are effectively isolated from the application programs, making it is easy to extend or restructure the system by simple configuration without rewriting any programs.

1.2.8 Investment Security

Along with rapid advances in technology and extensive business changes, flexibility and life-cycle cost justification of control and information systems is vital. ABB realizes how important it is to accommodate change without compromising your current system investment.

ABB has a long-standing commitment to protect your investment in automation solutions. We developed this commitment through incremental evolutionary additions, avoiding radical architectural changes that could jeopardize your investment. We continue to support, expand, and upgrade our large installed base of systems. We continue to develop and improve the Advant OCS system today. And we plan to continue these efforts well into the future. By designing to the latest international standards and by committing ourselves to open system architectures, we have provided the ability to adapt and evolve the system and solutions as needs and technologies change. This combination of field-proven performance and state-of-the-art technology provides advantages offered only by the Advant OCS.

Advantages like:

- The ability to combine Advant Technology-based products with existing MOD 300 systems
- Portability of applications, data and personnel within various technologies
- Integration of applications, information and systems from different sources into a cohesive, productive environment
- Commitment to a seamless migration toward newer, more advanced technologies as they become proven and available.
- And the flexibility to expand on or even re-apply your ABB-supplied automation system in a changing business environment.

1.3 Process Control

1.3.1 General

The Advant OCS offers powerful features covering all aspects of process control. The following are examples of control functions provided by the system:

- Process interfacing through local or distributed I/O
- Logic and sequence control
- Regulatory control, including auto-tuning, and adaptive control
- Batch Control
- Calculations and process optimization
- Historical recording of process trends and changes
- Recording of alarms and events
- Logging of measured and calculated values

1.3.2 AdvaControl Software

Manufacture of quality products demands advanced process control techniques. The system meets these demands through three powerful control packages that provide optimal implementation approaches in the areas of continuous control, discrete device control, high-speed interlock logic control, sequential and batch control, and supervisory control.

Configurable Control Functions

Configurable Control Functions (CCF) software provides comprehensive capabilities from a preprogrammed library of functions. CCF uses a menu-driven, fill-in-the-blank approach and does not require programming. This block structure is easy to implement and its representation matches the measurement and control functions of process diagrams. CCF is ideal for continuous control, device handling, interlocking and alarm handling. It saves valuable commissioning and startup time through the Autotune feature available for all PI and PID loops.

Taylor Control Language

Taylor Control Language (TCL) is a structured, high-level procedural language. The programmable flexibility of TCL is ideally suited for sequential/batch control, complex arithmetic and logic functions, supervisory tasks such as startups and shutdowns, and serial interfaces to third-party equipment. The unit relativity feature allows the user to write TCL sequences to be executed on different plant equipment without reprogramming. This decreases the amount of time that engineers must spend for sequence design, programming and debugging.

Taylor Ladder Logic

Taylor Ladder Logic (TLL) provides high-speed, industry-standard ladder logic control processing. It is ideal for device interlocking, motor control and drum programming device sequencing.

Plant personnel familiar with ladder logic can implement and use TLL with little training. By performing ladder logic functions directly on the system, the need for separate programmable controllers is reduced.

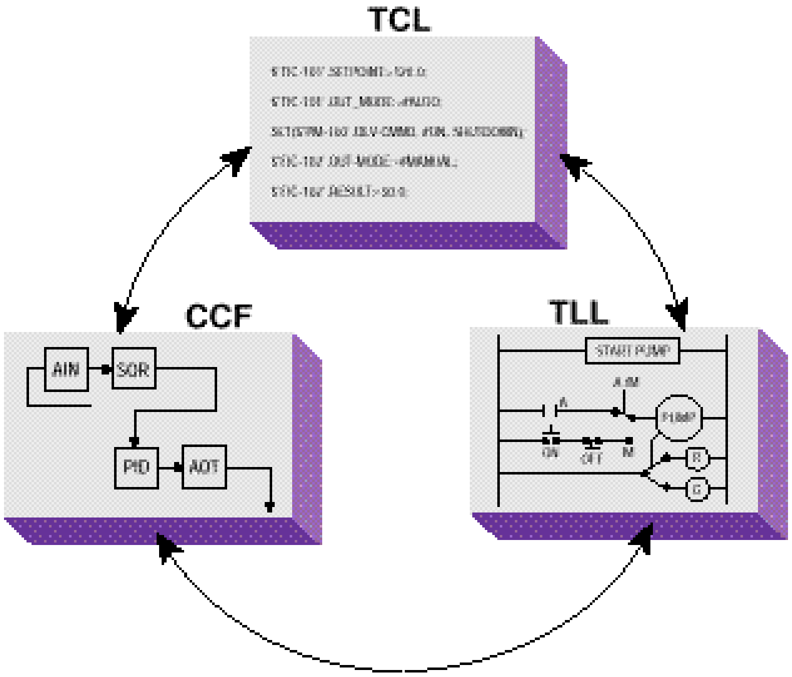


Figure 1-2. CCF, TCL, and TLL Provide Flexibility for Optimal Control Solutions

1.3.3 Controller Subsystems

The Advant OCS offers subsystems that can perform control functions to meet the users specific application requirements.

Advant Controller 400 Series

Two types of the Advant Controller 400 Series are available, the Advant Controller 410 (AC410) and the Advant Controller 460 (AC460). These controllers utilize the latest in advanced Advant Technology with Motorola 68040-based processors in the AC 460. The AC410 is ideal for applications that do not require processor redundancy. The AC460 is suited for applications where high capacity, performance and 1-to-1 redundancy are required.

1.3.4 Process I/O

Advant OCS communicates with the process through various types of sensors and actuators connected to process interface units, or to input/output (I/O) units. Interfacing is available for the following signal types:

- Analog Inputs for voltage or current, RTD and thermocouple inputs
- Analog Outputs for voltage or current outputs.
- Digital Inputs for isolated and non-isolated 5,24,48,125 VDC, 115VAC, 230VAC inputs
- Digital Outputs for isolated and non-isolated 0-60,125VDC, 115VAC, 230VAC transistor, relay and triac outputs
- Pulse Counters for counting low and high-speed digital pulse inputs
- Intelligent Field Devices using HART protocol
- Third-Party Devices via the Multi-Vendor Interface (MVI)

The system supports a choice of Process I/O options to meet various project requirements. I/O strategies can be selected independent of the choice of control techniques, and any combination of I/O strategy and control language is valid. Selection can be based on minimizing installation costs, and/or per-point costs, or maximizing availability.

Cabling represents a large portion of the cost of installing a process control system. In order to reduce this cost, a wide range of remote I/O units are available.

Series 100 I/O

Series 100 (S100) I/O is available for the Advant Controller 400 Series. The S100 direct I/O system consists of I/O modules with 4 to 32 channels, depending on type, which are placed in the I/O subracks. The Advant Controller 410 includes an integral S100 I/O Card File. The Advant Controller 460 interfaces to the S100 I/O through an interface module.

Series 800 I/O

Series 800 (S100) I/O is available for the Advant Controller 400 Series. The S800 I/O is a distributed, modular, I/O system which communicates with Advant Controller 400 Series over Advant Fieldbus 100 (AF 100). The S800 I/O provides easy installation of the I/O modules and process cabling. It is highly modularized and flexible so that I/O modules can be combined to suit many applications. The S800 I/O can be mounted in many configurations to fit a wide variety of requirements.

Taylor Remote I/O (TRIO)

TRIO Process I/O uses the TRIO field bus connected to groups of intelligent, highly-reliable, field-mounted blocks. Fewer terminations are required because the TRIO Field Bus replaces many single and multiconductor cables. TRIO blocks are small, rugged and designed to accommodate mounting at the point of control. They can be individually installed on machines, mounted in junction boxes or grouped in racks and panels.

TRIO blocks have approvals from a number of agencies. For example, Factory Mutual has approved most TRIO blocks for use in Class 1, Division 2, Group A, B, C and D hazardous locations. By definition, these are locations in which hazardous concentrations of flammable gases or vapors may exist under abnormal condition. Because TRIO blocks are suitable for use in these locations, it is not necessary to mount the blocks in specially designed, purged enclosures.

1.4 Operator Interface

1.4.1 General

Equipment for man-machine communication in Advant OCS includes all types of apparatus, from monochrome video terminals, to advanced, high-resolution color-graphic operator workplaces.

The Advant OCS operator interface functionality includes advanced features for communication with the user, such as:

- Presentation of user-defined process displays, standard displays, reports and various lists
- Effective operator dialog for manual control
- Alarm and event management and display
- Access to network-based applications and information from other systems
- Self-diagnostics and display of system status

Advant OCS makes use of the latest technologies in man-computer interaction to offer the highest standards in display legibility and ergonomics.

The operator workplaces offer true, full graphics with a resolution of 1280x1024 pixels, using up to 192 simultaneous screen colors. This, together with windowing capabilities, based on X Window System and OSF/Motif provides a uniquely powerful operator environment.

Displays can be presented as base displays covering the whole screen area or as overlapping displays presented on top of a base display. Overlapping displays are windows that can be moved, resized(scaled) and closed.

Windows can be opened on the operator workplace screens for interaction with applications in the information management and engineering workplaces, as well as in external applications on the plant network

The majority of the system displays are auto-generated standard displays, which can be assigned multiple levels of user security. The status of the process is presented on different types of displays:

- **Overview Displays** present the operator with a general overview of the process and I/O displays. The Overview is used to quickly identify problem areas in the plant and view alarm conditions of the I/O contained within the Overview.
- **Group Displays** provide a user-configured display of the associated process group. The display supports status and alarm state information for 12 controlled variables and trend displays for 12 control or indicate variables as well as group specific process graphics.
- **Loop Detail Displays** provide the operator with on-line dynamic loop tuning. The tuning parameters include; alarm limits, alarm suppression, alarm posting, gain, reset, rate values, loop scan rate, phase, and loop processing(on/off).
- Area Alarm Display presents the operator with a list of recent alarms sorted by time.
- **Custom Graphic Displays** use both static and dynamic color data symbols and have direct access to any variable in the system by tag name.
- **Trend Displays** present real-time process and historical data in the form of a strip chart recorder.
- **Sequential Function Chart Displays** support the runtime monitoring and manipulation of individual sequences describing the program flow in plain english. The chart presents actions that a sequence will execute, along with transition conditions which determine the flow of sequence execution.
- **System Status Display** shows the current state of all nodes and communication networks in the Advant OCS.

It is important to organize the displays to make it easy to find the required information quickly. For this reason, several means for display selection are provided, including menus, direct-selection keys, display links and configurable selection keys. This makes it possible to define display hierarchies and display selection paths that come natural to the operator.

Manual Control

The operator may intervene in the automatic control process by manually adjusting setpoints and parameters or take over control entirely.

The system permits multiple operator workplaces to connect to the same control application, and also have access to all process information. An operator-oriented environment ensures that only one operator is able to control a certain process variable at a time.

1.4.2 Advant Station 500 Series

The Advant Station 500 series of subsystems use RISC-based workstations that offer industry-leading performance, built-in networking, outstanding graphics and the flexibility of the UNIX operating system. ABB adds hardware and software components to adapt the basic platform to today's demanding real-time industrial requirements of process plant operations.

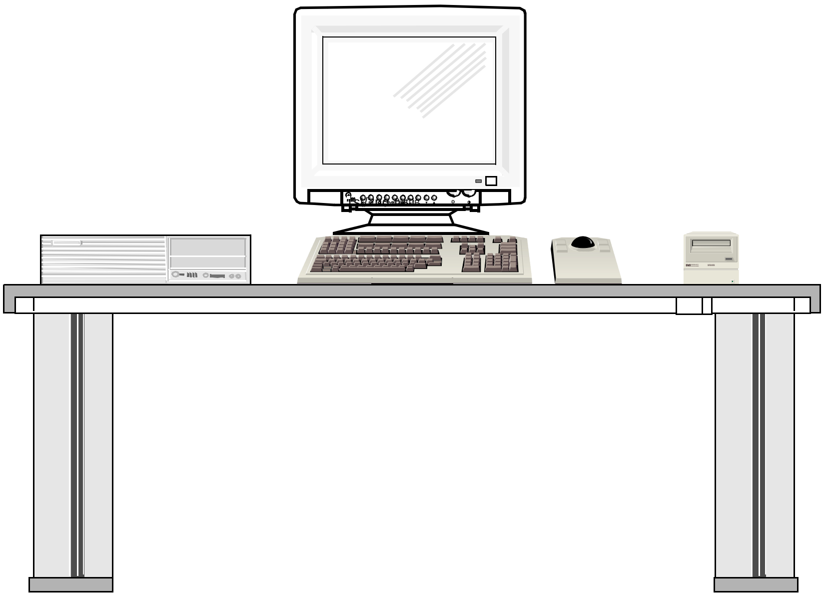


Figure 1-3. Advant Station 500 Series Subsystem with Standard Console Furniture

Advant Station 500 series workstations perform a wide variety of functions in the system when combined with basic software and Advant software. Available software packages are AdvaCommand™ operator interface software, AdvaBuild™ engineering software, AdvaInform™ information management software and Batch 300™ software.

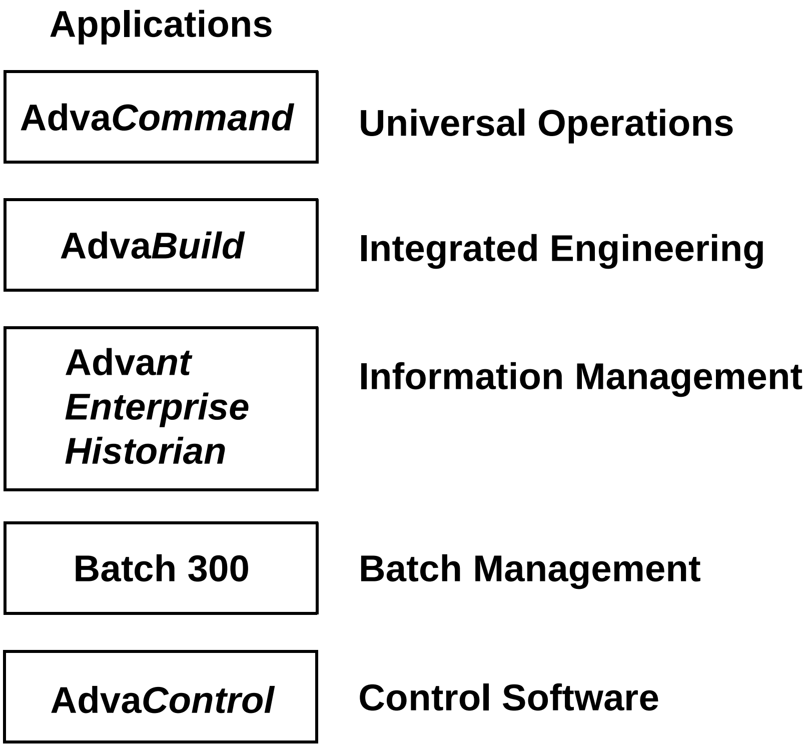


Figure 1-4. Available Software Packages

Each subsystem can be optimized for a single function or multiple function options can be combined onto a single station. Both hardware and software are scalable throughout the entire Advant Station 500 series.

Real Time Accelerator Board

The Real-Time Accelerator Board extends the capabilities of the UNIX workstation. With a powerful processor and on-board memory, the Real-Time Accelerator Board handles time-critical tasks such as real-time database management and DCN communications. By performing front-end processing, the accelerator lets the workstation processor dedicate its resources to those applications that the user interacts with directly.

Advant Station 500 series subsystems operate on a state-of-the art man/machine interface. The user interface includes high-resolution monitors, X Window driven displays, the consistent look and feel of OSF Motif, and an advanced graphics building package. Subsystems can support multiple high-resolution monitors, and keyboard, trackball, mouse and/or touch screen combinations. A universal keyboard can be used which supports the requirements of all users, eliminating the cost and confusion of multiple, dedicated keyboards.

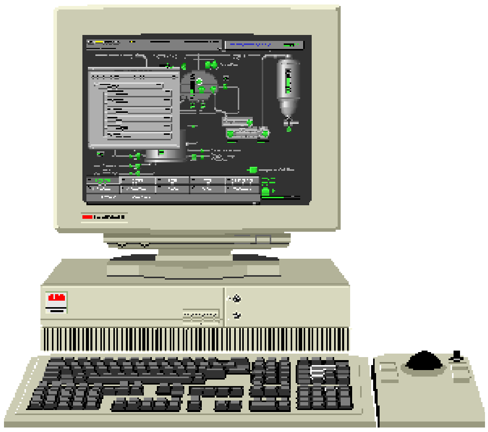


Figure 1-5. Advant Operator Workplace

1.4.3 AdvaCommand

Efficient plantwide operations require a system that works with operations personnel to manage process information in a consistent, easy-to-use manner. Operator workplaces using Advant technology employ AdvaCommand software. AdvaCommand display software manages the amount of information that an operator deals with during normal and abnormal operating conditions. It provides information in a standard presentation style, and in a standard access method that can be customized to individual operators. As a result, operator fatigue and errors are reduced. AdvaCommand enables operators to interact effectively and safely in all process situations, allowing them to spend more time on process improvements.

Single Window and Open Environment

The system provides a single window that integrates data from a variety of field devices and third-party system displays. It utilizes the same X-Window access approach used for all other system displays.

Data from a variety of sources including programmable controllers, information management computers and analyzers can be displayed on the same screen in one or more windows. This universal view of the process makes operations more manageable because operators need only be trained on one control system that supports information from several devices on unified operational displays.

Ergonomic Windowing Environment

ABB has applied window technology, third-party display access, and an advanced graphics package in the system, to create an ergonomic environment which enhances operator efficiency.

Quick Display Access

AdvaCommand minimizes the number of keystrokes required for operators to control the process through the use of pull-down menus and dialog boxes, providing rapid display navigation.

Pull-down choices include the Last Page Menu which keeps a running list of the last 50 displays the operator has used. If one of these displays is required for further reference, it can be quickly accessed by pointing and clicking. Similarly, the Personal Menu is a user-configured feature that shows up to 15 displays typically used by a specific operator. This unique menu eliminates the need to review the entire list of displays, reducing time and possible errors.

Alarm Management

The system provides prompt visual, and optionally audible notification of alarm and event occurrence. An alarm banner informs operators of the most recent alarm conditions without calling up additional displays.

Detailed alarm information is displayed by selecting this flashing banner. Operators can access an alarm status window without restricting the view of the current display, or directly fetch the display containing the tag in alarm.

On-Line Diagnostics

AdvaCommand includes a number of system diagnostic displays. A flashing diagnostic icon alerts operators to system problems. Selecting this icon automatically displays the cause and location of the problem.

Comprehensive system status displays let personnel diagnose problems quickly. The I/O cross-reference display facilitates I/O checkout by cross-referencing tag ID and channel association. This lets operators and maintenance personnel work as a team. The System Performance Display provides engineers with on-line information about microprocessor loading and memory usage. This information is helpful when developing applications, making efficient use of computing resources, and when planning upgrades or expansions.

AdvaCommand displays are easily configured using a set of advanced graphics and environment building tools which are features of AdvaBuild software.

Modern Display Builder

AdvaCommand graphics are created using the Display Builder. This AdvaBuild option takes full advantage of high-resolution monitors and windowing technology. Through increased object resolution, realistic colors and shading, operators are presented with a more accurate representation of the process, resulting in increased operator recognition of objects.

Palettes of color, shades, patterns, basic objects and application specific objects make graphic building easy. The basic process symbol palette conforms to ISA standards. Drawings can be easily cut and pasted between graphics. The Display builder lets you zoom in and out for detail work, and make any object dynamic. Sixteen levels of conditional logic simplify an operator’s job by placing more intelligence in the display.

User Accountability

The portion of the system an operator can view and control is established by the Environment Builder. An Environment consists of a list of tags, standard displays, user scripts, and custom graphics that an individual user has authority to access.

Within an Environment, access is controlled by the user's security classification. Every user name is configured with a security class of Engineer, Supervisor or Operator. This provides the flexibility to customize authority down to the individual displays that are available to each user. In addition, every user name is password protected, and all changes made while logged on are automatically logged by the system and printed.

Self-Configuring Displays

The simple association of tags, groups and areas results in the automatic generation of operation, engineering and diagnostics displays, reducing the amount of engineering time required to configure the system (i.e. Loop CCF, Detail, Group, Area, Status, Alarm).

1.5 Engineering

1.5.1 General

Efficiency and quality are key words when it comes to engineering capabilities in the system. Packages and stations are available, covering a wide variety of aspects of engineering. Functionality covered includes project structuring, graphical programming, display design, documentation, on-line modification and extension, commissioning and fault-tracing.

1.5.2 AdvaBuild

AdvaBuild is a family of engineering tools that enables engineers to work smarter as a team, reduce repetitive engineering tasks, and improve plantwide documentation. Engineering workplaces using Advant technology employ AdvaBuild software. AdvaBuild integrates plant engineering and documentation capabilities with DCS control database configuration. AdvaBuild integrates the complete set of tools needed for an automation project for process engineering, DCS database creation tools and operator graphics building.

Simplified Project Structure

The Structure Builder provides a common project framework and common access method of all tools. The Structure Builder helps integrate the efforts of previously isolated project teams based on function (e.g. P & ID) location (e.g. cabinet layout), and control (e.g. Advant OCS database) into one project structure. This supports a multiperspective project approach based on the IEC 750 standard.

Efficient Database Creation and Documentation

Engineers can spend a great deal of time at the beginning of a project entering large quantities of new information. The Template Builder is a bulk data-handling tool, where large amounts of data can be entered either through fill-in-the-blank templates or tables. The Templet Builder takes full advantage of the relational database. This saves debugging time by automatically searching for unresolved tag references. CCF loops are created using the Template Builder. The Function Chart Builder can then be used to view the loops graphically, make modifications, and schedule automatic graphical loop documentation of the entire control database.

The Advant OCS database is a hierarchical tree structure that can be easily navigated from the Structure Builder. The Structure Builder provides the ability to copy, delete, or move whole structures within a single project, or among separate projects to share application solutions.

TCL Source Code Management

The power of the TCL Builder lies in its revision control system. Access to the source code is restricted by assigning levels of authority to specific functions and documenting all modifications once a baseline version has been created. Code can be locked to prevent any changes if required. Furthermore, version control automatically records all changes made, without relying on engineers to manually document changes in the program header. As each modification is made, a new version is created so changes can be tracked. This lets two previous versions of TCL code or batch recipe be compared to determine differences.

The TCL Builder is an advanced development environment for Taylor Control Language and batch recipes. It provides syntax checks that generate a list of file errors and warnings. Through windowing, an engineer can compare compiled code listings against the source code structure for easier debugging. This enables engineers to debug their program and correct errors before the code is downloaded to an on-line system.

Field Engineering

The system offers powerful functions and tools such as distributed engineering, network access, and the PC Template generator for efficient field engineering. Portable engineering workplaces are available, covering many aspects of control system engineering. From off-line application programming and down-loading of total applications to commissioning, documentation, fault-tracing and on-line program editing.

Controllers can be programmed fully off line, partially in service or fully in service; the nature and extent of these activities govern the choice of approach. New graphical documentation of the application can always be printed, reducing the risk of the documentation being out of date.

When an engineering workplace is connected to one station in the network, it also gains access to other stations, eliminating the need for going around the plant with the engineering workplace. For remotely located stations it is even possible to connect the engineering workplace via the public telephone network.

1.6 Information Management

1.6.1 General

Management of process and production information is an integral and natural part of the Advant OCS. Through the use of industry standards, open platforms are provided for supplementary third-party applications or proprietary software.

The range of available functions includes:

- Powerful HP-UX platform for third-party or proprietary application packages.
- A powerful programming environment based on industry standards ensures portability
- Information integration through SQL, DDE, and OPC services
- Historical data collection, storage, archival and retrieval
- Reports
- SPC (Statistical process control)
- User Object definition and support
- Open, secure network access
- X-terminal support

1.6.2 Enterprise Historian

Information management workplaces using Advant technology employ Enterprise Historian software. This software facilitates the integration of process and production management functions, aiding personnel in achieving the efficient implementation of business strategies. Enterprise Historian software opens the systems by allowing third-party data and application integration.

SQL Data Access

SQL (Structured Query Language) is an open systems standard that provides a common set of commands for users to access data. This lets you access all data in the system, including real-time data, through this standard access method. Information is easily accessed by a wide variety of third-party software, such as Lotus 1-2-3 and Excel, without the need for specialized gateways. This facilitates direct access to data by managers and engineers.

History

History software provides recording and on-line playback of process and alarm/event information. Data from anywhere in the system can be recorded in a wide variety of data logs. New history tags can be added and existing tags can be changed on-line.

Multiple History subsystems provide redundant historical data recording for critical information and expand overall recording capacity. Long-term data archiving is possible with DAT cassettes holding Gbytes of data. This automatic feature requires no operator intervention, except initially loading a tape, and archived data can be played back on-line at any time.

Historical data can also serve as a useful process improvement training tool through the simultaneous comparison of past and current process conditions on AdvaCommand displays.

Reports

Reports are created in a flexible way that combines powerful SQL commands with a wide variety of standard report formats.

Reports can be scheduled for predefined times such as end of shift, day or month, or they can be executed based upon an event such as end of batch or equipment start. Reports can also be executed manually through the report scheduler or operator-selectable screen targets, printed on any system printer and/or automatically archived on hard disk. Archived reports can be viewed on CRT's, transferred to host computers, and kept track of in multiple revisions.

An extremely powerful and unique feature of AdvaInform Reports is the ability to perform database queries and produce a useful process snapshot. The query feature can be used to report on any criteria such as loops in automatic mode, those which are tracking, or those in local setpoint.

Statistical Process Control

Early detection of system variations is key to producing on-spec product. AdvaInform SPC provides the information operators need to determine whether process variables are within statistical control or if a systematic error is causing off-spec product, delays, or even potential product shutdowns.

SPC alarms alert operators to significant statistical deviations. Standard SPC displays can be viewed on-line. Control chart and histogram displays are configurable and provide such choices as process average (X-Bar) with range, chart of individuals with moving range, and moving process average with moving range charts.

Third-Party Software Integration

Enterprise Historian software allows the user to easily integrate third-party software packages.

Production planning, inventory management and MRP-II systems use real-time data, taken from the system using SQL access, to update dynamic inventories and influence production scheduling.

The User API allows for the development and implementation of special process and industry-specific applications directly on the high-powered RISC-based computer that resides on the control network. It also allows the user to take advantage of applications that already work such as advanced control, scheduling and optimization packages.

1.7 Batch 300

The wide variety of batch process applications demand a great deal of flexibility in process control and batch management systems. Batch 300, together with the standard features of the system, offer the degree of flexibility required to meet your demanding batch applications.

Batch 300 is based on the current work of the SP88 committee and NAMUR guidelines. These standards, and Batch 300, go far beyond traditional batch process control, and include Recipe Management Production Scheduling, and Batch, Unit and History Management.

Based on the accompanying model, Batch 300 is divided into the following functional areas:

Recipe Management provides three levels of recipe: site, master, and control. Recipe information includes header, equipment, procedure and formula values. As part of Recipe Management, the most generic site recipe is automatically translated to the master recipe and then to the control recipe.

Production Scheduling (Job Entry) places a job or order into the schedule. The system calculates the number of standard size batches required to fulfill the order. Two methods are provided to determine equipment usage. The “Follow first” method dictates that once a job of batches starts, all batches will use the same equipment. The “Parallel” method lets the system assign equipment as it becomes available unrelated to the previous batch.

Process Management processes scheduled jobs according to start time and availability of plant equipment. Batch IDs are assigned at this level and displays are provided to monitor and edit the job status. Resource Management, as part of Process Management, utilizes information about equipment and material inventories. This is used for controlling equipment availability.

Unit Supervision gives operators and production managers easy access to and control of batch production. Unit Supervision coordinates the control actions of a set of equipment (unit).

Process Control consists of the fully integrated TCL, CCF and TLL. Together, these three elements provide advanced process control capabilities and interlocking.

Production Information Management capabilities include recording and retrieval of historical batch data for use in comprehensive batch reports. Batch 300 provides both forward and backward lot tracking

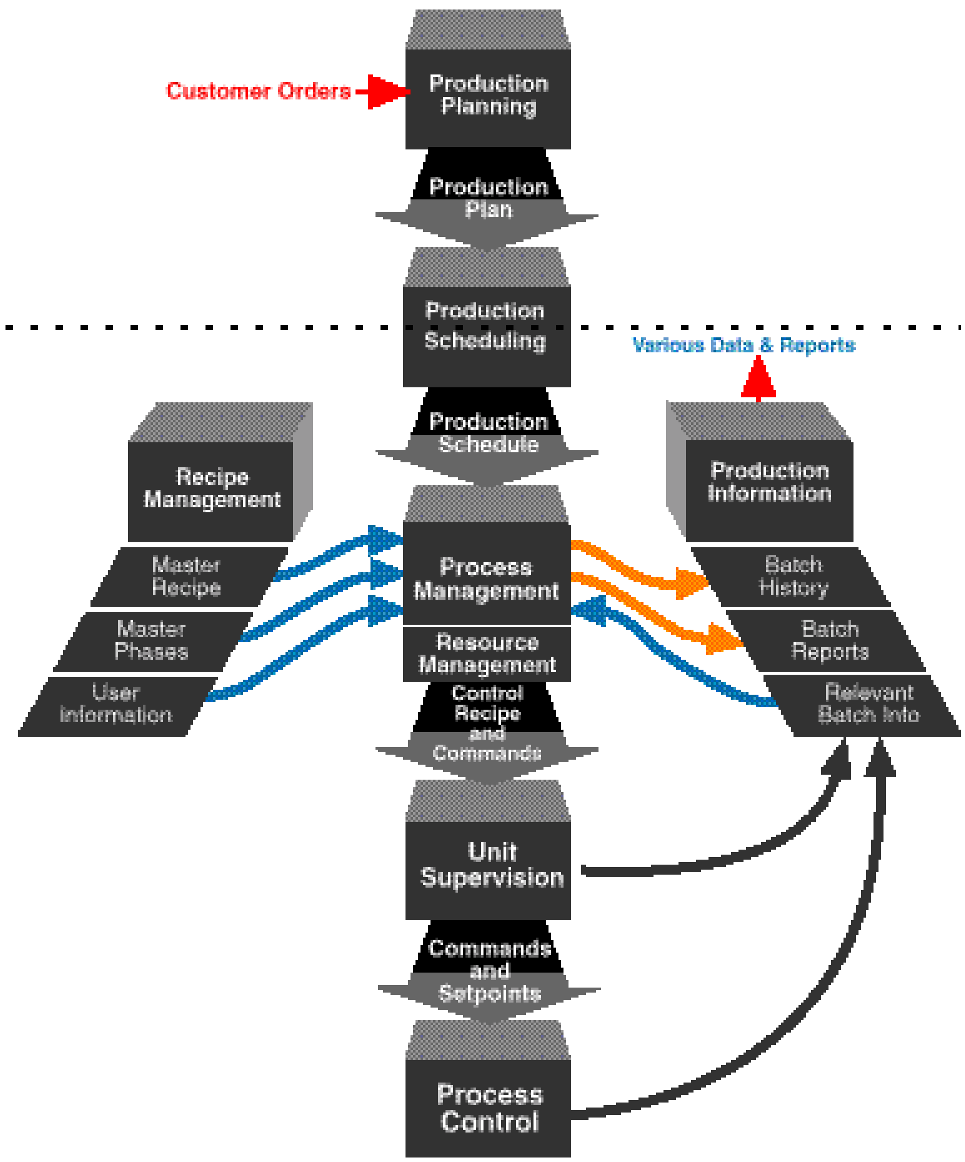


Figure 1-6. Batch 300 Control Activity Diagram

1.8 System Documentation

Documentation is the key to efficient installation, operation, and maintenance of the Control System. It is the communications channel through which the user can obtain factual information about all aspects of the system.

Since large amounts of technical information are necessary to adequately support any system, ABB has developed a documentation series with the most effective mix of standard and custom documentation for each system.

System documentation consists of the Documentation Reference Set and the Project Data Manual.

Documentation Reference Set

The Documentation Reference Set represents a multi-volume collection of operating, installation, and maintenance instructions plus pertinent instruction books for each different type of product in the system. These manuals are assembled into several volumes for use by operations and maintenance personnel. Instruction books such as reference manuals, software manuals, and configuration manuals are included.

The Reference Set includes coverage of ABB manufactured items as well as Original Equipment Manufacturer (OEM) instructions. The Documentation Reference Set is also available on CD or by subscription from the World Wide Web.

1.9 System Support

ABB is one of the worlds leading suppliers of control systems. As such we have a responsibility toward our customers, old as well as new. ABB provides its clients with a platform that can be expanded as the plant grows, thus minimizing overall life-cycle costs. The Advant OCS System consists of universal components that provide users with a path for system expansion. ABB is committed to provide compatible automation solutions that protect initial investments and ensure flexibility.

Support Policy

ABB warrants the availability of either spare parts or replacement units, or repair of such parts or units, for up to ten (10) years after an announcement in the applicable Price Book that manufacture of that product will cease. ABB shall update the then Current Major Version of the ABB Software and the immediately preceding Major Version.

> Note: Current Major Version shall mean the major version which is delivered in standard sales from time to time. A major new version of an Advant product may require changes in other products or applications connected to the product, such as an upgrade to the same major version. A minor new version of a product is a functional extension within a major version, and does not require any changes in any other products or applications connected to the product.

Both the hardware and software of the Advant OCS System are continually updated with new features and functions to keep it on the leading edge of technology. New capabilities are offered to existing users in the form of an upgrade to bring the installed system up to the latest version available. The availability of the upgrade protects your investment in hardware, software, and perhaps most importantly, application software.

The software policy is a commitment to a method of developing and releasing software, combined with a set of available services. The system software development separates the introduction of new features from the maintenance of existing software. This method allows a system to be delivered and maintained at a level of functionality for extended periods of time without requiring system shutdowns. Services are available to maintain the system functionality at the current level, or to bring the system up to the latest level of both hardware and software.

Software Updates

Software development for the Advant OCS System is an ongoing process. New features and functions are continually being developed. Software Update Agreements along with support contracts are available worldwide.

As new software versions become available over time, upgrades are available for users to add these new functions to existing system. The purchase of any upgrade is optional. Major functional enhancements are included with these new branches of software. Support for any new hardware introduced will be included. New major software packages may also be included.

New hardware capabilities can be added to existing systems in conjunction with software upgrades. In some cases due to memory constraints or CPU performance reasons, hardware elements may be required to be upgraded in order to accommodate new software features. A complete system analysis is available to determine the best way to incorporate new features into an existing system.

All updates are fully documented in update packages to keep your system instruction book reference set up to date. The software update items provided may include:

- Improved execution time due to efficiency improvement
- Corrections for identified software deficiencies
- Expansion in capabilities for displays, graphics, history, reports, etc.
- Other changes as appropriate

In addition, each version is fully supported through technical support and field service personnel that are trained and experienced in your level of software.

1.9.1 Technical Training

ABB Technical Training will allow you to learn how to optimize your Advant OCS to its full potential. As a result, you will get the most of your ABB investment. Increased productivity and performance, cost savings, and increased revenue is the result of ABB training.

Continuous learning opportunities, heavy hands-on training activities, and real-world simulated environments provide the knowledge and skills you need to master the technology. Our instructors are considered to be the subject matter experts and are dedicated to meeting your needs.

In addition to the course offerings listed below, we can deliver customized courses direct to you or at one of our training facilities.

Course Offerings / Course Duration:

B100 System Overview* / 1 - 4 days

B105 System Overview for Advant OCS* / 1 - 4 days

B110 System Engineering for Supervisors* / 2.5 days

B115 System Engineering with Advant Technology for Supervisors* / 2.5 days

B120 Taylor Control Language for Supervisors / 4.5 days

B125 Taylor Control Language with Advant Technology for Supervisors / 4.5 days

B200 System Operation* / 2 days

B205 System Operation w/Advant Technology* / 2 days

B300 Maintenance I / 4.5 days

B305 Maintenance w/Advant Technology / 4.5 days

B310 Maintenance II / 4.5 days

B315 Unix Fundamentals for Advant Technology / 4.5 days

B400 System Engineering / 9.5 days

B405 System Engineering w/Advant Technology / 9.5 days

B415 Advant OCS, Fundamentals / 4.5 days

B435 Advant OCS, ES Configuration / 4.5 days

B500 Taylor Ladder Logic (TLL) / 4.5 days

B510 Taylor Control Language (TCL) / 9.5 days

B515 Taylor Control Language w/Advant Technology / 9.5 days

B520 Computer Interface Programming* / 9.5 days

B530 Batch 300 / 3 days

B535 Batch 300 for Advant Technology / 3 days

B605 Advant OCS, IMS Basic Functions and Tools / 4.5 days

B615 Advant OCS, IMS Information Systems Application Development / 4.5 days

B635 Advant OCS, IMS Basic Tools w/History, Reports, and SPC / 5 days

B645 Advant OCS, IMS Advanced Techniques / 5 days

X215 MOD 300 Service Engineer Workshop (Special) / 4.5 days

* special courses scheduled upon request

Advant OCS with MOD 300 Software Training Facilities are located in the following countries:

Australia

Argentina

Canada

France

Germany

Italy

Korea

Mexico

Netherlands

New Zealand

Singapore

United Kingdom

United States:

- West Henrietta, New York
- Houston, Texas

Visit our Web Site

Our training schedule, course descriptions, announcements, policies, location information, etc. is available to you on the Web: http://www.abb.com/americas/iad/training

Chapter 2 Software Descriptions

2.1 AdvaControl Process Software

Today's sophisticated processes demand advanced process control techniques. The Advant OCS meets these demands through powerful control software applications:

- Configurable Control Functions
- Taylor Control Language
- Taylor Ladder Logic

These software applications provide optimal implementation approaches in the areas of continuous control, discrete device control, high-speed interlock logic control, sequential and batch control, and supervisory control.

2.2 Configurable Control Functions (CCF)

CCF is a structured function block control language for both continuous and discrete process control. It consists of software modules for the functions of continuous process control, discrete device handling, sequential process control, standard operational displays, and alarm detection. The function blocks are comprehensive, and easy to use. Control strategy implementation is simplified through the sophistication of the algorithms used. Complex functions are broken down into a series of simple options. The system provides preconfigured default values for all possible options, so the user only has to deal with the features that need to be "turned on."

The functions that are provided in the CCF software are derived from traditional control elements like panelboard controllers, signal function generators, and logic modules. These basic algorithms are enhanced through time saving options built into the software. CCF uses process variables in their scaled, floating-point form, with engineering units. Performing math, signal selection, or compensation algorithms is greatly simplified since artificial scaling factors are eliminated. Each input from or output to the field can have its direction reversed with a simple selection.

When the control functions have been configured, the operator's view has already been defined automatically. As an example, if a control loop has an optional remote setpoint, then the operator will be presented with the option of using it automatically.

Data is entered once. The user does not have to set up separate tables or communication buffers for communication with the operator or other controllers. Communication from one control loop to another is accomplished by using the loop's unique tag name reference where the data is needed. The user does not have to keep track of the locations and codes for various control schemes - only the unique tag name associated with each control function.

2.2.1 CCF Loop Structure

The CCF package is designed to implement the continuous and discrete control functions by combining individual function modules. There are three main classes of modules: Loop Class Modules (LCM), Function Class Modules (FCM), and Device Loops. LCMs are a logical collection of FCMs to perform a particular control function such as a control loop. The FCMs are essentially part of the LCM. Device Loops are used to control field devices with discrete inputs and outputs.

Each module is assigned a unique name during the configuration process. For LCM and Device Loops this name is called the tag name. This tag name is used to refer to the overall loop, or any variable within the loop. FCM information is accessed by the combination of the LCM’s name, a unique three character FCM name, and a particular FCM attribute name. Any other software package has access to the loop attributes through the use of this tag. Tag names can be any 12 alphanumeric characters.

Loop Class Modules

LCMs can be used to define indication loops, control loops, and calculation loops. LCMs are built from Function Class Modules which provide specific control function based on type. Combinations of these FCMs are grouped into the Loop Class Module, and they together make up the control loop.

There are several Loop-level attributes that are defined for each LCM. Some of them are:

- Tag Name
- Description
- Processing rate
- Loop state
- Designated measured variable
- Trend Rate
- Engineering Units

LCMs organize the various control functions and provide the convenient features for operator interface and interaction with other software packages. All of the standard display features of the MOD 300 Console are made available through the LCM. The Description, Trend, Units, and other loop information is automatically made available to the operator. This information is only entered once, as part of the LCM configuration.

The order of loop processing is important for some critical control applications. The LCM allows the user to specify which loops will execute in which order. As with other CCF parameters, if the order of processing is not important, then the user does not need to make any entries. The order of processing within the loop is also part of the LCM's function. This is determined by selecting various FCMs in the order desired.

Function Class Modules

Each type of FCM performs a specific function. Up to eight FCMs can be combined in one LCM. A common example is the combination of an analog input, PID, and analog output to form a control loop.

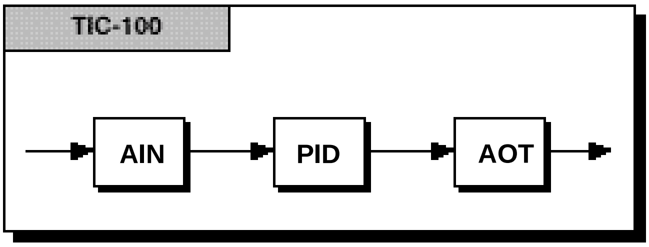


Figure 2-1. Loop Example

For example, the control loop “TIC-100” consists of three FCMs. The Analog Input FCM (AIN) accepts a signal from any of the MOD 300 analog inputs, whether remote or direct. The PID Controller FCM (PID) performs a wide variety of PID control algorithms. The Analog Output FCM (AOT) sends the result of the PID FCM to any of the various MOD 300 analog output types. The three letter names of the FCMs can be assigned any three alphanumeric characters. The default names used in the example will be used in most cases. When more than one FCM of the same type is used within the same loop, the names must be changed to make them unique.

The number of inputs and outputs associated with each FCM depends on the types of function performed. Some computational functions may require four or more inputs. Other scaling or I/O functions may only have one input and one output. The control FCMs can have many input sources for special purposes, and these will be discussed separately.

Device Loops

Device Loops are used to control discrete devices like motors and valves. Discrete inputs and outputs are used in combinations to turn on and off field signals, and to sense the state of the field device. Device loops are not built using FCMs, but are defined by choosing from one of the predefined device types, or by defining custom device types.

A Device Loop accepts the various start, stop, and status contacts from field devices and organizes them as an object. Text descriptions are assigned for the various command and states that are valid for that device.

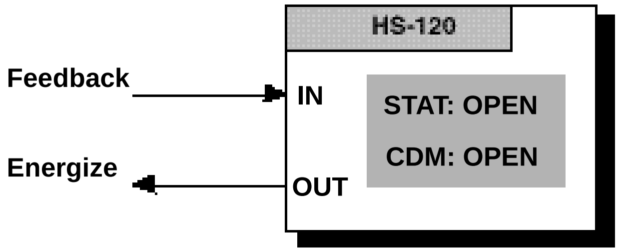


Figure 2-2. Device Loop Example

For example, a solenoid valve in the field is controlled by the device loop HS-120. One output from the device energizes the valve’s solenoid to open the valve. A limit switch on the valve provides feedback to the system that the valve is open. This device has two valid states: 0–CLOSED; 1–OPEN. When the operator takes control of the device on any standard display, the two options, CLOSED and OPEN, are presented. Other software packages can refer to the device using either the actual state value or by using the descriptor set defined for the device.

2.2.2 LOOP/FCM DISPLAY

The Loop/FCM Display is a runtime display accessible by all users that provides a comprehensive level of tuning features only available to users with the proper password level of authority. For each continuous loop, the engineer tuning displays are:

- The Loop/FCM Display, shown for a typical PID control loop in Figure 2-3, visually indicates the relationships between the various functional modules that make up a loop. This display allows a user with the proper authority to perform additional tuning functions not available on the Loop Detail Display. To avoid ambiguity the Loop FCM display shows the structure of the loop. It gives the sources of inputs, the destination of the results, and the status of the FCMs.
- A runtime version of the Loop Definition Templet. It is used to modify some of the fields that were originally configured via the loop's Loop Definition Templet.
- Runtime versions of the loop's FCM Templets. They are used to modify certain fields that were originally configured via the FCM Templets.

For each device loop, the Loop/FCM display is a runtime version of the Device Loop Templet.

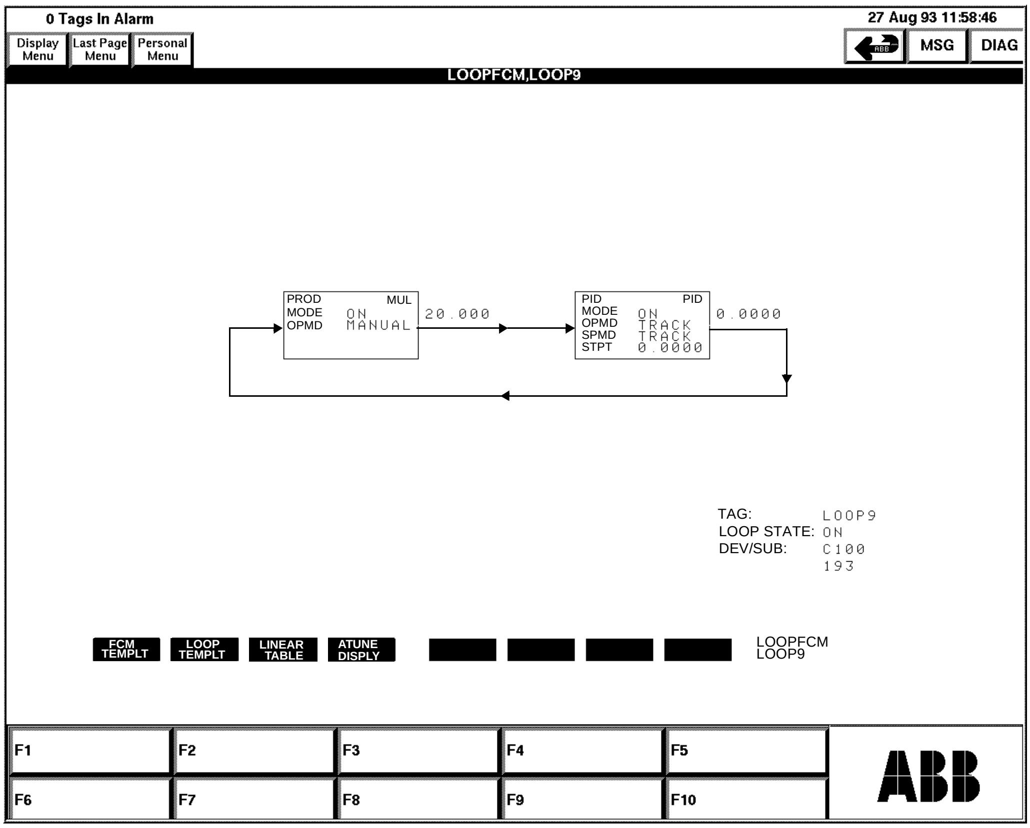


Figure 2-3. Example of a Loop/FCM Display

2.2.3 LCM Features

The Loop Class Module provides many convenient features that simplify the implementation of advanced control applications. The LCM is responsible for process alarming, control access privileges, and control modes. Each of these aspects of control apply to the loop as a whole. The LCM makes this view of the database convenient for the user.

Process Alarm Capabilities

Alarms based on the process measurement are defined as part of the LCM. Alarms on Setpoint, Output, Deviation, or other control parameters are defined as part of the PID control FCM. Each alarm has several parameters that can be set on an alarm type basis. Each alarm type can be turned on or off. The assigned priority to the alarm type is set to STANDARD, MED, or HIGH. The trip point is also set on a type by type basis. The following table lists the alarm types that are available for all process measurement.

Table 2-1. LCM Measure Alarm Types

Alarm Type	Alarm is Active When
Hi	Alarm variable exceeds a specified value
Lo	Measured variable falls below a specified value
Bad Measure	Data quality of measured variable is BAD
HiHi	Measured variable exceeds a second specified high value. This value is chosen to be Š the alarm limit of the Hi alarm.
LoLo	Measured variable falls below a second speci?ed low value. This value is chosen to be ð the alarm limit of the Lo alarms.
Rate	Rate of change of the measured variable exceeds a specified rate as measured from one loop processing cycle to the next.

Alarm Deadband can be used to reduce or eliminate nuisance alarms. Without deadband, an alarm will clear as soon as the measurement clears the alarm trip point. In cases where the measurement may be cycling near the trip point it may generate a series of alarms by repeatedly setting and clearing the alarm condition. Deadband refers to a zone near the alarm trip point that the measurement must pass before clearing the alarm condition. Deadband is set on an LCM basis and can be different for each tag. The following figure graphically shows the effect of deadband.

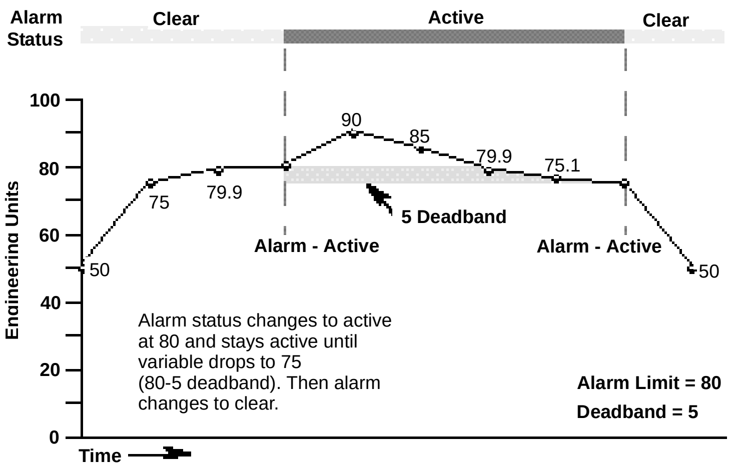


Figure 2-4. Example of Alarm Activation

Alarm suppression is a useful feature during startup or shutdown conditions when nuisance alarms can be generated by equipment that is not in service. ALARM CHECK ENABLE can be turned off during periods when the alarms conditions should not be tested. ALARM POST ENABLE provides the capability to prevent alarms from printing and/or generating audible indication on operator consoles. With CHECK ENABLE ‘ON’ and POST ENABLE ‘OFF’ the alarm conditions will be tested and will be visible on displays, but will not generate unwanted audible indications.

Computer Mode

TCL sequences and Host-based application programs can provide supervisory and advanced control functions. The Computer Mode capability controls when the supervisory program can have access to the control loop, and what, if any, actions are to be taken if the program does not operate properly.

The Computer Mode has two basic options: LOCAL and COMPUTER. When used in the LOCAL configuration the operator must request the computer to take control of the loop, and the supervisory program can then place the loop into the Computer Mode. When used in the COMPUTER configuration the supervisory program can issue the request and place the loop into the Computer Mode without the operator’s assistance. In either configuration the operator can force the loop into a Local mode that will disallow the supervisory program from gaining access to the loop.

2.2.4 FCM Features

CCF offers a comprehensive set of software functions called Function Class Modules. These configurable FCMs form building blocks for performing continuous and discrete control functions. Since many of the FCMs provide different functions depending on the configuration choices, the actual number of different functions is much longer than the list of FCMs. Many functions which would require several additional blocks in other control languages are implemented with less effort in CCF.

Each of the input and output FCMs provide the capability to reverse the sense of the input. Field devices that do not work as expected during startup operation can be easily accommodated without additional function blocks.

Process inputs to all FCMs have a scaling factor that can be applied, often eliminating the need for scaling external to the required FCMs.

Function Class Module Listing

Table 2-2 is an overview of the various types of FCM modules that are available by type.

Table 2-2. FCM Modules

Type	FCM	Description
I/O & Control	AIN	Analog Input
	AOT	Analog Output
	DIN	Digital Input
	DOT	Digital Output
	PIN	Pulse Input
	PTR	Pulse Train Output
	PDO	Pulse Duration Time
	PDR	Pulse Input Time Derivative
	PID	PID Controller
	AM	Auto/Man Controller
Logic	AND	Logical AND
	OR	Logical OR
	NOT	Logical NOT
	XOR	Logical Exclusive OR
	FF	Set / Reset Flip-Flop
	COM	Real Compare
	BAND	Bit-Wise AND
	BOR	Bit-Wise OR
	BNOT	Bit-Wise NOT
	BXOR	Bit-Wise Exclusive OR
Scale	RB	Ratio and Bias
	NRM	Normalize
	INR	Inverse Normalize
	SCL	Scale Input
	SQR	Modified Square Root
	FLW	Flow Calculation
	LKP	Linearization
	TMP	Temperature Compensation

Table 2-2. FCM Modules (Continued)

Type	FCM	Description
Math	ABS	Absolute Value
	SUB	Subtraction
	MUL	Multiplication
	DIV	Division
	ADD	Sum of 4 Inputs
	AVG	Average
	LOG	Natural Logarithm
	PLY	Polynomial
	EXP	Exponentiation
Time	FLT	First Order Filter
	TOT	Totalizer
	DTM	Dead Time
	TMR	Timer
	LLG	Lead/Lag Filter
	CNT	Counter
	DLY	Delay Timer
Extended Processing	MAV	Cont. Moving Avg
	PMX	Periodic Maximum
	PMN	Periodic Minimum
	PTO	Periodic Total
	PAV	Periodic Average
	PSD	Standard Deviation
	SFC	Select Next FCM
	RED	Redundant Signal Select
	SEL	Selector
	GET	Get Generic Value
	PUT	Put Generic Value

Table 2-2. FCM Modules (Continued)

Type	FCM	Description
	MTH	User Math
	UCL	User Calculation

Linearization Details

The Linearization FCM has several built-in tables that are used to provide compensation for thermocouple and RTD inputs. In addition to these Standard Tables, Custom Tables can be built using the BreakPoint Set capability of CCF. For each value of the input signal, the Result is determined by standard straight-line interpolation from the specified table.

When the Standard Tables are used for temperature element linearization, the user can specify the temperature scale that the result is to be generated in. The following scales are supported:

C - Degrees Celsius

K- Degrees Kelvin

F- Degrees Fahrenheit

R - Degree Rankine

The FCM provides both Cold and Hot Junction Compensation options for use with various thermocouple installations. In the case of Hot Junction Compensation, the user will also have to supply the temperature value at the junction so that a bias value can be calculated.

Table 2-3. Standard Linearization Tables

Table	Element Type
B	Type B thermocouple
E	Type E thermocouple
J	Type J thermocouple
K	Type K thermocouple
R	Type R thermocouple
S	Type S thermocouple
T	Type T thermocouple
DIN	DIN type RTD
BURNS	Burns type RTD

Custom Tables

Custom Linearization Tables are built using the BreakPoint Set TEMPLET. Up to ten pairs of floating point numbers (X,Y) will form the Linearization table.

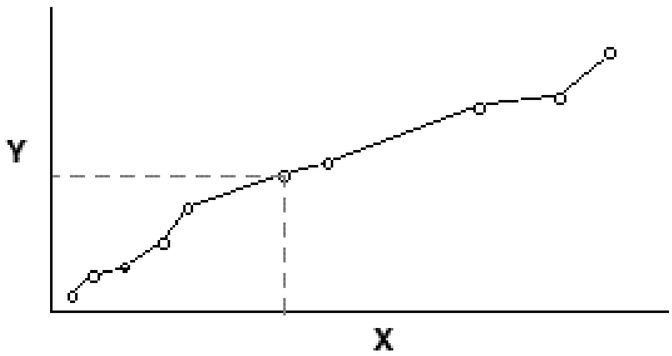


Figure 2-5. Breakpoint Sets

Flow Calculation Details

The Flow Calculation FCM performs compensation based on Differential Pressure measurements of Velocity (flow rate). The following table provide details on the algorithms used for the various types of measurements and compensations.

		Compensation Type			
		None	Density	Temperature	Pressure & Temperature
C Flow Calculation	Flow Rate	$K\sqrt{h}$	$K\sqrt{h}$	$K\sqrt{h}$	$K\sqrt{h}$
	FR @ Flowing	$K\sqrt{h}$	$K\sqrt{h/G_f}$	$K\sqrt{\frac{h(1+Bdt)}{g_T}}$	$K\sqrt{\frac{hT_f}{P_f G}}$
	FR @ Standard	$K\sqrt{h}$	$K\sqrt{h * G_f}$	$K\sqrt{\frac{h}{(1+Bdt)\ g_T}}$	$K\sqrt{\frac{hP_f}{T_f G}}$
	Mass Flow Rate	$K\sqrt{h}$	$K\sqrt{h * G_f}$	$K\sqrt{\frac{h\ g_T}{[1+Bdt]}}$	$K\sqrt{\frac{hP_f G}{T_f}}$

Figure 2-6. Flow Calculation Algorithms when the Flow Calculation Technique Field Contains DIF PRESSUREg

Key to Algorithm:

K	Flow Coefficient
h	Differential Pressure Input
V	Velocity Input
G_f	Density at reference flow rate
B	Coefficient of Thermal Expansion
T_f	Temperature at reference flow rate
G	Density at standard conditions
P_f	Pressure at reference conditions
dT	Temperature minus standard temperature
g_T	Specific gravity at standard conditions

		Compensation Type			
		None	Density	Temperature	Pressure & Temperature
Flow Calculation	Flow Rate	KV	KV	KV	KV
Flow Calculation	FR @ Flowing	KV	KV	KV	KV
Flow Calculation	FR @ Standard	KV	KV G_f	KV $\frac{1}{1+Bdt}$	KV $\frac{P_f}{T_f}$
Flow Calculation	Mass Flow Rate	KV	KV G_f	KV $\frac{g_T}{1+Bdt}$	KV $\frac{P_f}{T_f}$ G

Figure 2-7. Flow Calculation Algorithms when the Flow Calculation Technique Field Contains VELOCITY

Dead Time Simulation Example

The Dead Time FCM is used to implement a pure dead time. Figure 2-8 illustrates this.

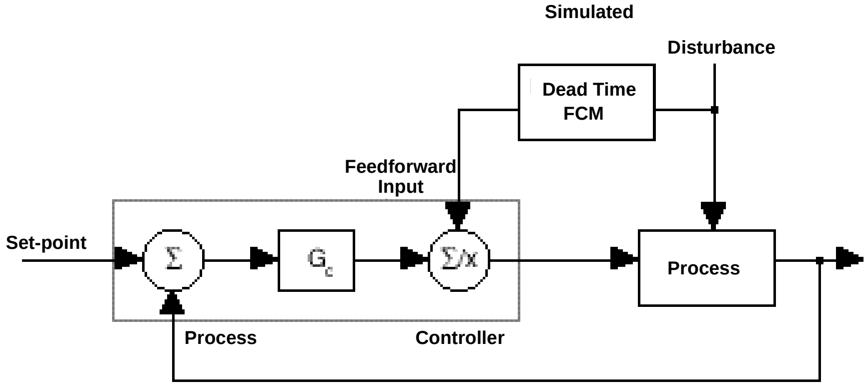


Figure 2-8. Feed Forward Using Simulated Dead Time

Dead Time Compensation Example

When the process contains a dead time which threatens control loop stability, this FCM provides a compensated process signal to the loop controller. For example:

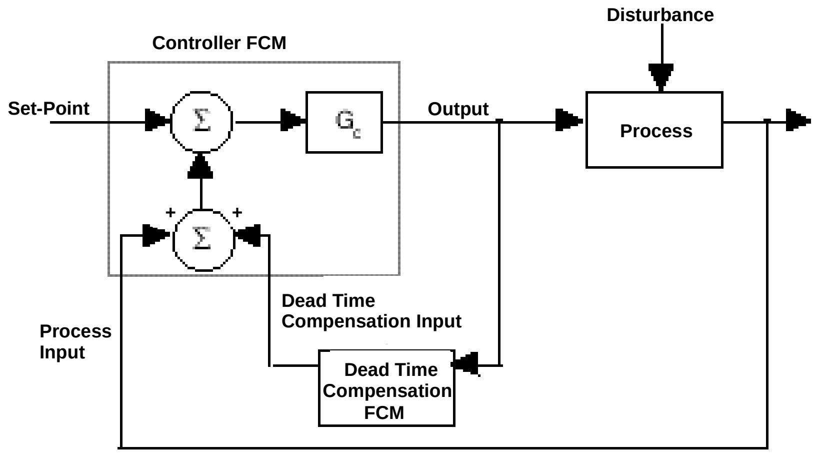


Figure 2-9. Dead Time Compensation Example

2.2.5 Control FCM Features

Several of the Function Class Modules provide features which allow direct operator interaction. The PID Controller and Auto / Manual Controller have control modes that the operator can manipulate to affect the way the algorithm operates. These FCMs allow the user to create sophisticated mode selections and advanced control features available without any programming. Simple selections determine whether the loop will have feed forward control enabled. If these functions are available, then the console software will automatically make these options visible and selectable to the operator.

Some of the advanced features of the two primary control FCMs are discussed in the following sections.

Auto/Manual Controller FCM

The Auto/Manual Controller FCM is used to set up a ratio/bias station or a manual loader. It accepts an input from another FCM and modi?es the input with ratio and bias values. When the Auto/Manual Controller FCM is in the Auto Output Mode, the modi?ed input becomes the FCM output (Result). When it is in the Manual Output Mode, the output is a value entered by the operator from the Console. When it is in the Track Output Mode, the output tracks the value of another signal generally from another loop.

The simplified block diagram shows the mode selections available with the Auto / Manual FCM.

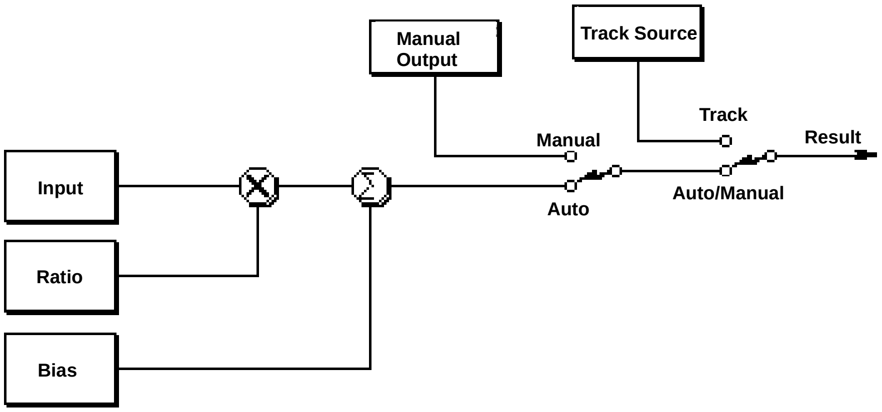


Figure 2-10. Simplified Block Diagram of Auto/Manual Controller

Bumpless Mode Transfers and Tracking for Auto/Manual Controllers

During operation, switching from Auto to Manual Mode requires one step and is bumpless because the Manual output value automatically tracks the Auto output value when the FCM is in Auto.

Switching from Manual to Auto can be made bumpless by using either one of the following techniques:

- Ratio or Bias Balancing: The Balance field is used to specify that either the ratio or the bias is automatically adjusted by the system so the Auto Output Value of the controller is equal to the Manual Output Value.
- Output Tracking: The output of a PID FCM supplying the input for the Auto/Manual Controller FCM can be con?gured to track the TRAK- VAR parameter of the Auto/Manual Controller FCM.

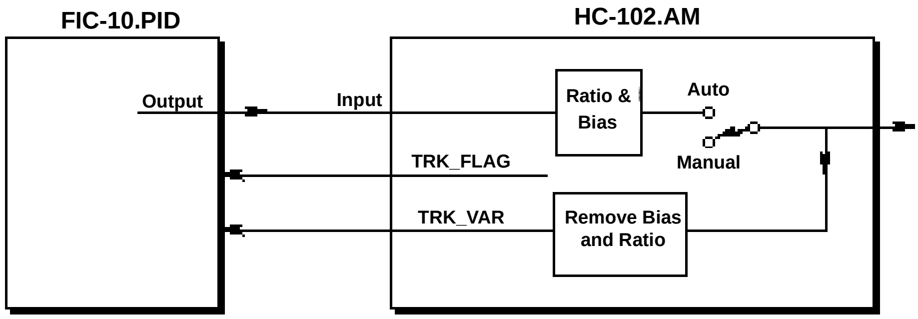


Figure 2-11. Bumpless Mode Transfer in Auto/Manual Controls (Output Tracking)

PID Controller FCM

The PID Controller FCM applies a control algorithm to a continuous variable in the process. The applied algorithm is one of the variations of the standard PID (proportional, integral, derivative) control function.

The PID Controller FCM provides many built-in functions that eliminate many external function blocks. Some of these include:

- FeedForward / Feedback
- Adaptive Gain / Reset
- Deadtime Compensation Source for process input
- Incremental or Full Value algorithm
- Ratio / Bias of Remote Setpoint
- Setpoint Tracking
- Output Tracking
- Alarming based upon set point deviation and Output

The following options are available for the controller's output:

Track	Output value is set to equal speficied signal
Allowed modes	The combinations of Auto, Manual, and Track that can be used are specified on the Output Modes Allowed field.
Initialization	The mode the output takes upon startup is speci?ed via the Initial Mode field. For the Manual Mode, the initial value of the signal is speci?ed by the Initial Output field
Limits	Limits for the output are speci?ed by the Output High Limit, Output Low Limit, and Output Rate Limit fields. The modes using the limits are speci?ed via the Limited Output Modes field.
Action	The output is speci?ed to be direct or reverse acting via the Controller Action field

Bumpless Mode Transfers and Tracking for PID Controllers

During operation, switching from Auto to Manual Output Mode requires one step and is bumpless. When the mode is switched to Manual, the output is maintained at the value it had prior to the switching. The output value can then be manipulated. The following figure illustrates bumpless mode transfers and tracking.

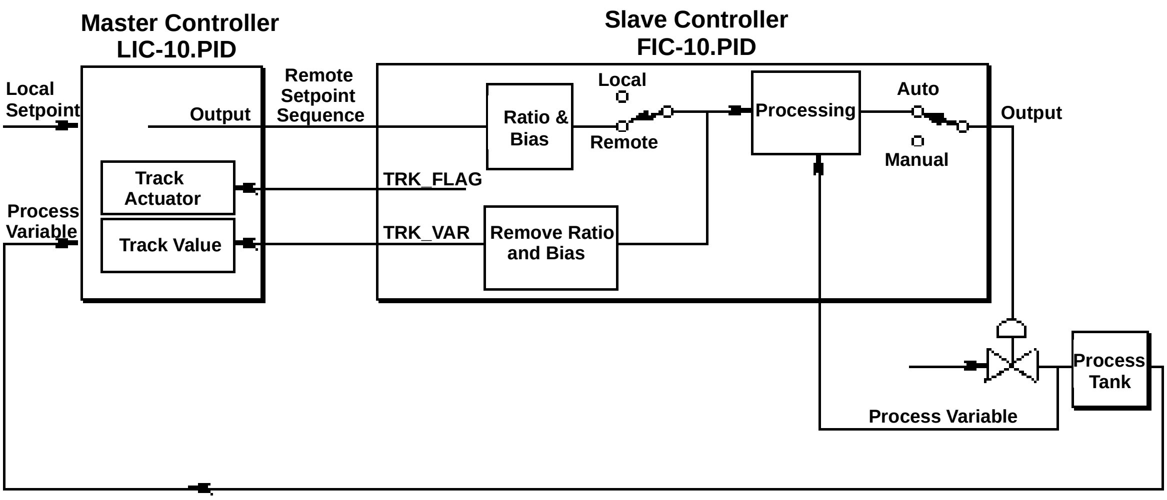


Figure 2-12. Example of Bumpless Mode Transfer using Setpoint and Output Tracking

2.2.6 AUTOTUNE

The AUTOTUNE algorithm is responsible for performing the calculations which result in the new controller algorithm parameters. The tuning parameters which are calculated are the GAIN, RESET, and PREACT values. The AUTOTUNE algorithm is invoked from a tag's Loop/FCM display. Once invoked, the AUTOTUNE algorithm will manipulate the Controller's output and then monitor the response of the process. This action is referred to as the *identification phase* of the AUTOTUNE algorithm.

Based on the response observed by the algorithm, calculations on the process values will be performed. This action is referred to as the *design phase* of the AUTOTUNE algorithm. The results can then be used to update the controller algorithm parameters. This action is referred to as the *activation phase* of the AUTOTUNE algorithm. The Activation phase is also referred to as the 'Commissioning' phase in some Process Control industry literature.

Closed Loop Method

This is the default method. Closed Loop method is used if the process is subject to frequent load disturbances. The Closed Loop algorithm is less sensitive to these disturbances than the Open Loop Algorithm. The Closed Loop method must be used if the process is an integrating process. An integrating process is one which will not return to a steady state following a step change in the controller output. As previously stated, the AUTOTUNE algorithm consists of three phase:

1. Process Identification

   The goal of this phase is to characterize the process. In order to accurately characterize the process, two parameters need to be extracted from the process. They are:

   - Ultimate Process Gain
   - Ultimate Process Period

2. Controller Design

   The goal of this step is to calculate the controller algorithm tuning parameters values based on the controller type desired and the information extracted during the Process Identification step. The following parameters are calculated:

   - Proportional Gain
   - Integral Gain
   - Preact Time Constant

3. Parameter Activation

   The goal of this step is to apply the parameters obtained during the Controller Design step to the control algorithm. The AUTOTUNE function will then notify the user that autotune has been completed and place the Controller into the proper operating mode.

   The Activation Phase of the Closed Loop method will require one loop scan to update the database.

Open Loop Method

The Open Loop method is an automated form of the time-proven 'reaction-rate' method. The Open Loop algorithm can be used on both PI and PID controllers. In addition, the Open Loop method must be used to tune DTC (Dead Time Compensated) controllers.

As previously stated, the AUTOTUNE algorithm consists of three phases:

1. Process Identification. The goal of this phase is to characterize the process. In order to accurately characterize the process, three parameters need to be extracted from the process. They are:
   - Process Gain
   - Process Lag
   - Process Dead Time
2. Controller Design

   The goal of this step is to calculate the controller algorithm tuning parameter values based on the controller type desired and the information extracted during the Process Identification step. The following parameters are calculated:
   - Proportional Gain
   - Integral Gain
   - Preact Time Constant
3. Parameter Activation

   The goal of this step is to apply the parameters obtained during the Controller Design step to the control algorithm. The AUTOTUNE function will then notify the user that autotuning has been completed and place the controller into the proper operating mode.

   The Activation Phase of the Open Loop method will require one loop scan to update the database.

2.2.7 Device Loop

The term "device" is used to identify a process item driven by a system digital output (momentary or contact) or whose state is sensed by a system input. Typical devices are motors, pumps, switches and valves.

A device loop is used to display the state and direct an output command of device from a console or application program. Device loops detect alarms based upon not receiving feedback from the field or based upon unexpected changes of state or invalid states.

There are fourteen standard device types ranging from simple one input devices to four input / 2 output devices with 16 states. In addition to the standard choices, there are two types of custom device types available. If a device does not fit into one of the standard categories, a special device type can be created. These special devices are similar to standard devices with up to 16 inputs and up to 16 outputs (4 of which may be momentary). They can reference a descriptor set the same as standard devices. A Special Device Templet can be used by one or more Device Loops in the same node. Table 2-4 lists the various types available.

Table 2-4. CCF Device Types

Type	Input	Output
1	None	2 Contact
2	None	1 Contact
3	None	1 Momentary
4	None	2 Momentary
5	1 Contact	1 Contact
6	1 Contact	2 Momentary
7	2 Contact	1 Contact
8	2 Contact	2 Contact
9	2 Contact	2 Momentary
10	4 Contact	2 Contact
11	1 Contact	None
12	2 Contact	None
13	3 Contact	None
14	4 Contact	None
User Defined	Set by TCL	Set by TCL
Special	Up to 16	Up to 16 contact. (up to 4 Momentary)

Simulation/Device Override Modes

As a standard feature of the device loop, there exist various simulation modes designed to aid in testing and simulating device situations for TCL program or host computer applications. These modes are very valuable in the testing of sequencing prior to actual field checkout and may be changed during runtime by TCL sequences or the host computer. These are described in Table 2-5.

Table 2-5. Device Simulation and Overrides

Simulation Mode	Device Override	Effect
Off	OFF	Normal
ON	OFF	Device field inputs are ignored and outputs are not actually sent to the field when a command is changed. Timeout occurs when command and state do not match.
OFF	ON	Device field inputs are ignored. When the device timer expires, the device's state is set to the device's command.
ON	ON	Device field inputs are ignored and outputs are not actually sent to the field. The devices state is set to the device's command without waiting for the device timer to expire.

2.2.8 Primary History Log

The Primary History Log is used to collect the MEASURE, RESULT or SETPOINT values of a continuous loop for trend display. Functionality for Primary History Logs resides only on Advant Controllers, including the AC410 (PM150) and AC460 (PM510). At runtime, only the presentation range for a Primary History Log can be changed from trend displays.

2.2.9 CCF Software Specifications

Minimum Hardware Requirement OS/ES, Advant Controller

Minimum Scan Rate100 msec in Advant Controller

Data Base Size

Advant Controller 410Up to 1.5 meg

Advant Controller 460Up to 4.0 meg

OS/ES Configuration Dependent

2.3 Taylor Control Language

2.3.1 General

The Advant OCS with MOD 300 Software provides a real-time, high-level programming language for process control called the Taylor Control Language. The TCL software package includes development and runtime support facilities for developing and implementing custom programs. These programs or sequences run in conjunction with the Configurable Control Function software and the Taylor Ladder Logic software. Typical applications for TCL programs include:

- Sequential/batch control.
- Complex arithmetic and logic functions.
- Supervisory tasks such as startups and shutdowns.
- Serial interfaces to third party equipment.

TCL is a structured programming language modeled after Pascal. It includes many block programming structures such as compound statements, IF…THEN…ELSE statements, etc. In addition, TCL has unique programming structures that are specifically designed for process control and MOD 300 applications. The use of English-like key words and the specially designed programming structures allow users with relatively little programming experience to develop custom programs for process control.

This section provides an introduction to the unique functional elements of TCL.

2.3.2 Unit Relativity and Symmetry

Unit Relativity is an important distinguishing capability within the system. This feature allows sequences, graphics and reports to be written in a generic manner such that they may be reused on any similar unit without modification. The advantages of this are reduced engineering development time, sequence debugging time and software maintenance time.

It is important to understand the concept of units and unit symmetry for development of TCL programs and integration of these programs in the system environment.

The term unit is used to describe an arrangement of related MOD 300 components such as controller cards and/or a station where TCL programs and recipes can be specified to run. When the system components are associated with such devices as a batch reactor with valves, measuring elements, etc., the term unit can be expanded to include these devices as well. In this context, the term unit refers to a group of related system and process devices that collectively perform a specific function on a process.

The term unit symmetry is used in Advant OCS literature to describe the situation where a process may have many units that are structurally and functionally identical. (i.e. tanks, reactors, etc.)

TCL provides the means to establish an association between the common elements in symmetrical units such that generic programs can be developed and run on symmetrical units without having to be modified for each individual unit.

For instance, consider the three symmetrical units shown in Figure 2-13. Each unit has a unique rinse valve (RINSE-1, RINSE-2 and RINSE-3). These valves can be assigned a common reference name such as RINSEVALVE on a Unit Relative Names Templet. Then a TCL program can be developed using the reference name instead of the specific device names as shown in the following example.

Example:

*RINSEVALVE.DEV_CMND:= #OPEN;

When the program is run on UNIT 1, RINSE-1 will be opened. When the program is run on UNIT 2, RINSE-2 will be opened, and when the program is run on UNIT 3, RINSE-3 will be opened. Notice that the discharge pump is a shared resource and does not represent unit relativity.

Unit variables are created on the Unit Master Templet in CCF. These variables are global for the unit that the Unit Master Templet is associated with. Unit variables provide a means of sharing parameters between programs that are running on a unit.

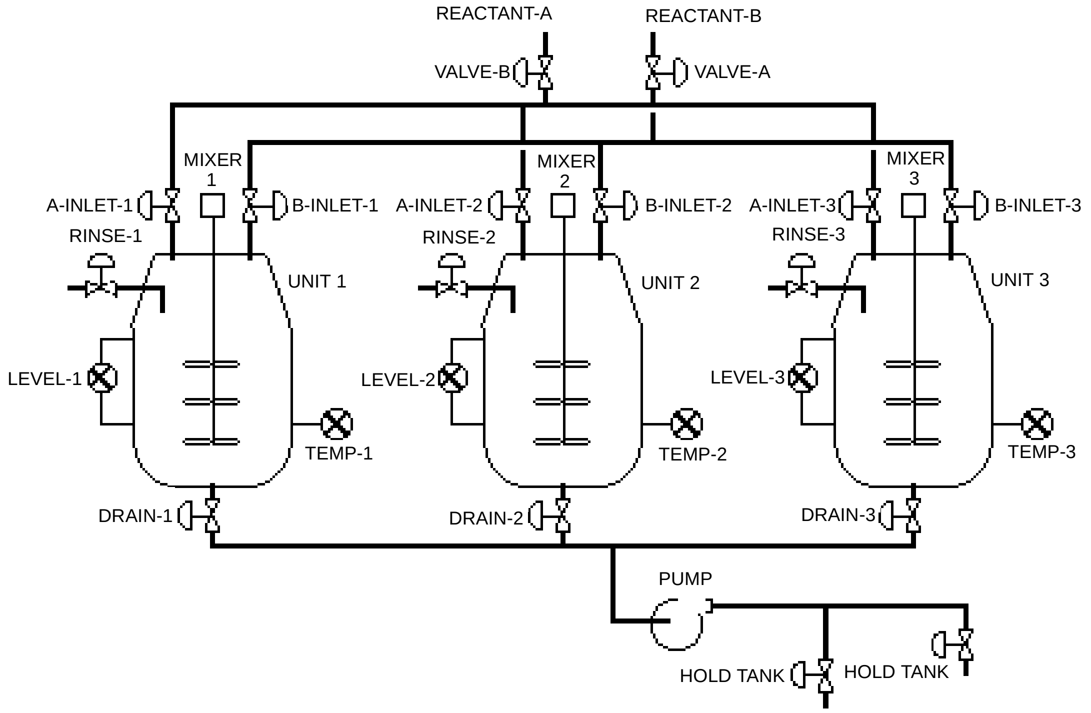


Figure 2-13. Symmetrical Units

2.3.3 TCL Program Hierarchy

TCL provides a hierarchy of program types for applications that require a hierarchical control structure. This hierarchy includes Operations, Procedures and Schedules. Every Program hierarchy is as follows: Schedules are the top level, followed by Procedures and then Operations. A TCL program can invoke the execution of another TCL program through an external program call. When an external program call is used, the calling program must be higher in the TCL program hierarchy than the program that it calls. Thus a Schedule can call Procedures and Operations, and Procedures can call Operations.

The external program call is one of a number of methods for invoking the execution of a TCL program. The relation of program hierarchy to external program calls is described briefly in the following paragraph. The hierarchy of Schedules, Procedures and Operations is designed to accommodate the logical organization of a plant manufacturing cycle. For instance, consider a manufacturing cycle where the cycle is subdivided into the following phases: fill, mix, heat, drain and rinse. Each phase can be controlled by a separate TCL Operation. The entire manufacturing cycle could be controlled by Operations alone; however, manual intervention would be required to transfer control from one Operation to the next. A Procedure can impose a first level of supervisory control over the process by directing the transfer of control from one operation to the next without manual intervention. A Schedule can impose a second level of supervisory control by directing the transfer of control from one Procedure to the next to allow many manufacturing cycles to run without manual intervention.

2.3.4 Recipes

Recipes provide the means to direct data to one or more TCL programs running on a unit. For instance, a TCL recipe can hold various setpoint values, high/low limits and other data that are required for one or more TCL programs that control a specific product manufacturing cycle. A second manufacturing cycle may use the same programs with a different recipe. A unit can be loaded with one recipe at a time. The recipe data is accessible by all TCL programs running on the unit. The same recipe may be loaded to more that one unit at a time.

Traditional Recipes

A recipe is made up of items. Each item in a recipe has the following data associated with it: value, engineering units, item ID, high limit and low limit and descriptor. These types of recipe items that contain parameters only are the type that are used in traditional batching techniques. This is shown in the following table:

Table 2-6. Traditional Recipe Example

Item ID	Value	Description	Units	High Limit	Low Limit
COMPA	2.0	Component A amount	GAL	2.2	1.8
COMPB	10.2	Component B amount	GAL	10.3	9.7

Table 2-6. Traditional Recipe Example (Continued)

Item ID	Value	Description	Units	High Limit	Low Limit
COMPC	3.1	Component C amount	GAL	3.1	2.9
COOKTIME	5	Cooking time	MIN	6	4
COOKTEMP	350.0	Cooking temperature	DEGF	360.0	345.0

Flexible Batch Recipes

Another practical use of the recipe structure is called the Flexible Batch Recipe. Instead of using only parameters as items of the recipe, the recipe items consist of operations or steps and their associated parameters. The recipe items themselves are string variables and a TCL sequence is used to decode the operations and parameters associated with them. This provides the flexibility, not only to vary parameters from recipe to recipe, but also to specify different batching techniques or steps from recipe to recipe. Table 2-7 illustrates a flexible batch recipe.

Table 2-7. Flexible Batch Recipe Example

item ID	Value
OPER_1	ADD 220 KG CHEMA TO TANK1
OPER_2	ADD 250 KG CHEMB TO TANK1
OPER_3	HEAT_UP TANK1 TO 35 DEGC
OPER_4	HOLD 20 MINUTES
OPER_5	TRANSFER TANK1 TO TANK4

Recipe Parameters

Any TCL programs that are running on a specific unit can access the parameters from the recipe that is active on that unit or any other unit. The recipe mnemonics for the parameters are given in Table 2-8.

Table 2-8. Recipe Parameters

Mnemonic	Data Type	Description
RVALUE	Real	Value of real item
HI_R	Real	High limit for a real item
LO_R	Real	Low limit for a real item
IVALUE	Integer	Value of an integer item

Table 2-8. Recipe Parameters (Continued)

Mnemonic	Data Type	Description
HI_I	Integer	High limit of an integer item
LO_I	Integer	Low limit of an integer item
SVALUE	String	Value of a string item
DESC	String	Descriptor
ENGU	String	Engineering units label
RECIPEID	String	Name of recipe

2.3.5 Sequence State

A TCL program has three possible states: inactive, active and paused. The allowed state transitions are shown in Figure 2-14.

When the TCL program is downloaded, the initial state is inactive. A program that is inactive will not be processed until its state is changed to active. All the programs that are active on a given system device are executed on a timesharing basis according to their priority level, status and mode. Activation of TCL programs and parallel processing are described as separate subjects later in this section.

An active program becomes inactive when the END statement which marks the end of a TCL program is executed. A program can be aborted prior to its end through the ABORT statement.

An active program can also be paused through execution of the PAUSE statement. When paused, program execution is temporarily suspended. A paused program can be resumed through execution of the RESUME statement.

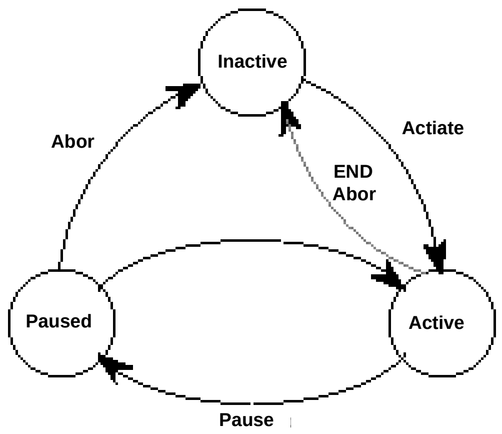


Figure 2-14. State Transitions

2.3.6 Sequence Status

The status of a TCL program can be normal or abnormal. When the status is normal the program will execute according to the other dynamic parameters. Normal is the default status when the program is downloaded.

The status will change from normal to abnormal upon the occurrence of any one of 16 possible abnormal conditions. There are four predefined abnormal conditions. Also, four are reserved for ABB use and the remaining 8 can be user-defined. A user-defined abnormal condition is established by implementing logic to detect the abnormal condition and then associating an ABNORMAL statement with the logic. For example:

```
EVENT 'CONDITION NO.'
    SETEVEMT ($'CV101'.MEASURE <LOWLIMIT);
    ACTION (ABNORM (7), CHARGE, UNIT1);
ENDEVENT
```

Table 2-9. Abnormal Conditions

Priority	Condition	Priority	Condition
1	Communications Failure	9	Reserved
2	Data Base Access Failure	10	Events Cleared (Node Down)
3	Reserved	11	Reserved
4	TCL Runtime Error	12	Reserved
5	User-defined	13	User-defined
6	User-defined	14	User-defined
7	User-defined	15	User-defined
8	User-defined	16	User-defined

In this case, when the measured value for tag CV101 exceeds the value defined by LOWLIMIT, the status of the program named CHARGE running on UNIT1 will be changed to abnormal condition 7. Once an event has been set up or 'armed', it acts as a continuous parallel check. This eliminates the need for additional monitor only sequences.

Predefined abnormal conditions do not require detection logic. The system will automatically monitor for these abnormal conditions.

Control can be passed to a specific subroutine when a normal-to-abnormal status transition occurs. This is done by associating a subroutine with a specific abnormal condition through an ABNORMSUBR statement. When the transition to abnormal occurs, control will be passed to the specified subroutine.

For example, in:

ABNORMSUBR (ABNORM(1), SHUTDOWN (HOUR));

the SHUTDOWN subroutine is being associated with abnormal condition 1. When abnormal condition 1 occurs, the program will invoke the SHUTDOWN subroutine and pass an integer parameter called hour to the subroutine.

If no association is made between a subroutine and an abnormal condition, the program will be placed in the PAUSED state, and the sequence status will be set to ABNORMAL when the abnormal condition occurs.

2.3.7 General Language Features

TCL is a free formatted English-like process control language designed for translating process requirements into structured programming constructs.

The language may be broken down into the following categories:

- Arithmetic Operators, Relational Operators and Logical Operators
- TCL Functions
- Control Block Parameters
- Program Flow Statements
- Peripheral I/O Statements
- Disk I/O Statements (i.e. data and/or text file reads and writes)
- Database manipulation and Process control
- Interface statements to Report Package and History Package

Operators

Arithmetic Operators yield either real (floating point) or integer values. These are in Table 2-10.

Relational Operators are used for performing magnitude comparisons. These are in Table 2-10.

Logical Operators are used in logical expressions to perform Boolean algebra on two integer or real expressions. The results will be either true (non-zero) or false (zero). These are included in Table 2-10.

Table 2-10. TCL Operators

Type	Operator	Description
Arithmetic Operators		
	+	Addition, string concatenation
	-	Subtraction or unary -
	*	Multiplication

Table 2-10. TCL Operators (Continued)

Type	Operator	Description
	/	Division
	MOD	Modulus
	(e.g., 27 MOD 10 = 7)	
	**	Exponentiation
Relational Operators		
	=	Equal to
	<>	Not equal to
	<	Less than
	<=	Less than or equal to
	>=	Greater than or equal to
	>	Greater than
Logical Operators		
	NOT	Negation
	AND	Logical AND
	OR	Logical OR

Functions

Functions are a grouping of frequently used routines that are built into TCL. They can be used in any expression to return values that are then used in the same expression as a variable or a constant. The five categories of functions, Mathematical, Trigonometric, Bit Manipulation, String Manipulation and Date/Time are shown in Table 2-11.

Table 2-11. TCL Functions

Type	Function	Description
Mathematical		
	ABS (x)	Absolute value of x
	LOG(x)	Common log of x
	SQRT(x)	Square root of x.
	EXP(x)	e raised to the power x
	LN(x)	Natural log of x
	ROUND(x)	Round the decimal portion of x
Trigonometric		
	SIN(x)	Sine of x (x in radians)
	COS(x)	Cosine of x (x in radians)
	TAN(x)	Tangent of x (x in radians)
	COT(x)	Cotangent of x (x in radians)
Bit Manipulation		
	BIT_AND(exp1,exp2)	Bitwise AND of the two expressions.
	BIT_OR(exp1,exp2)	Bitwise OR of the two expressions.
	BIT_XOR(exp1,exp2)	Bitwise exclusive OR of the two expressions.
	BIT_COMP(exp)	Bitwise one's complement of the expression.
	BIT_SHIFT(exp,count)	Bitwise shift of the expression. Positive count for left shifts, negative count for right shifts.
String Manipulation		
	LEN(x)	Length of string value x
	MID(x,y,z)	Return substring of z characters starting at position y (z and y >= 1) in string x
	ORD(x)	Ordinal (integer) number related to ASCII character
	CHR(x)	ASCII character related to ordinal number x

Table 2-11. TCL Functions (Continued)

Type	Function	Description
	ASTOI(x)	Returns integer number equivalent of ASCII string
	ASTOR(x)	Returns real number equivalent of ASCII string
	ITOAS(x)	Returns ASCII string equivalent of integer number
	RTOAS(x)	Returns ASCII string equivalent of real number
Date/Time		
	DATE(x)	Date according to x
	TIME(x)	Time according to x

Control Block Parameters

Control block parameters are those parameters associated with dynamic program control such as state, status and mode. A complete list of control block parameters is provided in Table 2-12. Control block parameters are global in that they can be accessed by any TCL program.

Table 2-12. Control Block Parameters

Mnemonic	Data Type	Value
CURSTEP	Integer	Display step being executed.
CURSTMT	Integer	Program statement being executed.
INSTID	String	Unit name as defined on a Unit Master Templet
NEXTSTEP	Integer	Next display step number to execute.
PAUSTEP	Integer	Step number at which to PAUSE when in SEMI-AUTO MODE.
SEQMODE	Integer	#MANUAL, #AUTO, or #SEMIAUTO
SEQSTATE	Integer	#ACTIVE, #PAUSED, or #INACTIVE
SEQTYPE	Integer	#SCHED, #PROC, or #OPER
SSTATUS	Integer	#NORMAL, #ABNORMAL_1 thru #ABNORMAL_16

Program Flow Statements

Program Flow statements either control the order in which TCL statements are executed, or they provide the required structure for a TCL sequence. Program flow statements include

Conditional statements and Looping statements. A summary of these statements is in Table 2-13.

Table 2-13. Program Flow Statements

Statement Type	Syntax
Conditional Statements	IF....THEN....ELSE
	CASE.. OF..OTHERWISE
Looping Statements	FOR... TO (or DOWNTO)..DO
	REPEAT... UNTIL
	WHILE..DO
	GOTO

Peripheral I/O Statements

The peripheral I/O statements (OPEN, CLOSE, INPUT, and OUTPUT) provide a means of data exchange between the TCL program and Serial I/O ports. ASCII conversion functions (ASTOI, ASTOR, RTOAS and ITOAS) and Bit Manipulation functions are provided to facilitate communications with peripheral ASCII devices.

Table 2-14. Peripheral I/O Statements

Statement	Description
OPEN	Opens a specific port and returns a port number to be used in other Peripheral I/O statements.
CLOSE	Dissolves the association between a port and a TCL program.
INPUT	Read data from a peripheral device to local variables in the TCL program.
OUTPUT	Transfers data from specified local variables to a peripheral device.

2.3.8 Data Base and Process I/O Manipulation

The FETCH and SET statements are used to read and write items in the data base.

The FETCH statement can read the value of any data base parameter that can be accessed by TCL. The SET statement can write the value of any data base parameter that can be accessed by TCL. The FETCH and SET statements are performed synchronously, i.e., the database access is performed as part of statement execution, a failure subroutine may be specified for immediate execution. The statements have the form

label: **FETCH (item, value, *subroutine (parameters));***

SET (item, value, *subroutine (parameters));*

where

item is the data base item being fetched. The possible types of items are shown in the

following table.

value is the new value to be assigned to the item.

subroutine is the name of the subroutine that executes if a database access error

occurs. Optional parameters may be passed to the subroutine.

.

Table 2-15. Database Items for FTECH/SET Statements

Item	Type
*name.parameter	Unit relative name and parameter
@’program’-’unit’.para	Program, unit, parameter for a control block parameter
*RECIPE(’item id’,unit).para or*BATCH (’item id’, unit).para	Item identifier and parameter for a recipe parameter. Unit is an optional parameter.
unitvar	Name for a unit variable
$'tag‘.para	Loop or device tag and parameter
$'tag'-'fcmname'.para	Loop tag, FCM name, and parameter

2.3.9 Sequence Debug Display

The Sequence Debug Display supports runtime troubleshooting and debugging of sequences. The display is accessed by selecting **Sequence Debug** from the Display Menu, then selecting a specific sequence from the Sequence Menu. The troubleshooting and debug functions on this display are TRACE and BREAKPOINT.

In AdvaCommand the debug display has been enhanced to incorporate overlapping windows and Motif style. This allows more efficient testing of TCL code by giving you the ability to use overlapping displays to view and modify debug parameters while the sequence code executes.

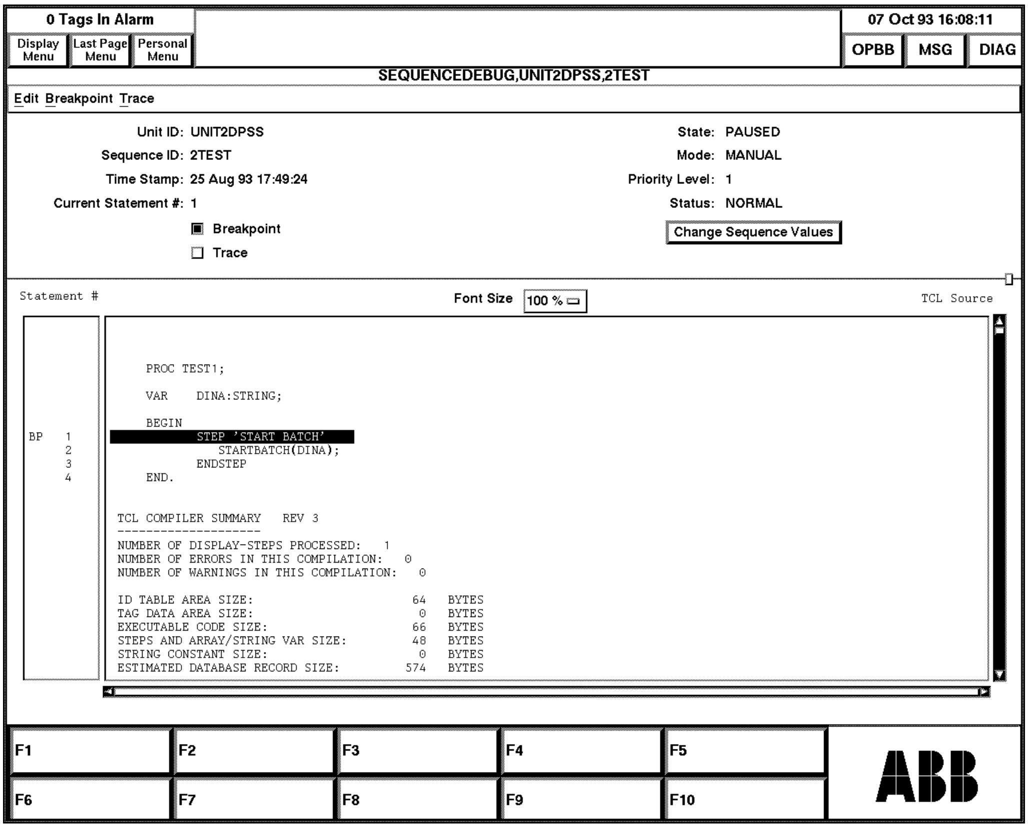


Figure 2-15. Sequence Debug Display (Advant Station 500)

Sequence Debug Display Format

The unit ID, sequence ID, time stamp, current statement number, and the sequence state, mode, priority level and status are shown at the top of the display. Below this are toggle buttons that show the status of the breakpoint and trace debug functions. The main portion of the display shows a listing of the sequence source statements as they were written using the TCL Builder, and an executable line number for each statement. At the end of the listing, TCL Compiler Summary and TCL Linker Summary information are included.

Trace

The trace function tracks the sequential order of the last 12 executed statements. The trace function can be enabled or disabled at any time and may also be applied to a value or variable. The user can add four trace variables. The user can trace integer and real variable types and local or database variables.

Breakpoint

Breakpoints support testing of program logic via semi-automatic or manual program execution. When breakpoints are enabled, the sequence is executed until the sequence reaches a step at which a breakpoint has been set. The sequence then enters the paused state, where it remains until either resumed or aborted. While the sequence is in the paused state, tests can be performed and commands can be given to check the sequence logic. The breakpoint function is enabled and disabled without disturbing breakpoints that have been set.

Breakpoints are indicated on the Sequence Debug Display by a <BP> to the left of the step number. On the Sequence Detail Display, the Pause Step field contains the step number at which the breakpoint is to occur.

Edit Menu

The user can move the contents of the display to a requested point in the program through various options in the **Edit** menu. To go to a specific line number, choose **Go To Line #** from the **Edit** menu.

To go to a specific text string in the program, choose **Search for Text** from the **Edit** menu.

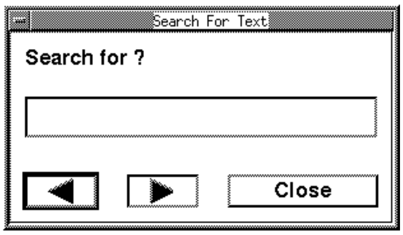


Figure 2-16. Search for Text Window

2.3.10 AdvaCommand Sequential Function Chart (SFC) Display

The Sequential Function Chart (SFC) Display supports runtime monitoring and manipulation of an individual sequence. It presents information similar to that found in the Sequence Detail Display, but it does so in a graphical flow chart format. This chart presents TCL steps (actions a sequence will execute), along with the transition conditions which determine the flow of the sequence execution. Activities and conditions describe the program flow in plain language rather than the TCL syntax used in the Sequence Debug Display.

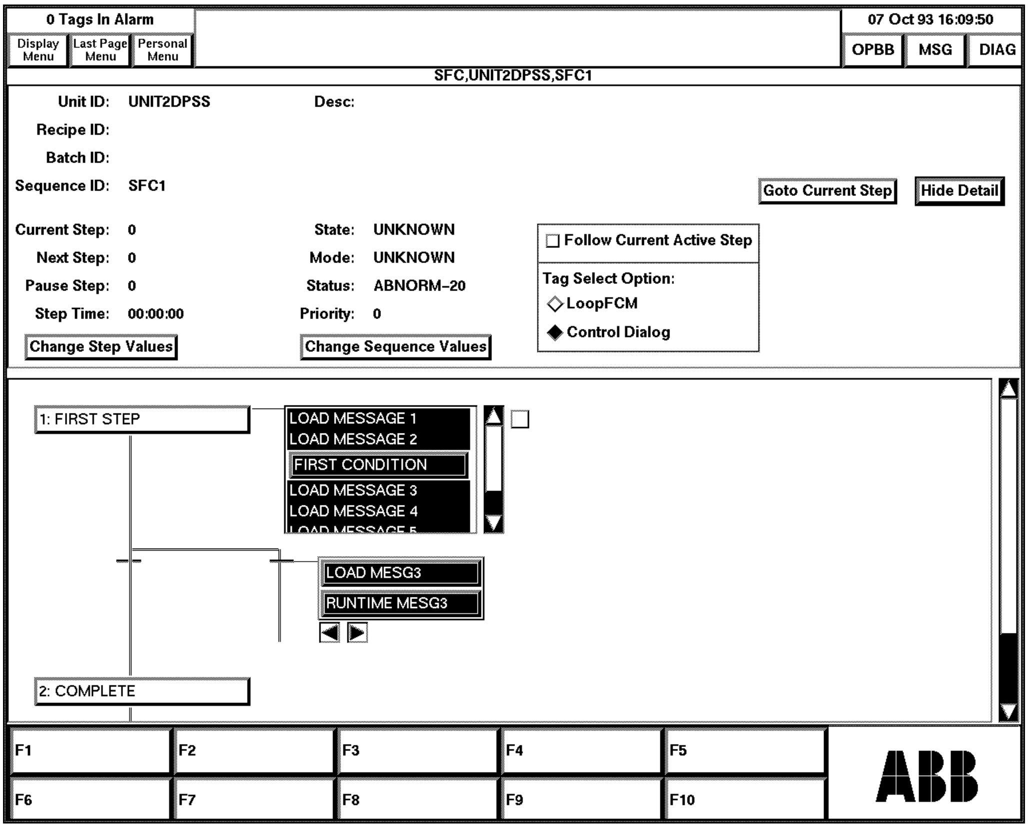


Figure 2-17. SFC Display

2.3.11 SFC Display Format

The Unit ID and Description, Recipe ID, Batch ID, and Sequence ID are shown at the top of the SFC Display. Step data fields show the current step, next step, pause step (the step on which the program pauses), and step time (the time spent executing the current step). Clicking on the Change Step Values button displays the Step Value dialog.

Fields are also displayed for the current state, mode, status, and priority. The state, mode, or status may be changed via the Change Sequence Values button. This displays the Sequence State, Mode, and Status dialog.

The Follow Current Active Step toggle button, when selected, automatically follows the current active step as the sequence progresses. The step that is currently active is shown expanded in the center of the display.

The Tag Select Option enables you to choose whether a LoopFCM Display or a loop control dialog is called up when a condition or a transition button associated with a loop is selected.

The Goto Current Step button displays the current active step expanded in the center of the display.

The Hide Detail button reduces the information shown in the top portion of the SFC Display to the Unit ID and Description, Recipe ID, Batch ID, and Sequence ID. This expands the lower portion of the display and enables you to view more steps.

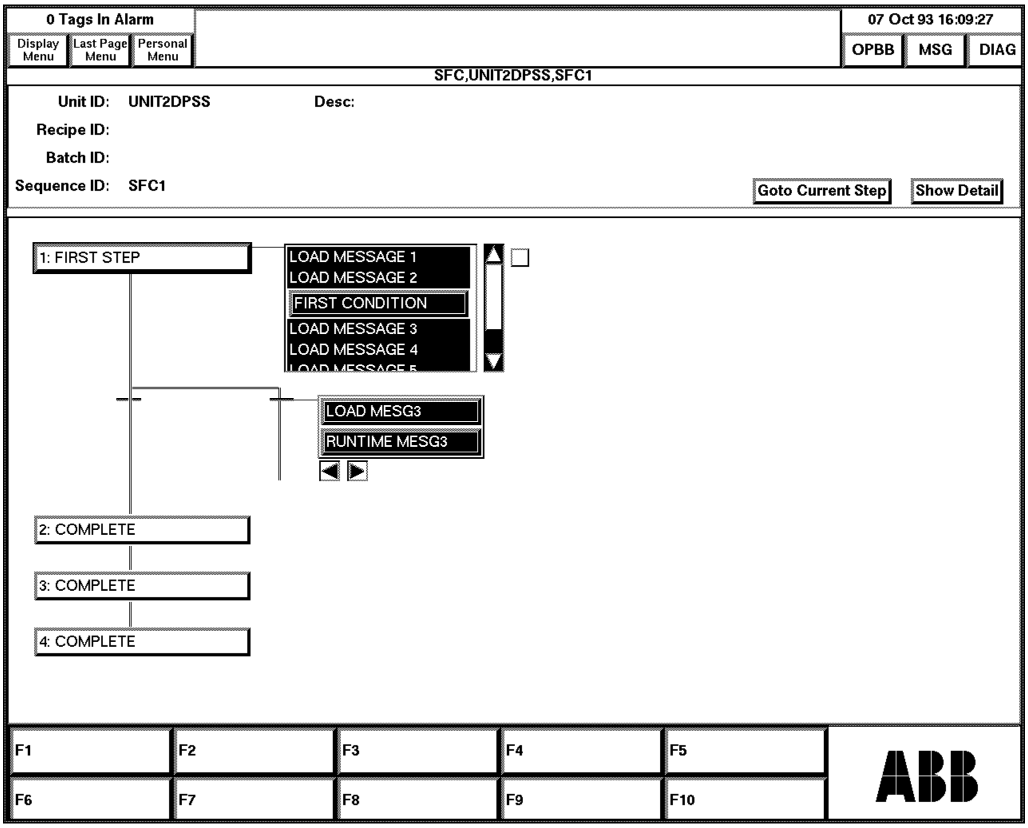


Figure 2-18. SFC Display with Details Hidden

The Show Detail button adds the details to the display.

When a step is expanded, a window to the right of the step displays the activities and conditions associated with the step. Activity statements appear flat on the display, and condition statements appear as raised buttons.

2.3.12 SFC Display Operation

Activities

Step activities specify the actions that will be performed in each program step. Activities are highlighted to illustrate the degree of execution of the program (the point the program has progressed to). There are three highlight states: Base, Last-Executed, and Executed.

Conditions

Step conditions contain tag references for operator control. There are three highlight states for condition statements: Base, Executed-True (the expression in the statement directly following the condition is true), and Executed-False (the expression is false).

Selecting a condition provides direct control access to the database reference associated with the condition. You can change the value of the referenced database point in order to satisfy the expression in the statement following the condition. To gain control access, click on a condition button. Either the LoopFCM Display or the control dialog for the loop associated with the condition is called up, depending on whether LoopFCM or Control Dialog is selected as the Tag Select Option in the upper portion of the display. You can change loop values from either the LoopFCM Display or control dialog.

Operator access to the database reference is only available after the statement has been executed.

Transitions

Step transitions contain tag references for operator control. There are three highlight states for transition statements: Base, Evaluated-True (the transition expression is evaluated as true), and Evaluated-False (the transition expression is evaluated as false).

Selecting a transition provides direct control access to the database reference associated with the transition. You can change the value of the referenced database point to satisfy the transition expression. To gain control access, click on a transition button. Either the LoopFCM Display or the control dialog for the loop associated with the transition is called up, depending on whether LoopFCM or Control Dialog is selected as the Tag Select Option in the upper portion of the display. You can change loop values from either the LoopFCM Display or control dialog.

2.3.13 TCL Specifications

Minimum HardwareOS/ES, Advant Controller

Maximum Array Size256 x 256

Maximum Recipe SizeMemory limited

Maximum Number of Recipes65536

2.4 Taylor Ladder Logic

Taylor Ladder Logic (TLL) is a software package that implements industry standard ladder logic functionality. It can be used in place of a gateway and PLCs when ladder logic control is required. It executes in Advant Controllers.

TLL contains a full set of instructions for implementing all standard ladder logic functions such as relay manipulation, timer and counter manipulation, and input, output and comparison of large numbers of data points. The TLL software package contains an extensive set of console displays providing an efficient means to produce, execute, and maintain ladder programs. The TLL configurator displays provide a way to specify the scan rate for a node and build the structures such as counters, timers, and files required by the ladder programs.

The TLL displays provide a complete set of utilities to create, edit and produce a fully cross-referenced listing of ladder logic programs which can be backed up to a removable media. TLL runtime displays include the ladder diagram display which shows a graphic representation of the ladder logic segments being executed and allows the user to start or stop the scan of the logic, load and remove segments. An extensive debug facility allows the logic to be checked via I/O forcing. Other runtime displays allow changes to the timers, counters, files, registers I/O and sequences.

2.4.1 Program Structure

When a TLL program for a node or controller is produced, it is done by creating a group of smaller program units called *segments*. Figure 2-19 shows part of a segment. Each segment is numbered and this determines the execution order.

Scan Rate

TLL segments in the same node or controller are processed periodically at the scan rate. When a scan begins, the segment with the lowest segment number is scanned first, followed by the other segments in segment number order. At the beginning of the next scan interval, the process repeats. The fastest possible scan rate is 20 milliseconds. The slowest is 1000 millisecond. The scan rate is in multiples of 10 milliseconds.

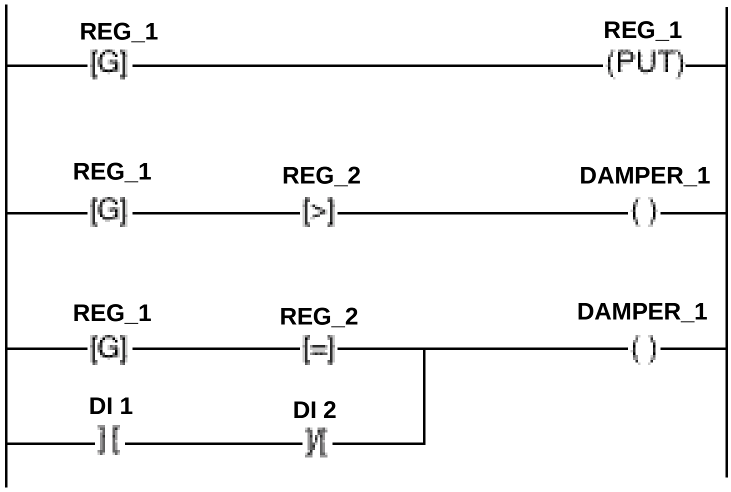


Figure 2-19. Example of Ladder Structure

This provides a great deal of flexibility in designing the contents of segments. Some segments execute one limited task, while others can execute much more complicated tasks.

A segment is a sequence of rungs. Figure 2-20 gives the details of a single line rung. The rung starts and ends at the power rail labeled “1”. It contains up to eight elements i.e. elements labeled “2” and “3”(for clarity, the diagrams in this manual do not attempt to show all eight). The element at position eight call out 3 has special constraints. It must always be present and it must contain an output type instruction. Position eight is the only place that output type instructions are allowed.

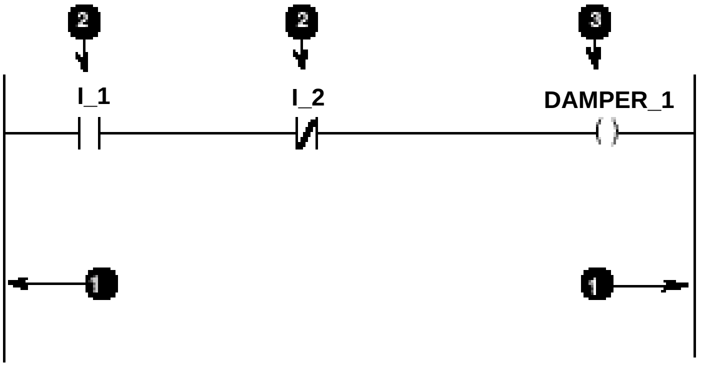
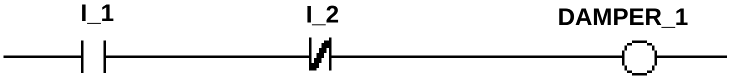


Figure 2-20. Details of a Single Line Rung

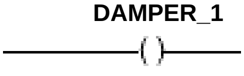
The power flow (execution order) in a rung is always from left to right. Rungs are processed in sequence from top to bottom.

The elements shown below in positions 1 thru 7 of a rung compare logical expression that determines if the output function in the position eight element is performed or not. For example, in the following rung.



in the instructions

make up the logical AND, while



is an output type instruction. When the AND evaluates to 1, the output function is performed. When the AND evaluates to 0, it is not performed. In either case, power flow goes to the next rung in sequence.

It is possible to have multi-line rungs as Figure 2-21 demonstrates. This structure is called a branch.

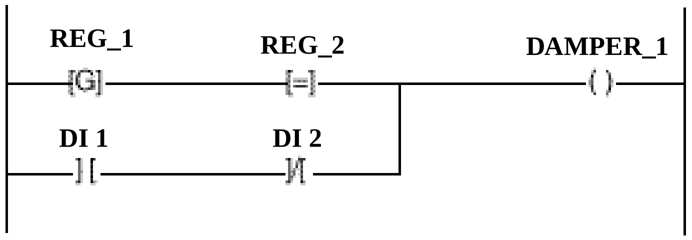
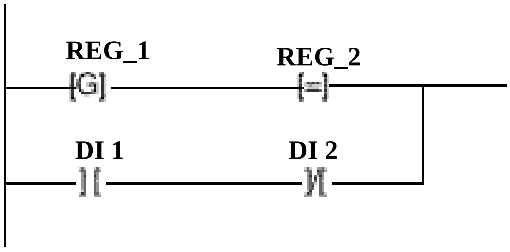


Figure 2-21. Multi-Line Rung

The lines in a branch act as a logic OR. For example, in the branch:



The system passes on a logical 1 from the branch if either the logic in the upper line

or the logic in the lower line

evaluates to 1

There can be more than two lines in a branch. Branches must end before the eighth element.

TLL uses a set of digital input and output points that are local to the controller or node. Output points are referred to as *coils* and input points are called *contacts*. For a coil, an initial output can be configured to be in effect upon bootup.

2.4.2 TLL Program Instructions

A TLL segment consists of a series of instructions that manipulate the data structures that are described in the previous section. TLL contains a complete set of the instructions to implement ladder functions. These instructions are described in detail below.

Relay Instructions

The relay instructions are used to energize, latch, or examine the status of outputs, examine the status of inputs, and to provide branch paths in the ladder logic rungs. These instructions may also be used with Registers to implement dummy coils or flags. The status of timers or counters may be examined via the DN or EN attributes.

Table 2-16. TLL Relay Instructions

Symbol	Name	Description
] [-	Examine On	tests that a input or output is energized. If it is energized, the instruction produces a TRUE value which affects the way the rest of the rung or branch line is scanned.
-]/[-	Examine Off	tests that an input or output is de-energized. If is de-energized, the instruction produces a TRUE value
-( )-	Output Energize	energizes or turns on the referenced output if the rung condition is TRUE, otherwise it de-energizes the output.
-(L)-	Output Latch	energizes and latches the referenced contact output if the rung condition is TRUE, otherwise it takes no action.
-(U)-	Output Unlatch	de-energizes and unlatches the referenced output if the rung condition is TRUE, otherwise it takes no action.

Data Manipulation Instructions

The Data Manipulation Instructions allow the ladder logic program to access the values of AC or PR in registers, timers, or counters and use them in relational comparisons to determine continued execution of a rung.

Table 2-17. Data Manipulation Instructions

Symbol	Name	Description
-[G]-	Get	fetches the contents of the referenced record for use by subsequent instructions of the rung.
-[GET]-	Get Data Base	fetches the contents of the referenced data base variable.
-[PUT]-	Put	puts the value obtained from the previous Get or Get Data Base instruction into the referenced register.
-[=]-	Compare Equal	compares the value from the preceding Get or Get Data Base instruction with the value in the referenced register. If they are equal, the instruction produces a TRUE.
-[<]-	Compare Less Than	If the value is less than the register value, the instruction produces a TRUE.
-[>]-	Compare Greater Than	If the value is greater than the register value, the instruction produces a TRUE.
[<=]	Compare Less Than or Equal to	If the value is less than or equal to the register value, the instruction produces a TRUE.
-[>=]-	Compare Greater Than or Equal to	If the value is greater than or equal to the register value, the instruction produces a TRUE.

Math Instructions

The Math Instructions perform the basic math operations of addition, subtraction, multiplication, and division of integer numbers. The numbers used by the operations come from the two previous Get or Get Data Base Instructions on the rung. The answer is stored in a register that is named when the instruction is entered. If there is an error such as an overflow, underflow, divide by zero, etc., the instruction returns the largest possible integer value (2,147,483,647).

Table 2-18. TLL Math Instructions

Symbol	Name	Description
-(+)-	Add	adds the values of the two preceding Get instructions and places the answer in the referenced register.
-(-)-	Subtraction	requires two Get instructions. The value of the second Get instruction is subtracted from the value of the first Get instruction. The answer is placed in the referenced register.
-(X)-	Multiplication	multiplies the values of the two preceding Get instructions and places the answer in the referenced register.
-(:)-	Division	divides the value of the first Get instruction by the value of the Get that immediately precedes the Division Instruction. The answer is placed in the referenced register.
	BCD ->BIN	allows up to eight BCD digits in a file to be changed to a binary number and stored in a register.
	GRAY ->BIN	allows up to eight Gray coded digits in a file to be changed to a binary number and stored in a register.

Timer Instructions

These instructions allow the program to keep track of the timed intervals. The instructions perform actions based on transitions (i.e. FALSE to TRUE) of the rung conditions.

Table 2-19. TLL Timer Instructions

Symbol	Name	Description
-(TON)-	Timer On	turns on a timer. After the timer runs, its accumulated value is retained as long as the rung condition remains TRUE.
-(RTO)-	Retentive Timer On	starts a timer. After the timer runs, it retains its accumulated value regardless of rung condition.
-(RTR)-	Retentive Timer Reset	resets the accumulated value of a timer to 0 for an up timer or PR for a down timer.

Counter Instructions

These instructions allow the ladder logic to keep track of counted events. The instructions perform actions based on transitions (i.e., FALSE to TRUE) of the rung conditions.

Table 2-20. TLL Counter Instructions

Symbol	Name	Description
-(CTU)-	Count Up	increments a counter.
-(CTD)-	Count Down	starts a downwards count.
-(CTR)-	Counter Reset	reset the accumulated value of a counter to 0.
-(CTP)-	Counter Preset	sets a counter to its preset value. This instruction is usually used before starting a downwards count.

File Instructions

These instructions allow the ladder logic to transfer data from registers to files, files to registers, and from one file to another. Each instruction must have a counter associated with it to provide an index into a file for a particular element. The counters have to be incremented or decremented by the Ladder Logic to provide the proper index for the Register to File Move and File to Register Move Instructions. The entire contents of a file is moved by the File to File Move Instruction.

Table 2-21. TLL File Instructions

Name	Description
Register to File Move	transfers one value from the register to the file. When the rung condition becomes TRUE, the value in the register is transferred to the position in the file that is indexed by the present value of the counter.
File to Register Move	transfers one value from the file to the register. When the rung condition becomes TRUE, the value in the position of the file indexed by the present value of the counter is transferred to the register
File to File	transfers the entire contents of the source file to the destination file.

Sequencer Instructions

These instructions allow the ladder logic to transfer data to and from the files and the process I/O.

Table 2-22. TLL Sequencer Instructions

Name	Description
Sequencer Input	compares values from the process input with a value in a file.
Sequencer Output	outputs values from a sequencer to the field.
Sequencer Load	loads values from the process input into a file.

Miscellaneous Instructions

These instructions provide for conditional execution of portions of the ladder and allow pre-configured messages to be sent to message receivers such as loggers, consoles, and historical recorders.

Table 2-23. TLL Miscellaneous Instructions

Symbol	Name	Description
-(MCR)-	Master Control Reset	start of a ladder section for execution if rung condition is true, else reset non-retentive outputs.
-(NCR)-	End of Master Control Reset	end of a ladder section for conditional execution with output reset
-(ZCL)-	Zone Control Last State	start of a ladder section for conditional execution with outputs held
-(NCL)-	End of Zone Control Last State	start of a ladder section for conditional execution with outputs held
-(MSG)-	Message	sends a predefined text message to operators and printers

2.4.3 Ladder Logic Editor

The Ladder Logic Editor Display is used to build and modify Ladder Logic Segments.

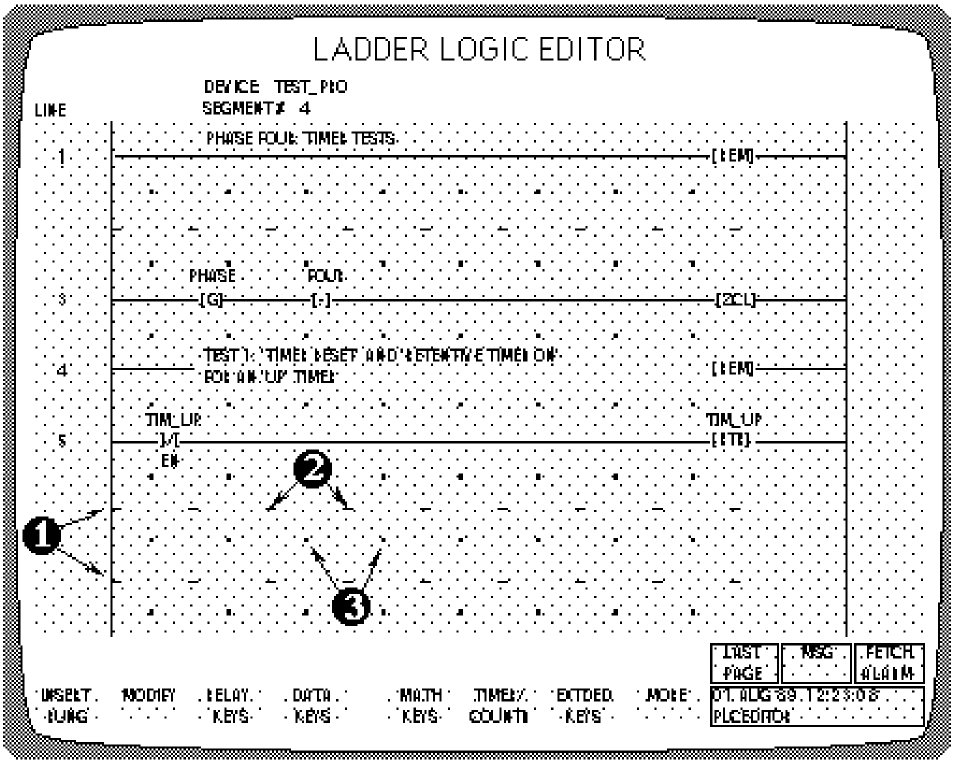


Figure 2-22. Example of a Ladder Logic Editor Display Showing the First Level of Main Softkeys

Building a segment involves making a graphic representation of the required ladder. The diagrams start as two vertical power strips. The softkeys are then used to insert rungs with their associated instruction symbols. The left power rail has short horizontal lines attached to it as shown by label "1". These are the rung targets that are used when inserting a rung into the diagram. Call out 2 shows short horizontal targets that are selected when inserting an instruction. When an instruction symbol is inserted, the system prompts for any additional information it needs for the instruction. Call out 3 shows dots that are selected when inserting a vertical line for a branch.

When the diagram is saved, it is automatically compiled and any errors that will prevent the segment from being loaded into the node or controller will appear.

2.4.4 Segment Display

The Segment Display is used to monitor and control TLL execution in a node or controller.

General Information

The Segment Display can be used to:

- Load and remove segments
- Turn TLL scanning on and off
- Debug segments by forcing the I/O points to specified conditions
- Access displays for the TLL Data Structures (timers, counters, etc.)

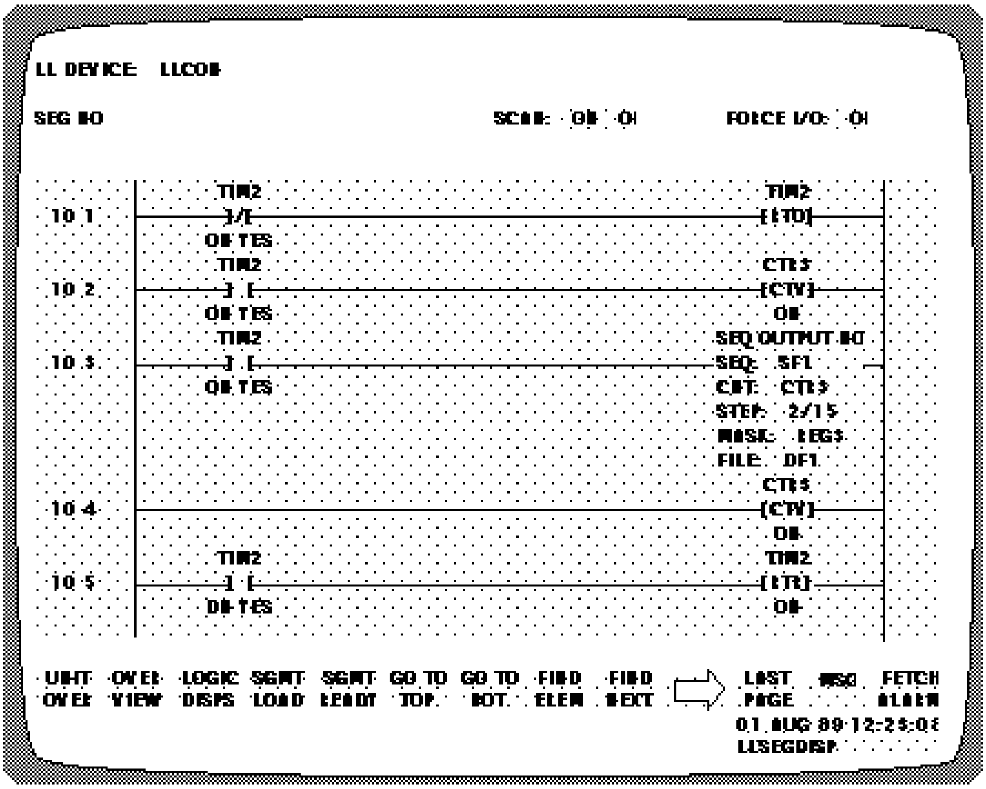


Figure 2-23. TLL Segment Display

Information on the Segment Display

LL DEVICE: LLCONT1

The LL DEVICE Field gives the name of TLL in the node or controller that contains the segments. It is a discrete field that can be used to call up the display for other nodes or controllers.

SCAN ON OFF

The SCAN field is used to toggle the scan on and off.

FORCE I/O: ON

The FORCE I/O field indicates if any I/O point in the ladder logic device is being forced to a user specified condition. A point can be forced to specific condition via the I/O point Expansion Window.

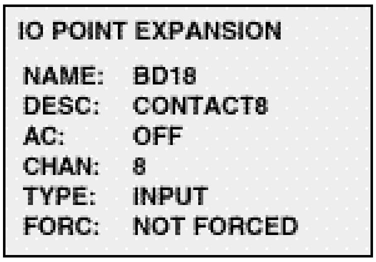
The body of the display is a ladder logic diagram. In the left margin there is an indication of the segment number and the rung number of each ladder rung. The power rails are displayed in red because they are always energized. The rungs and branches are displayed in red if they are energized and white if not. The elements are labeled with the name that was entered for them when the segment was built. Examine On symbols show either the state of the contact or the data quality of the input. Timers and counters show either their enable/disable condition or whether they are still running.

Expansion Windows

When an element is selected on the Segment Display, an expansion window containing detailed information for the element appears.

Each expansion window has some items that are changeable.

Point Expansion Window

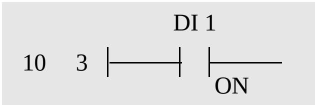


The entry in the DESC, FORC, and AC fields can be changed.

Forcing I/O Points

This expansion window allows the debugging of segments by specifying states for the AC parameter of I/O points. However, if AC is changed, first put the I/O point into a forced state. This can be done by selecting the FORC Field and change its value between On and Off. When a point is forced, determine the value it has in the segment only. The actual condition of the point in the field is not modified.

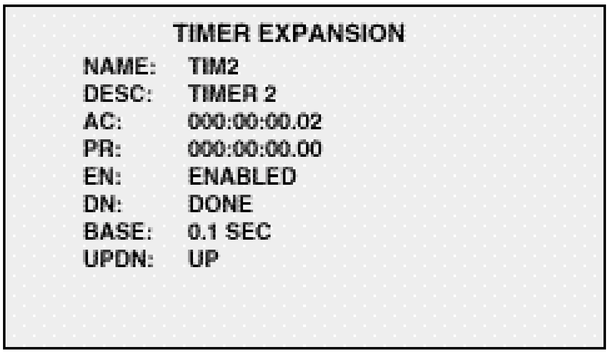
The display indicates all points that are forced. For example, a point that is not forced appears as follows:



A point that is forced has a small F displayed with it and appears as:

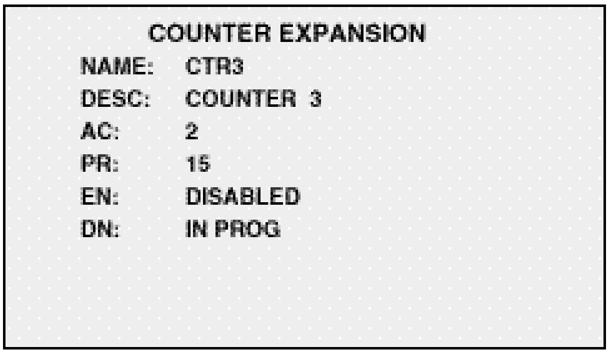
Forcing can also be performed via the I/O Point display.

Timer Expansion Window



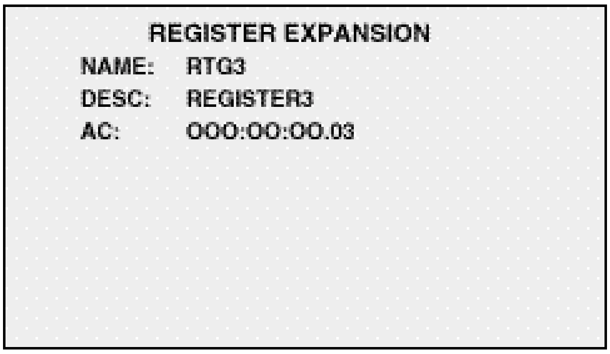
The entries in the DESC, AC, PR, and ENABLED fields can be changed. This is the format for making time entries to the AC and PR fields.

Counter Expansion Window



The entries in the DESC, AC, PR, and ENABLED fields can be changed.

Register Expansion Window



The entries in the DESC and AC can be changed.

Message Expansion Window

A message expansion shows the text of the message.

2.4.5 TLL Specifications

Minimum HardwareOS/ES, Advant Controller

Fastest Scan Rate20ms

Register Resolution4 Byte integer - 10 digits displayed

Counter Resolution4 Byte integer - 10 digits displayed

Maximum Rungs Per Segment255

Maximum Elements Per Rung7 / branch + output element

255 elements, max.

253 branches, max.

Maximum Devices Per Segment32 I/O points / step

128 steps, max.

Maximum Registers Per LadderMemory dependent

Maximum Counters Per LadderMemory dependent

Maximum Files Per LadderMemory dependent

2.5 AdvaCommand Operator Software

Each Advant Station 500 Series is packaged with a base level of software and data management. This base software provides a consistent way of interfacing with the system and its various functions. Application packages are added to this environment to optimize the station for the specific needs of the user.

2.5.1 Basic Functions

While optimized for operators, the Advant Station 500 series with AdvaCommand provides a universal window for all users including managers, maintenance personnel, and engineers.

The set of basic functions in the Advant Station 500 series of operator workplaces with AdvaCommand includes the following:

- User Interface
- Advant Authority and Security Enhancements (ASE)
  - ASE User Configuration Tool
  - ASE Log Files
  - TCL Runtime User Identification
  - Automatic User Logoff
  - Read-only Advant Station with AdvaCommand Software
- Central Graphics and Environment Administration
- Display Hierarchy
- Operator Displays
  - Display Structure
  - Display Transfer
  - Control Access

– Alarms and Events
– System Diagnostics and Maintenance

2.5.1.1 User Interface

The AdvaCommand user interface enables the operator to communicate with the process, the system, and the applications. Functions included in the user interface are presentation of process and system information, command entry, display and window handling.

The screen is divided into areas, each reserved for a specific purpose. The basic screen layout is shown in Figure 2-24.

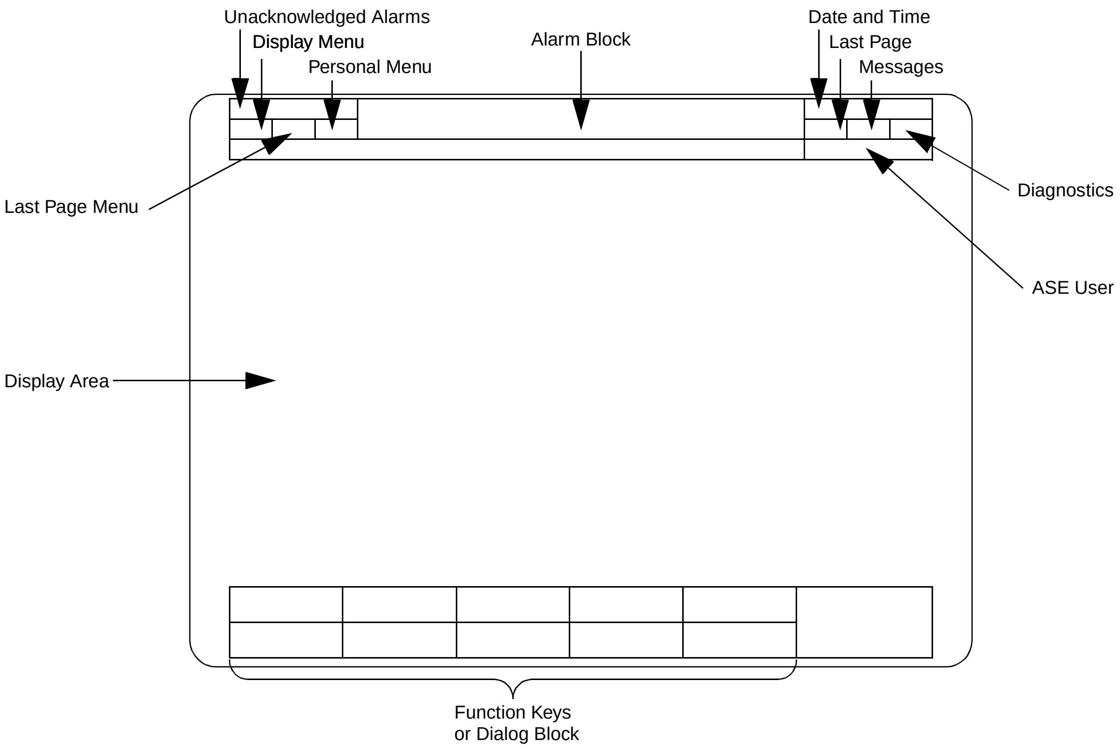


Figure 2-24. Basic Screen Layout

The screen is divided into two major sections, the Main Window and the Display Area.

Main Window

The Main Window is the fixed area of the screen that is always accessible. The upper section of the window includes areas for menu and message access, alarm access, alarm information, ASE user if currently installed environment uses ASE feature, as well as a date and time field. The lower section of the window includes a dynamic function key and a dialog area.

- The Unacknowledged Alarm Area shows the current number of tags in alarm in the operator workplace.

- The display menu button displays a scrollable pull-down menu of all of the displays that are accessible by this workstation. The last page menu displays a list of the last 50 displays which were displayed in the display area of this screen, the last page displayed being the first in the list. The personal menu is persistent and displays a list of up to 50 displays which each user has specified to be in his personal menu.
- The alarm block displays the three most recent, highest priority, unacknowledged alarms.
- The date-and-time field shows the current date and time as measured by the internal system clock.
- The MSGS or messages button, when selected, links to the message page that collects TCL billboard messages.
- The DIAG or diagnostic button, when selected, links to the diagnostic display.
- The ASE user field shows the username of the currently logged in ASE user. Clicking on this field brings up the OS Login dialog.
- The 10 dynamic function buttons along the lower portion of the window correspond to the ten function keys on the Advant OCS keyboard. Selecting the dynamic function key screen target takes the effect that is currently shown on that key.
- A Dialog window appears along the bottom of the main window when an operator takes control of a loop. The dialog provides information required for process changes to setpoints, outputs, etc. Dialogs are used for taking control of many functions such as loops, devices, trends, TCL, Batch 300, etc.

When you execute a function that requires operator interaction, the appropriate dialog box is displayed over the dynamic function keys (such as when you take control of a loop).

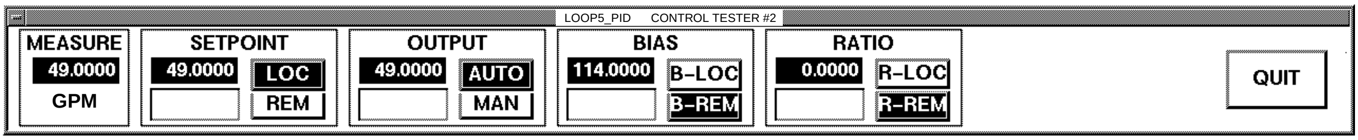


Figure 2-25. Loop Control Dialog

The dynamic function keys are not active when covered by a dialog box. You can move a dialog box from the lower section into the display area to uncover the function keys. The keys become active when you uncover them, either by moving or closing the dialog.

Display Area

The Display Area in the center of the window displays process graphics, standard displays, run-time displays, and third party displays.

The status of the process is shown on different types of displays. An environment defines which graphic displays, control code and database information can be viewed and accessed from that station. Displays within the environments may be configured so that operators can access only the information that they are specifically responsible for, such as a specific portion of a plant or process.

Access is controlled by the security level of a user. Every user name is configured with a security level, either engineer, supervisor, or operator. User passwords are protected and all changes made while a user is logged on are automatically printed/recorded in a optional historical data archive.

A collage feature allows a collection of display pieces to be saved as a separate display under a user specified name.

2.5.2 Advant Authority and Security Enhancements (ASE)

ASE allows usernames and passwords to be maintained separately from the environment and ‘linked’ to a set of environment authorities. When ASE users log into an environment, they inherit all access and authority from their authority group as defined in the Environment Builder.

2.5.2.1 ASE User Configuration Tool

The ASE User Configuration Tool is used to add/edit/delete ASE users to the ASE user authority groups previously defined in the Environment Builder. Additional ASE parameters can be configured for the maximum number of unsuccessful login attempts before a diagnostic message is generated, the maximum number of retries to start the change password dialog before a message to login with the old password is generated, and the minimum waiting period between password changes. The ASE user can change their password once within the time period configured by the system administrator. Additional attempts to change the password within the specified time period result in an error message.

2.5.2.2 ASE Log Files

ASE creates history log files for user activities such as logons, logoffs, and password changes. These files can hold a maximum of 2000 entries on a first in first out basis.

2.5.2.3 TCL Runtime User Identification

If ASE has been enabled for a TCL sequence, at runtime you are prompted to enter your username and password for user verification when a TCL reply statement is executed.

2.5.2.4 Automatic User Logoff

The AdvaCommand software can automatically logoff all users after a configurable time of inactivity. Activity consists of moving the mouse or pressing a key on the keyboard. A message is displayed at runtime when automatic logoff occurs. The time range is 20 minutes to 24 hours.

2.5.2.5 Read-Only Advant Station with AdvaCommand Software

Individual Advant Stations with AdvaCommand software can be configured to be read-only. Once enabled, users can only view, not change, process information on the station regardless of their user authority. At runtime, a read-only station is identified by a red ABB logo in the lower right corner of the AdvaCommand Main Window. If the station is read-only and a user attempts to access any process dialogs, access is denied and an error message is generated.

2.5.3 Central Graphics and Environment Administration

The AdvaCommand Central Administration feature allows you to set up a server/client scheme for environments and graphics. Environments and graphics are maintained on a central server station, thus freeing resources on the client stations. The client stations install environments and graphics directly from the server without having to store them locally. This scheme eliminates the need to distribute changed environments and graphics to each destination station prior to installing them.

2.5.4 Display Hierarchy

Operational Displays are organized into a hierarchy. All standard displays are memory resident including tag and graphic data. When tags and graphics are used in area, group, and sequential displays, they conform to a structured hierarchy as described in the following diagram.

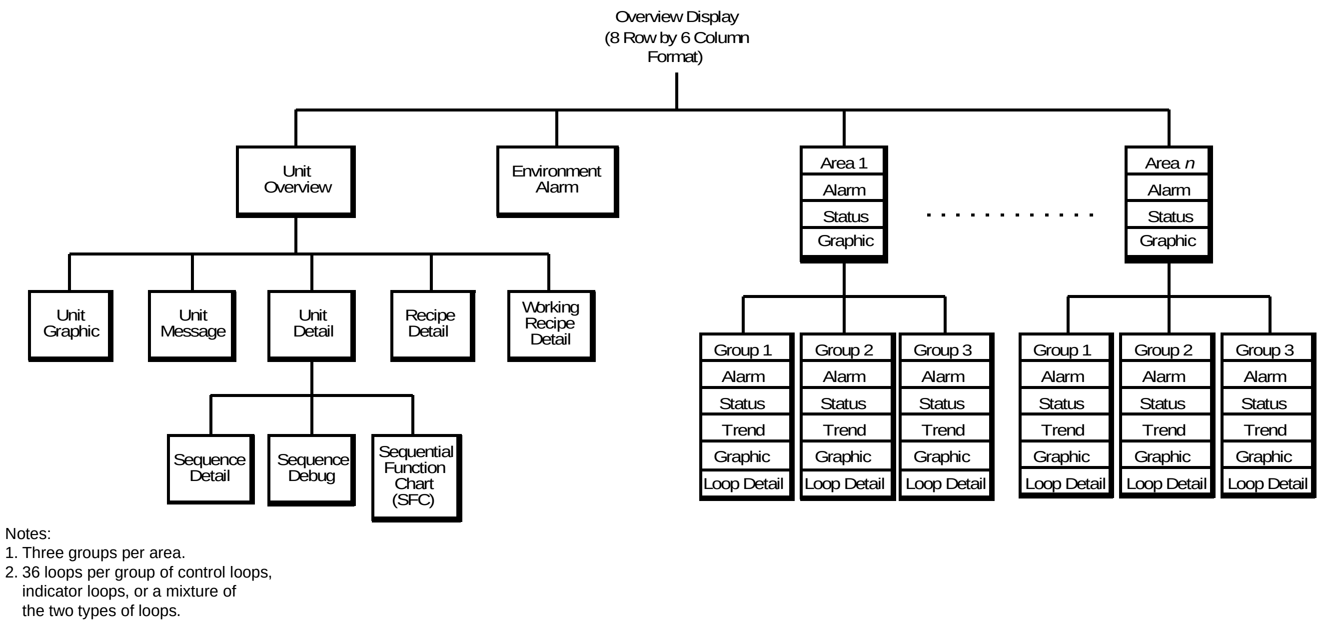


Figure 2-26. AdvaCommand Operator Display Hierarchy

2.5.5 AdvaCommand Features

AdvaCommand offers an extensive list of ease-of-use and navigation features. The tag view feature allows you to view specific tag information from any tag associated element. This feature also applies to hierarchical displays and user graphics.

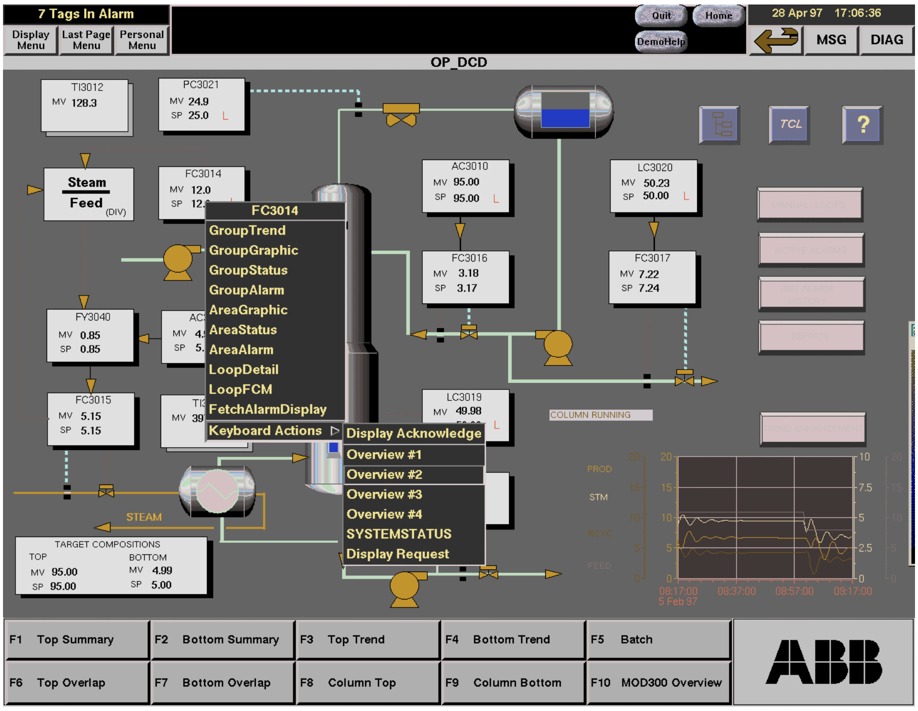


Figure 2-27. AdvaCommand Tag View Display Example

A collage feature allows a collection of display pieces to be saved as a separate display under a user specified name.

Additional features in AdvaCommand include:

- Zoom feature - larger, smaller, zoom to fit, reset to original size
- Automatic environment install
- TCL version mis-match feature
- Coordinated display call-up allowing overlaps to be directed to a particular display
- Optional DataKey security

2.5.6 Operator Displays

The operator can view and manipulate the process from several different types of displays. The following is a brief description of some of these displays.

Overview Displays present the operator with a general overview of the process and I/O displays. The Overview is used to quickly identify problem areas in the plant and indicate alarm conditions of the I/O contained within the Overview. Up to four Overviews may be tied to specific function keys on the keyboard.

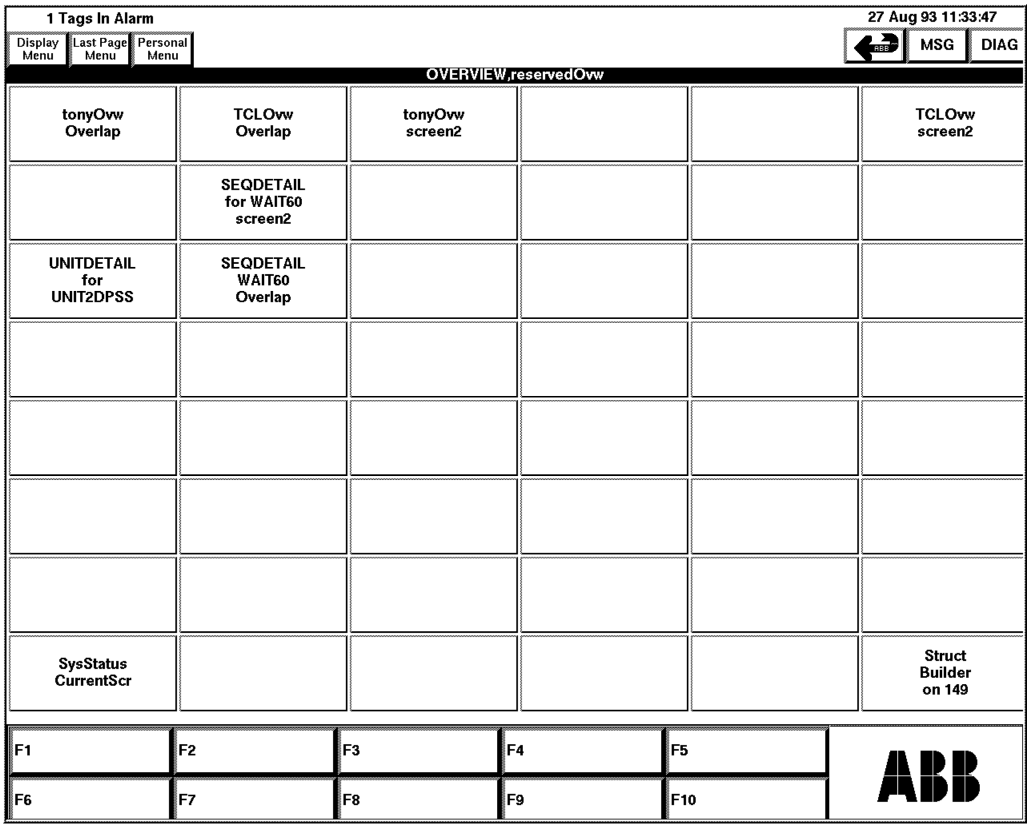


Figure 2-28. Overview Display

The **Area Alarm Display** presents the operator with a list of alarms sorted by time.

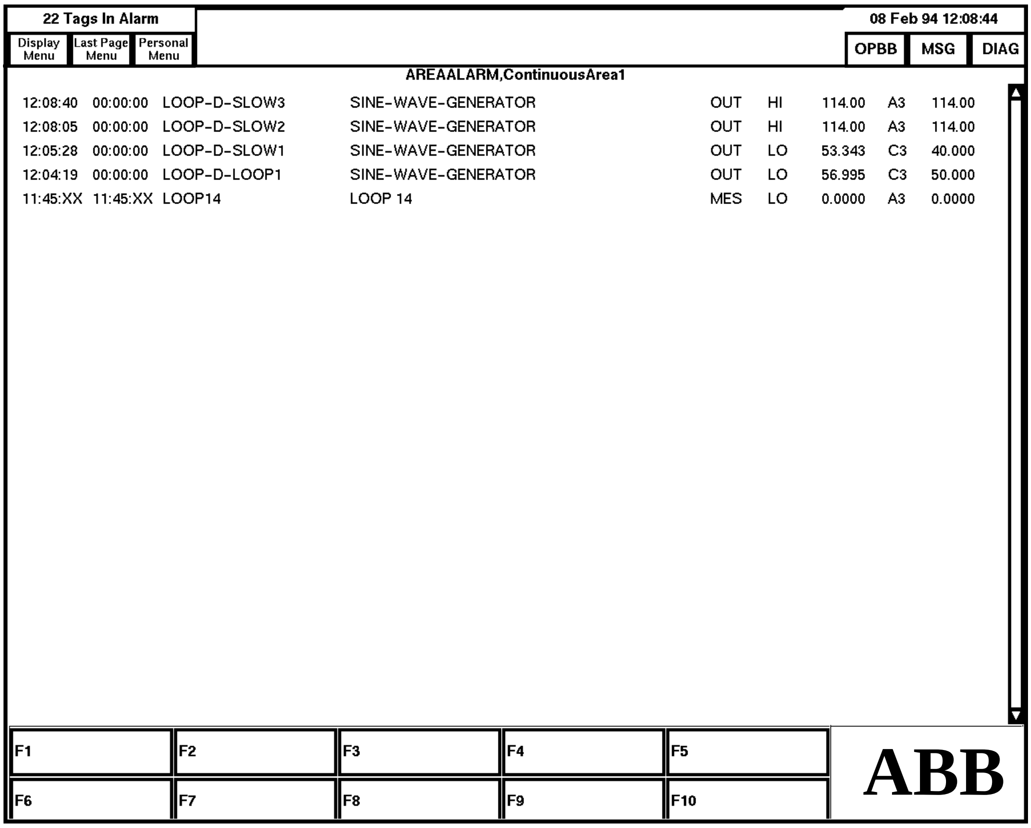


Figure 2-29. Area Alarm Display

Group Displays provide a user configured display of the associated process group. The display supports status and alarm state information for 12 controlled variables or 36 indicate variables and trend displays for 12 control or indicate variables.

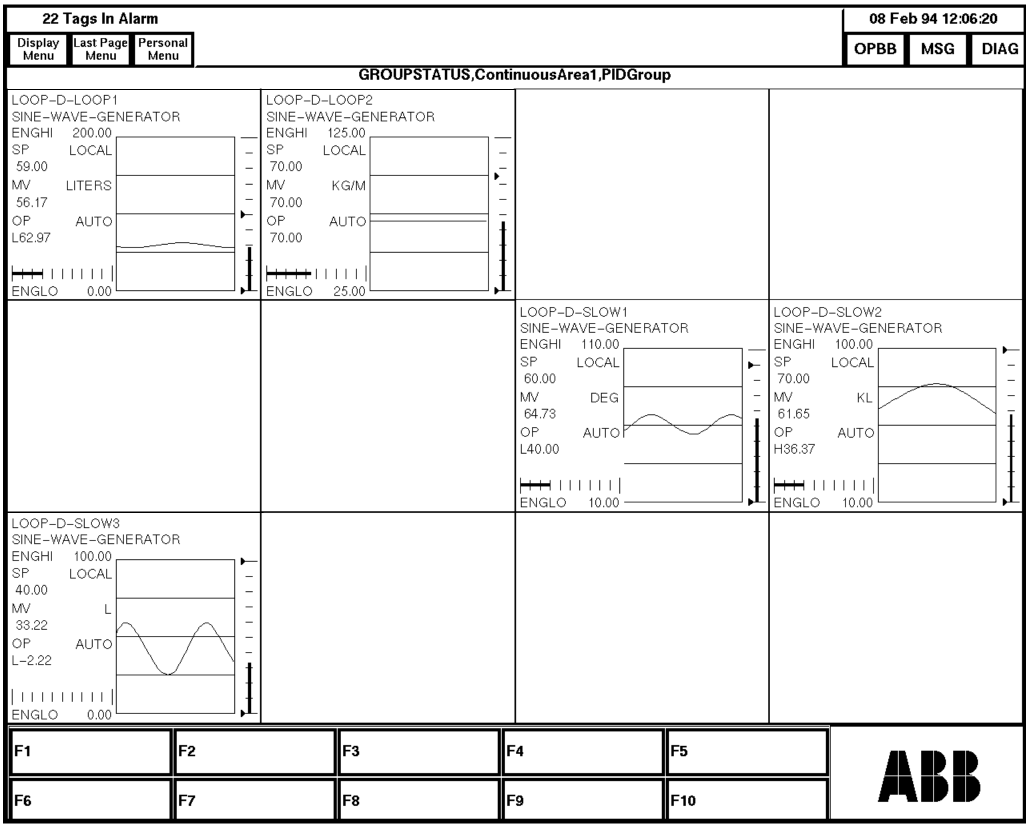


Figure 2-30. Group Status Display

Loop Detail Displays provide the operator with on-line dynamic loop tuning. The tuning parameters include: alarm limits, alarm enable/disable, alarm posting, gain, reset, rate values, loop scan rate, phase, and loop processing (on/off).

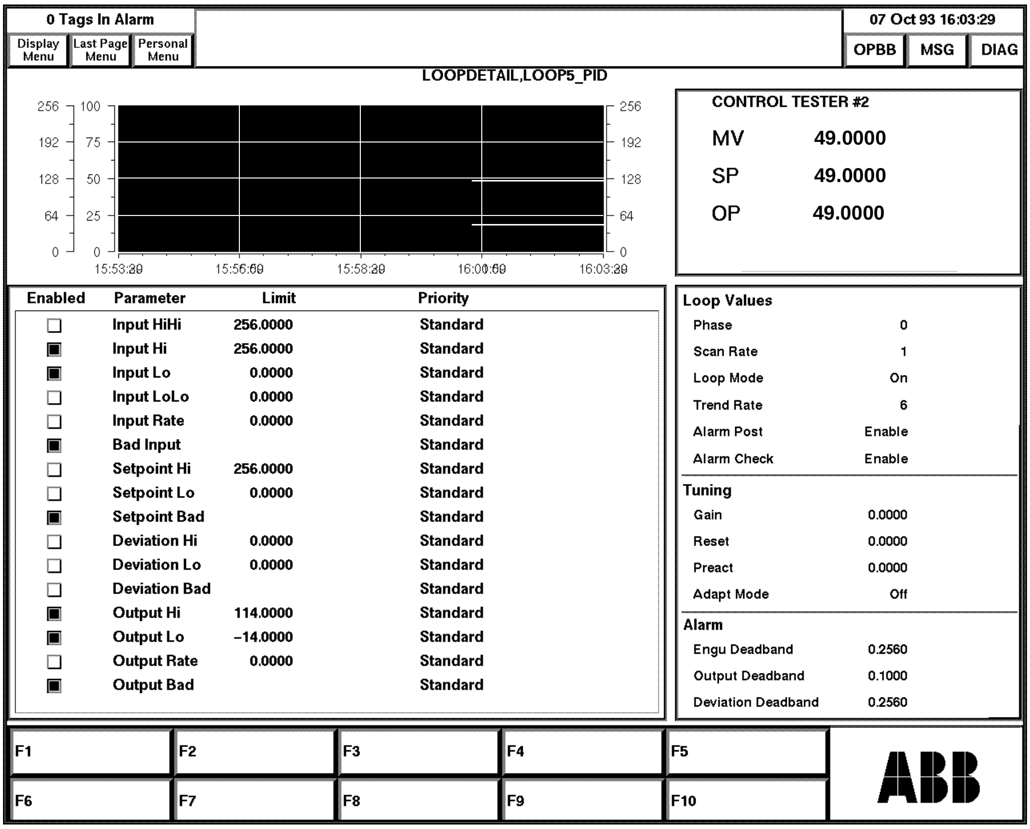


Figure 2-31. Loop Detail Display for a PID Loop

Custom Graphic Displays use both static and dynamic color data symbols and have direct access to any variable in the system by tag name.

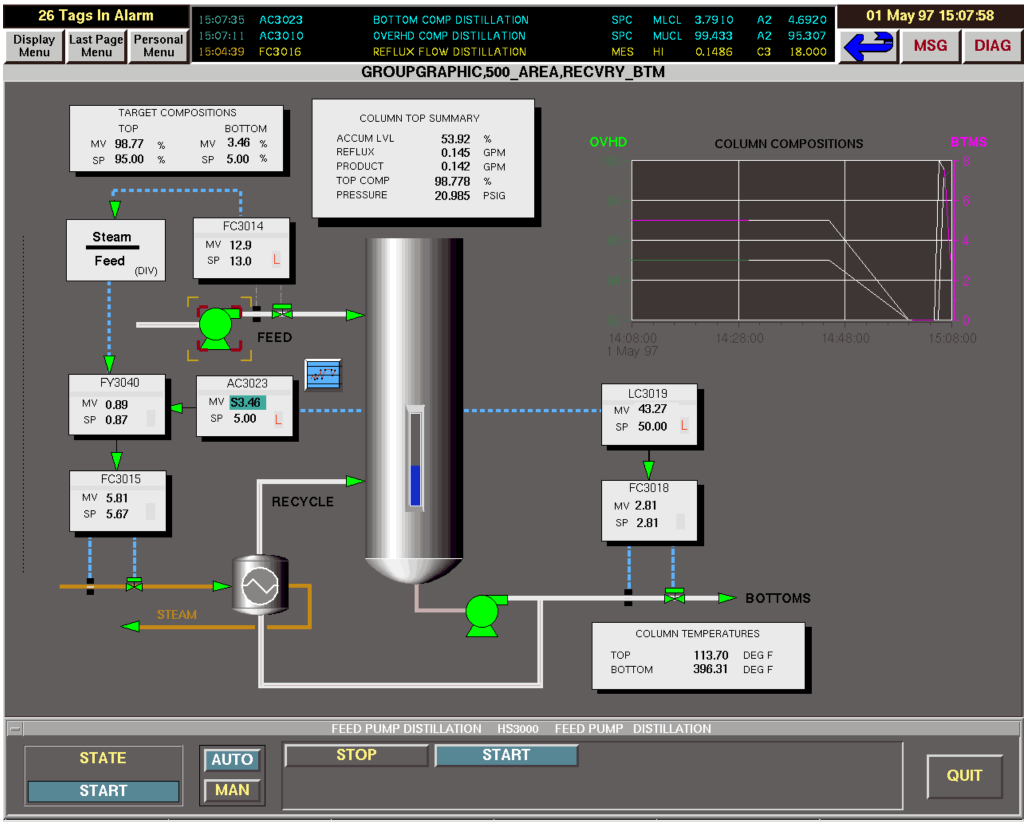


Figure 2-32. Example of Custom Graphic Display

AdvaCommand graphics are created using the Display Builder. This AdvaBuild option takes full advantage of high-resolution monitors and windowing technology. Through increased object resolution, realistic colors and shading, operators are presented with a more accurate representation of the process, resulting in increased operator recognition of objects.

Palettes of color, shades, patterns, basic objects and application specific objects make graphic building easy. The basic process symbol palette conforms to ISA standards. Display elements can be easily cut and pasted between graphics. The Display builder lets you zoom in and out for detail work, and make any object dynamic. Up to sixteen levels of conditional logic simplify an operator’s job by placing more intelligence in the display.

Real-time Trend Displays present process data in the form of a strip chart recorder.

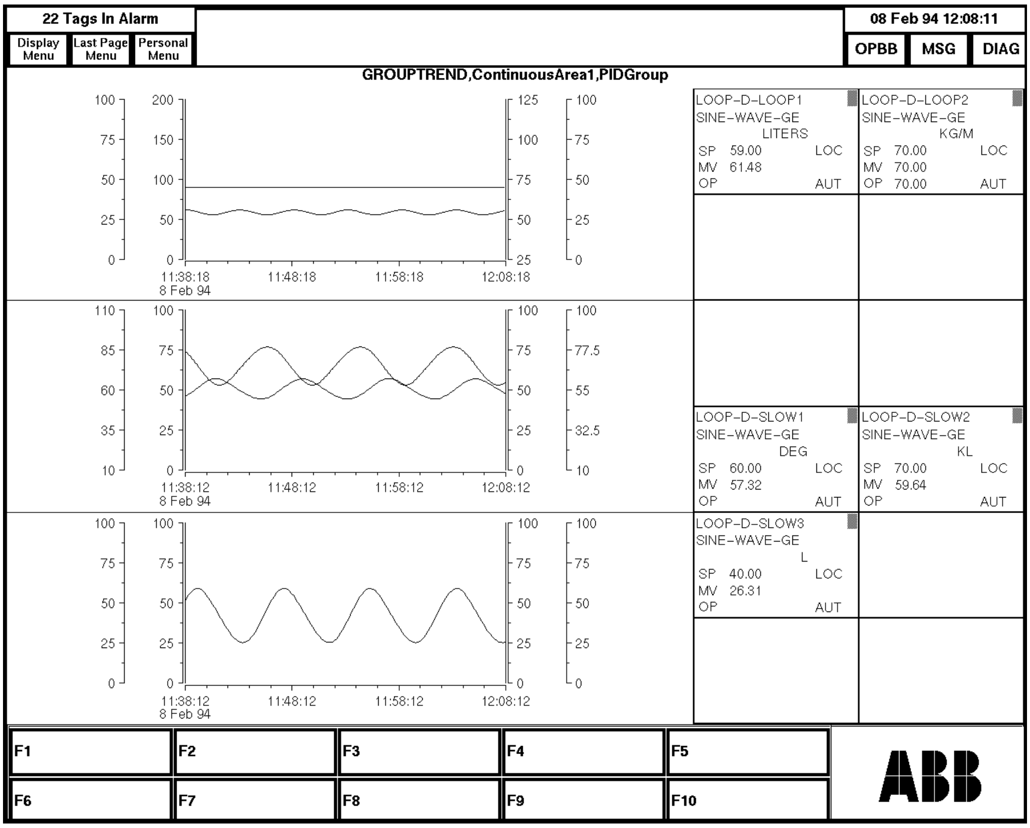


Figure 2-33. Group Trend Display

2.5.6.1 Display Structure

Dynamic data for a display is obtained from the process stations when the display is called up. The display is then updated each cycle or as events occur until the display is closed.

The display handling in the Advant Station 500 series offers convenient features such as basic displays, overlapping displays, and pull-down menus, making operator interaction effective and efficient.

- A base display covers the whole display area. It always removes and closes all other displays in the display area before being presented. The size of a base display is fixed.
- An overlapping display is presented on top of the currently shown displays, thus covering them, without affecting them in any other way. Overlapping displays can be moved, resized and closed. Up to five overlapping displays may be viewed simultaneously per station.

Several displays can be presented simultaneously on the screen, i.e. one base display and one or more overlapping displays can be viewed at the same time. All predefined system displays in Advant Station 500 operator workplaces are normally called up as base displays. If required, a system display can also be called up as overlapping. This is useful when the operator wants to take a look at the alarm list while still keeping an eye on the process.

Windows can be opened on the operator workplace screens for interaction with applications in information management workplace and engineering workplaces as well as in external computers on the plant network.

Both base and overlapping displays are normally presented on operator request. Several display selection options are offered:

- From the display selection menu, where it is also possible to distinguish overlapping displays from base displays.
- In each process display the dynamic keys can be configured to be links to other displays.
- A display can be called up for presentation by using the display request command key and then entering the display name.
- The paging keys, Personal Menu, Last Page Menu enable the operator to recall the previous presented display and to page between chained displays.
- Display links are elements in the display area that can point to other displays. When such an element is selected, the associated display is presented. Display links can also activate external applications.
- Tag view from any tag associated element (Applies to hierarchal displays and user graphics).

2.5.6.2 Display Transfer

An operator can request importation and presentation of displays that are configured and stored in other Advant Station 500 nodes. A copy of the selected display is transferred from one Advant Station 500 to the requesting station, where it is installed as any other display prior to being used.

Displays obtained in this way can be included in any of the available menus like any other displays.

2.5.6.3 Control Access

The operator can, provided he has the right authority, select any object for manual control. Selection gives the operator access to this object for the duration of the dialog sequence. After having engaged an object in this way, the object must be released, either explicitly (by cancelling the selection), implicitly (by selecting another object or basic display), or automatically (after expiration of a certain time).

2.5.6.4 System Alarms

The system handles the processing of alarms and events with comprehensive detection, notification, and the optional logging of alarm and event messages. Alarm and event information can also be sent to History and Reports, utilized in Taylor Control Language (TCL) processing, and to trigger data writes to plant computers such as a DEC™ ALPHA™.

Operator Notification

Comprehensive alarm/event notification is provided by MOD 300 displays, audible and visual annunciation at keyboards, and printers.

Alarm Displays

A colored target appears behind the tag in alarm on all displays containing the tag. A separate display is provided that lists all current alarms as determined by user (choices are: all alarms in environment, alarms in Area X, alarms in Group Y). A flashing target on the display represents an unacknowledged alarm. Alarm priority is indicated by the color of the target. If a high-priority alarm occurs, a colored “H” target corresponding to a high alarm appears next to the tag in alarm.

A selection of 192 colors are provided to distinguish alarm categories. The alarm category colors are selectable on a per environment basis. This uniform color scheme speeds operator recognition and response to alarms. In addition, colors can appear as solid, or blinking fast or slow.

Environment/Area/Group Alarm Display

Only the highest priority active alarm for a given attribute is presented in the display. The alarm value is a dynamic variable that is constantly refreshed.

When you do an environment download, the system retrieves all active alarms as acknowledged alarms.

Selection of any alarm message will take the operator immediately to the alarm page configured for that tag.

Page Select Alarm Panel Keyboard

The Page Select Alarm Panel (PSAP) is a specialized, multipurpose keyboard that is ideally suited for alarm notification. When initialized the PSAP provides visual notification to system users via its 192 LED indicators and provides 48 separate push-buttons for quick access to detailed alarm information screens. A user insertable label is located next to each push-button. One red and three yellow alarm LEDs per push-button are provided for indicating high-priority and standard alarm conditions. All MOD 300 keyboards are configurable to provide audible alarm notification.

Alarm/Event Logging

Alarm and event messages can be logged to color, or black and white printers through the Alarm/Event Logger. All alarm acknowledgments are also printed along with the identity of the user who acknowledged the alarm. In addition, the Logger is used to provide a hard copy record of Billboard messages from Taylor Control Language programs and of system diagnostic messages.

The Logger software has the ability to recognize different priorities of alarm and event messages. With the appropriate printer, it is possible to specify the color and font type in which the messages are printed. Type fonts that can be configured are: Bold, Underline, and Normal. Four colors can also be specified: red, blue, green and black.

More than one Logger can be associated with a system so that messages can be directed to different printers according to their process area.

Unacknowledged Alarm Text

The time stamp for an unacknowledged alarm is shown in the color specified on the Console Setup Display for unacknowledged alarms of its priority. The message text for the unacknowledged alarm is shown in the color specified for acknowledged alarms of the same priority. For example, with the color for unacknowledged high priority alarms specified as flashing red and the color for acknowledged high priority alarms specified as cyan, the time stamp for an unacknowledged high priority alarm is shown in flashing red and its message text is shown in cyan.

Audible Alarms

Whenever an alarm or TCL message is received by the console, audible signals are activated on keyboards when users with authority are logged on. The audible indicators are turned off on all keyboards when you press the ACK or silence key.

Alarm Acknowledgment

The normal alarm cycle goes through three stages: notification, acknowledgment, and clear. When a variable goes into alarm, the alarm is displayed in the upper section of the main window and begins to flash in the color associated with the severity of the alarm. An audible tone may also be heard if it was specified during console setup. The ALARM message continues to flash and the audible tone continues to sound, until the alarm has been acknowledged.

Selection of the ALARM message calls up a display containing the tag in alarm. The particular display called up depends on which display was specified during configuration as the display to appear when the ALARM target is selected. On the display called up by selection of the ALARM target, the tag in alarm also continues to flash until the alarm is acknowledged.

Alarms are acknowledged by pressing the ACK key on either the keyboard, or the right hand button on a two-button mouse, or the middle button on a three-button mouse if configured as such, or trackball button.

Alarm acknowledgment can be configured to be either local or global. When configured as local, alarm acknowledgment only affects that particular operator workplace. If configured for global, alarm acknowledgment will be system wide. An auto acknowledge mode is available for unattended or backup consoles. When the auto-acknowledge mode is used, all alarms are shown as having been acknowledged and the fetch alarm list will contain no messages. Global acknowledgment can be configured to acknowledge alarms on consoles throughout the system.

A Ringback alarm sequence is also available to alert operators when an alarm condition returns to normal. If Ringback is specified for a loop during configuration, an alarm-clear notification must be acknowledged after the normal alarm cycle has been completed. The Ringback notification consists of the tag appearing in a user selectable color, with an optional audible.

2.5.6.5 Diagnostics and Maintenance

Advant Station 500 Series operator workplaces present the status of the system on system status displays, with regard to nodes and communication links, including all peripheral equipment and process I/O interface boards. The displays are updated each cycle, thus containing real-time information. System status information is extremely useful during installation and commissioning of the control system, especially since the subsystem is totally self-configuring.

Diagnostic displays include:

- System Status Display - show current status of all nodes
- Subsystem Status Display - information on the specified nodes general condition
- Controller Subsystem Status Display - information on the specified controller
- I/O Displays - show condition of process I/O signals
- I/O Reference Display - shows the tag configured with associated channel
- Remote I/O Display - shows status of I/O of block of Field Bus
- Serial Port Display - provides information about the parameters of the ports
- Diagnostic Message Display - shows all messages as they are stored
- System Performance Display - information on the performance of a node

System Status Display

The System Status Display shows the current status of all subsystems (nodes) recognized on the DCN. You can call up this display at any time using any of the standard display access methods.

There are 24 status blocks on the System Status Display that show the status of up to 24 configured subsystems on the DCN. To view the status blocks for additional subsystems, use the scroll bar. Each status block is a target that calls up the appropriate Subsystem Status Display when selected.

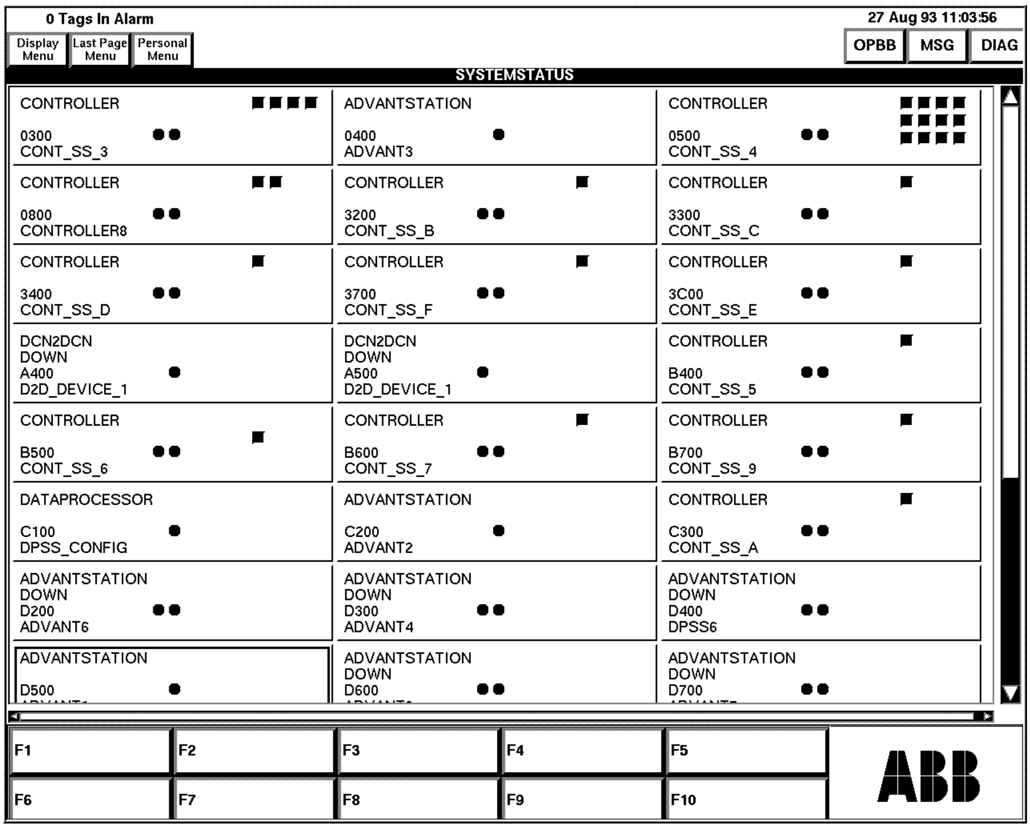


Figure 2-34. System Status Display

Subsystem Status Display

The Subsystem Status Display provides information on the specified node's general condition.

The Advant Station Subsystem Display provides the device number, type, and current state of the Advant Station subsystem.

For example, the AC460 Subsystem Status Display provides the DCN status of the AC460 subsystem and the CPU status (active and backup), I/O submodule status, and carrier module status associated with each controller of the AC460 subsystem.

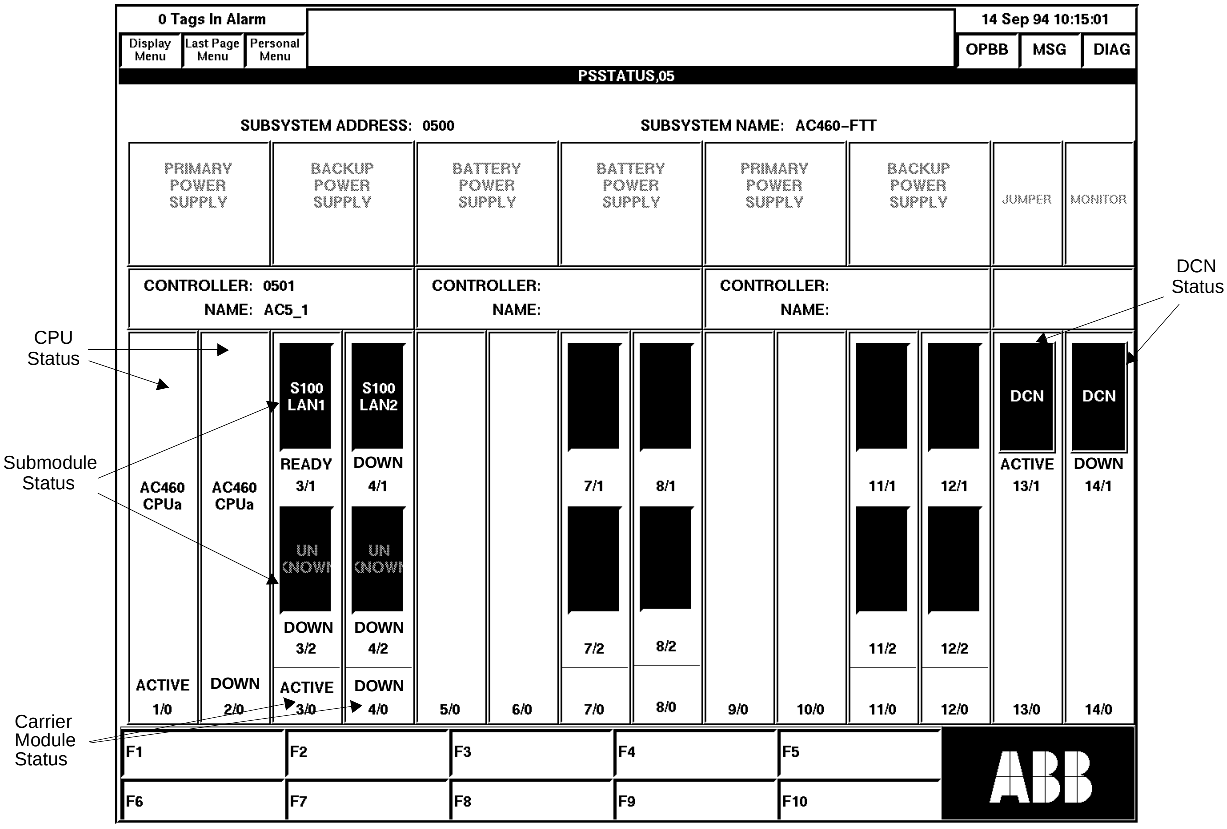


Figure 2-35. AC460 Subsystem Status Display

Diagnostic Messages Display

The Diagnostic Messages Display shows all messages as they are stored within local memory along with older messages stored on disk for the selected subsystem. The data displayed is a representation of what was reported and filed as a diagnostic failure, along with an indication of the time and frequency. Red messages indicate a fatal condition, and yellow messages indicate a nonfatal condition.

System Performance Display

The System Performance Display is called up from the Subsystem Status Display. It provides information on the performance of a specified device/subdevice (node) in terms of CPU loading, Configurable Control Functions (CCF) software loading, and memory pool usage.

2.5.7 Optional Software

No optional AdvaCommand software exists, however, the following software options can be configured on your operator workplace:

AdvaBuild Software (Described in Engineering Software section)

AdvaBuild Basic Functions

AdvaBuild Display Builder

AdvaBuild Environment Builder

AdvaBuild TCL Builder

AdvaBuild TLL Builder

AdvaBuild PLC Builder

AdvaInform Software (Described in Information Management Software section)

AdvaInform History

AdvaInform Reports

AdvaInform SPC

AdvaInform PDL

AdvaInform SQL*Access

Batch 300 (Described in Batch Software section)

2.5.8 AdvaCommand Configuration Guidelines and Performance

Table 2-24. AdvaCommand Memory and Disk Drive Requirements

Functionality	Minimum		Recommended	
	RAM	Disk	**RAM**	Disk
AdvaCommand (standalone)	96MB	2GB	128MB	3GB
AdvaCommand w/ AdvaBuild option	96MB	3GB	128MB	4GB
AdvaCommand w/ AdvaInform History	96MB	4GB	128MB	4GB

NOTE: Additional RAM is available in sets of 32MB, 64MB, and 128MB.

The following performance numbers were calculated using 520/132MHz and 520i/132MHz workstations.

Table 2-25. Operator Workplace Display Performance

Operator Display	Call-Up Time
Custom Graphic w/ 60 Display Values	1 sec cached
Custom Graphic w/120 Display Values	1.5 sec cached
Area Status Display	2 sec cached
Max. Number of Display Overlaps per Station	5
Max.Number of Dialog Overlaps per Station	5

NOTE: The maximum number of Overlaps for remote displays is unlimited. There is a 50% increase in display call-up time with AdvaInform option installed.

Table 2-26. AdvaInform History Comparison

Parameter	AdvaCommand w/ History	Dedicated History
Max. Sample Rate per Minute	2000	10,000
Max. Number of Configured Logs	2500	40,000

2.6 AdvaBuild Engineering Software

The Advant OCS offers a variety of engineering tools to effectively match specific project and application requirements. System based tools including AdvaBuild, for Advant Stations, and the Multibus configurator with PC Templet Generator are offered as part of the system. This includes support to the MOD 300 Page Builder and Console Configurator.

2.6.1 AdvaBuild Engineering Tools

AdvaBuild software integrates plant engineering tools for DCS database configuration. This software supports the following project engineering functions:

- Configuration of the control database
- Project Documentation such as function charts and database reports

AdvaBuild software consists of a family of modules called Builders that are integrated in a framework. The framework consists of three basic components: User Interface, common database, and the Structure Builder. Other builders for example, Template Builder, Function Chart Builder, and TCL Builder are connected as required.

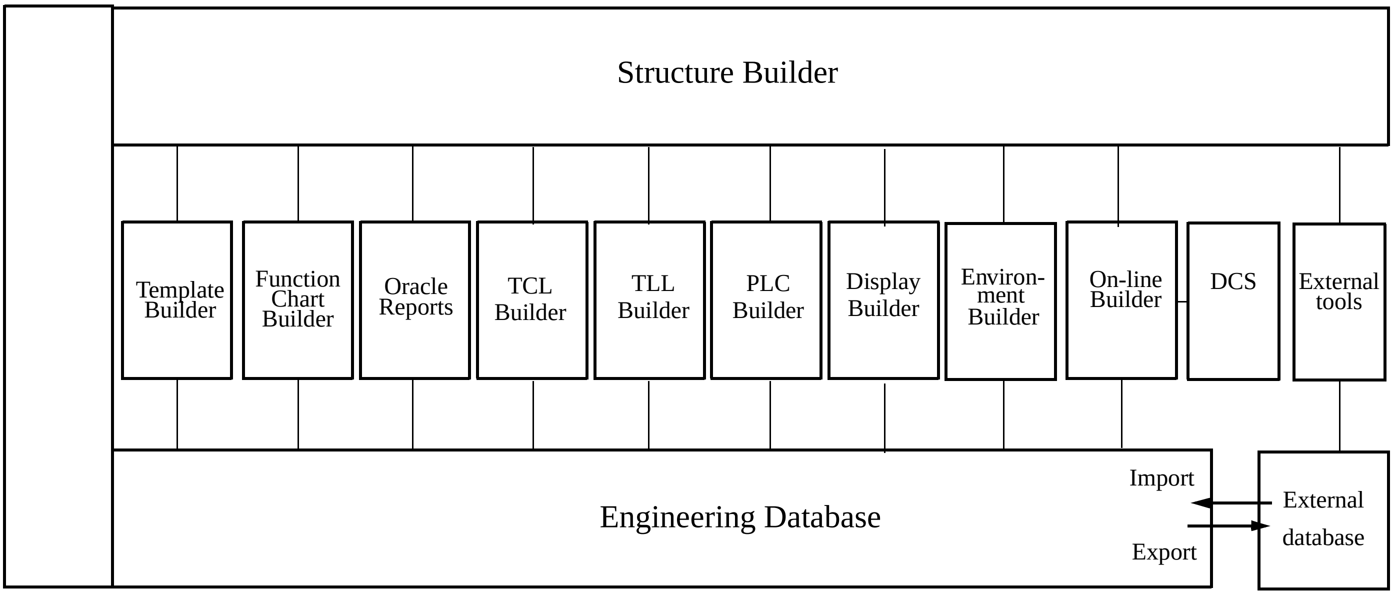


Figure 2-36. AdvaBuild Software Architecture

These builders are highly integrated engineering tools that reduce engineering costs and delivery time, enhance the quality of project documentation, and relieve highly skilled persons from routine work. Since the builders are integrated in the framework, information that is input into one builder is automatically available and can be accessed by other builders. For instance, when you enter loop configuration data in the Template Builder, this data is also available to the Function Chart Builder for generating loop diagrams. Thus the data needs to be entered just once into the common database.

AdvaBuild Basic Functions include the Structure Builder, Template Builder, Function Chart Builder, Om-line Builder, and Oracle Reports.

The AdvaBuild family of engineering tools can be configured to reside in different nodes of the system to meet specific application requirements as shown below:

Table 2-27. AdvaBuild Options

Option	Engineering Workplace	Operator Workplace	Information management Workplace
Structure Builder	Standard	Option	N/A
Template Builder	Standard	Option	N/A
Function Chart	Standard	Option	N/A
Oracle Reports	Standard	Option	N/A

Table 2-27. AdvaBuild Options (Continued)

Option	Engineering Workplace	Operator Workplace	Information management Workplace
On-Line Builder	Standard	Option	N/A
TCL Builder	Option	Option	N/A
TLL Builder	Option	Option	N/A
PLC Builder	Option	Option	N/A
Display Builder	Option	Option	N/A
Environment Builder	Option	Option	N/A
Object Type Builder	N/A	N/A	Option

NOTE: Auxiliary software for X-Server license is optional for engineering workplace.

2.6.2 Structure Builder

The Structure Builder integrates and provides access to the other builders in the AdvaBuild framework. The Structure Builder also provides the means to build and maintain the object hierarchy for a project. This involves inserting, copying, moving, and deleting objects in the hierarchy. The object hierarchy establishes the basic physical and functional characteristics of the project. For instance, inserting a GENERICD object in the database structure establishes the existence of a subsystem in the database. The detailed physical and functional characteristics of the subsystem (DCN address, Console functionality, and so on) are established by defining the object attributes via the Template Builder.

The Structure Builder provides two modes for displaying the object structure. They are the **Tree Presentation** and the **List Presentation**.

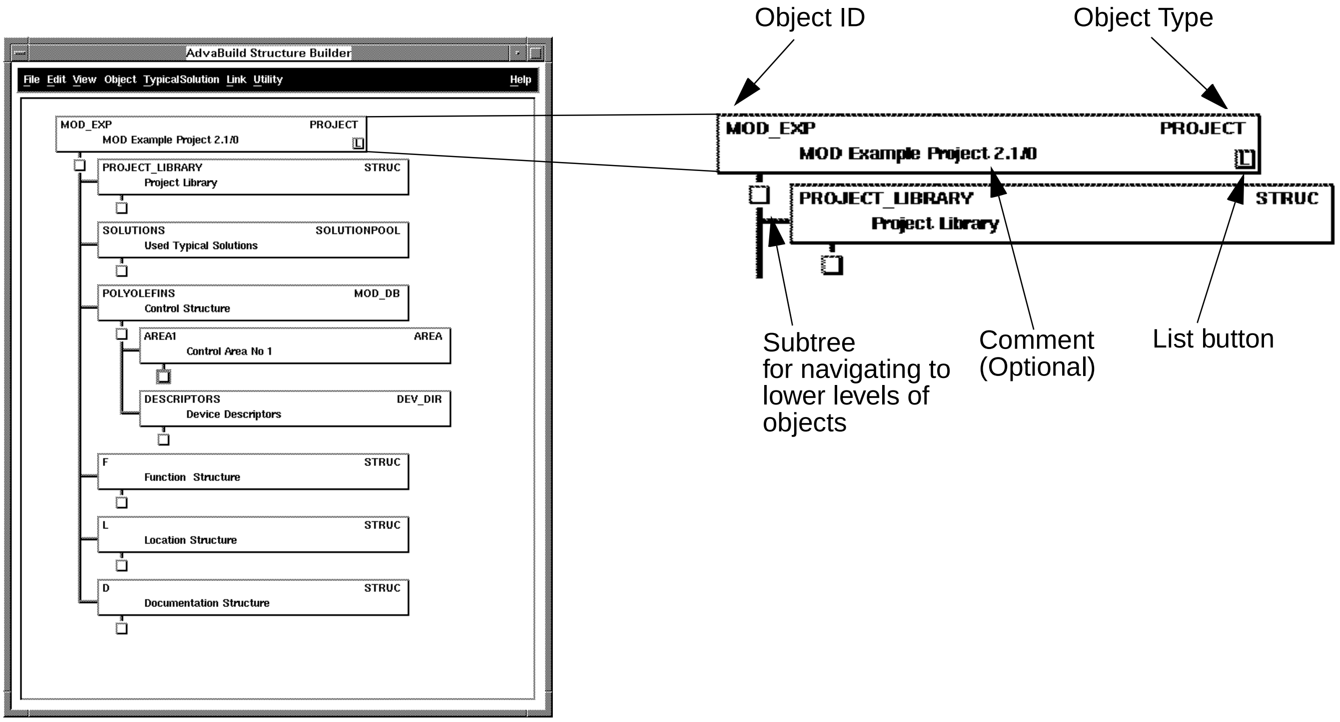


Figure 2-37. Structure Builder Tree Presentation

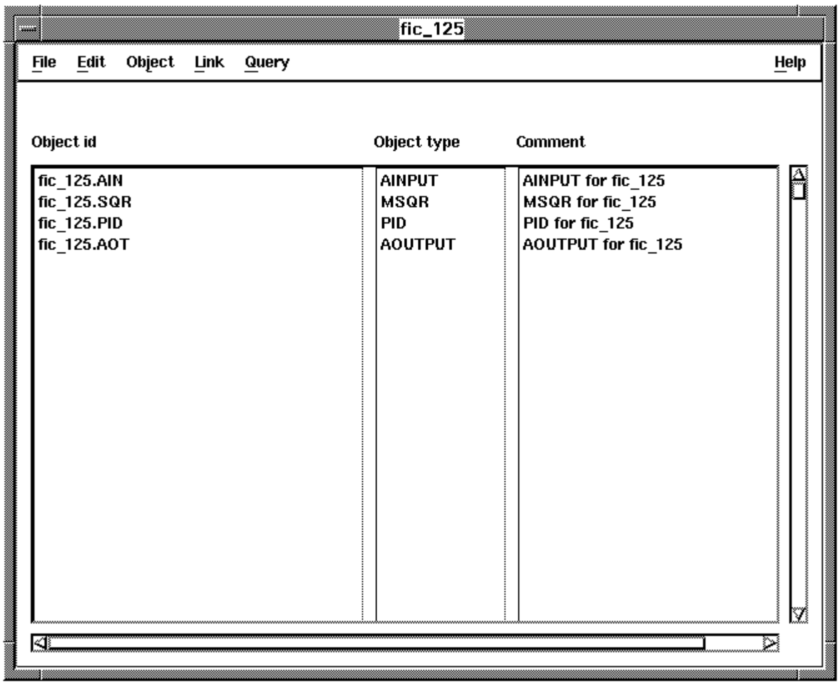


Figure 2-38. Example, List Presentation

You can insert, copy, move, and otherwise manipulate objects both in the tree presentation and the list presentation.

FREE Object Type

You can insert FREE objects in the project object hierarchy as a means to start third party systems from the tree structure in the Structure Builder. FREE objects can be used to represent the following types of systems:

- Maintenance system
- Third party engineering system
- Tools which administer external documents and drawings
- Operating system commands

FREE objects can be created automatically by EIU, when the external tool is able to generate a list of included documents with all relevant information to access the documents.

2.6.3 Template Builder

The Template Builder is a fill-in-the-blank tool providing system database configuration capabilities. When an object is opened via the Structure Builder, the Template Builder displays an interactive template with configurable fields for defining object attributes. The template has two formats. The default format displays one object of a selected type (single-object form) as shown in Figure 2-39. The multiple-object form shows multiple database objects of a selected object type for a selected subtree (for example all analog loops for a specific control module) Figure 2-40. The multiple-object form facilitates bulk data entry, such as when creating a large number of objects with similar attributes. Objects of a given type may be inserted, copied or deleted on the form.

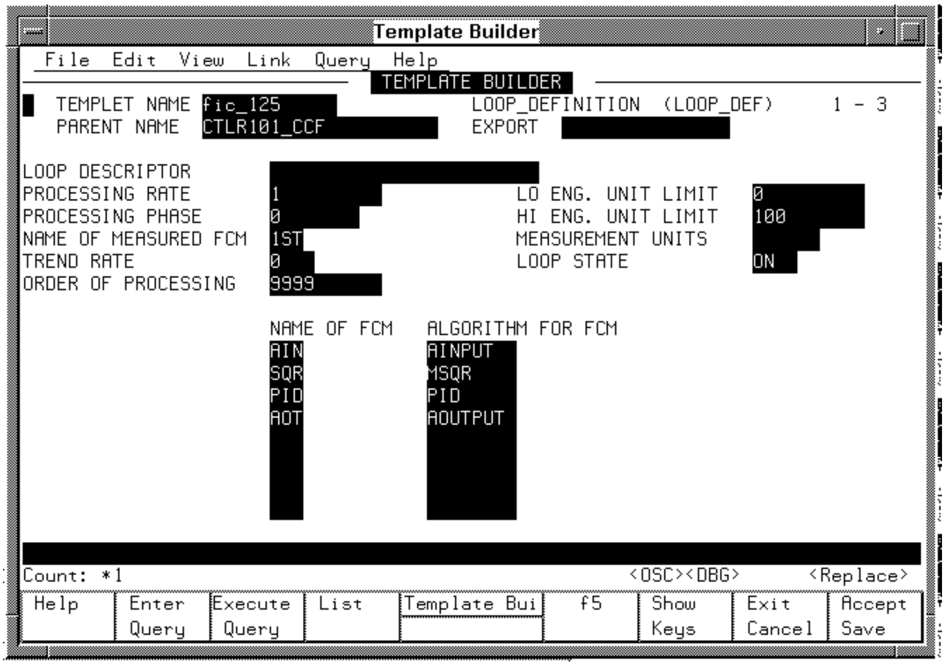


Figure 2-39. Single Object Form

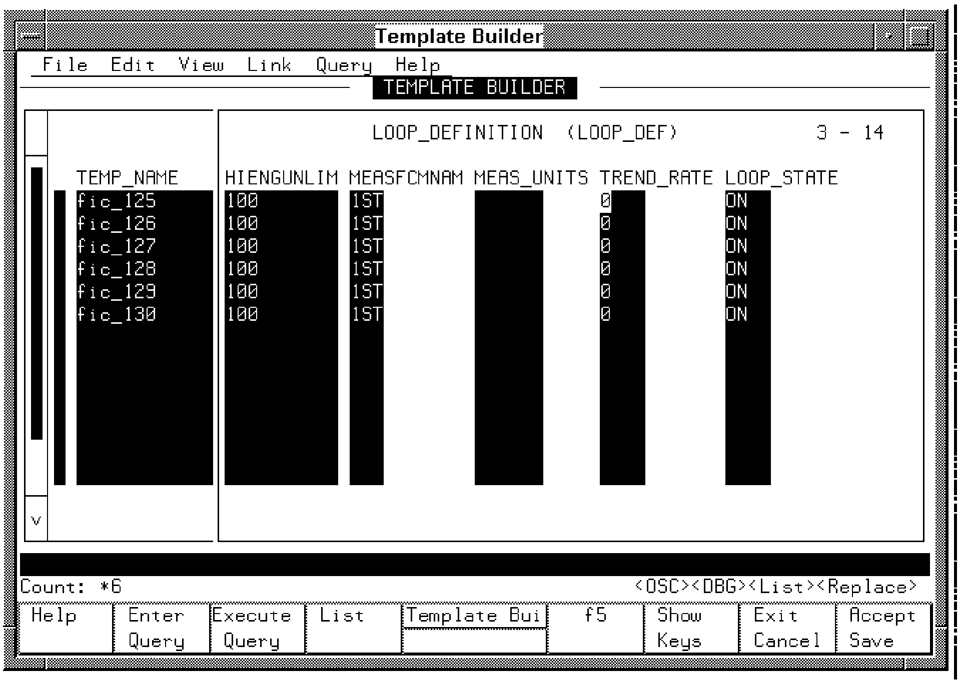


Figure 2-40. Multiple Object Form

Cross Reference Function

The Cross Reference function can check the database for unresolved references. When building control loops, function blocks are linked together and the output of one block is the input to the next. Sometimes, in the process of building the loops, a function block may be accidentally omitted. For example, a PID block needs an input block to it in order to get its measured variable. If the input block is not inserted, this it is an unresolved reference. The Cross Reference dialog box is shown in Figure 2-41.

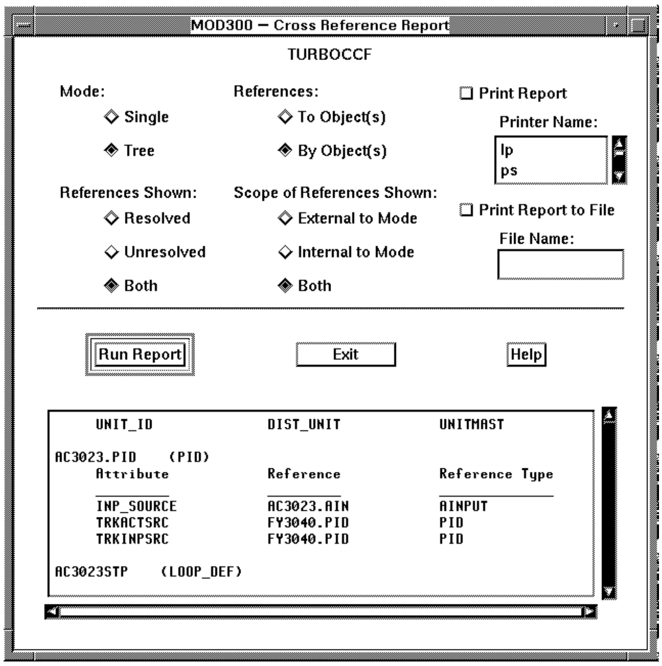


Figure 2-41. Cross Reference Dialog Box

2.6.4 Function Chart Builder

The Function Chart Builder is a point-and-click tool used to graphically build, modify and maintain control loop configurations. The Function Chart Builder displays information as an easy-to-understand, block structured graphic. It supports graphical configuration of the Configurable Control Functions (CCF) software, as shown in Figure 2-42. When the Loop Definition object is opened via the Structure Builder, either of two views of that object can be opened. The Template Builder view provides the interactive template display as described earlier. The Function Chart Builder view provides a graphical method for inserting, connecting, and configuring Functional Control Modules under the Loop Definition Template.

It is easier to configure a single (model) loop via the Function Chart Builder because FCMs can be inserted, connections between FCMs are defined, and some FCM attributes are defined from one window, rather than having to use many different template forms (one for each FCM object). Having configured one model loop, the loop can be copied using the Multiple-object form in the Template Builder to create multiple instances of the loop.

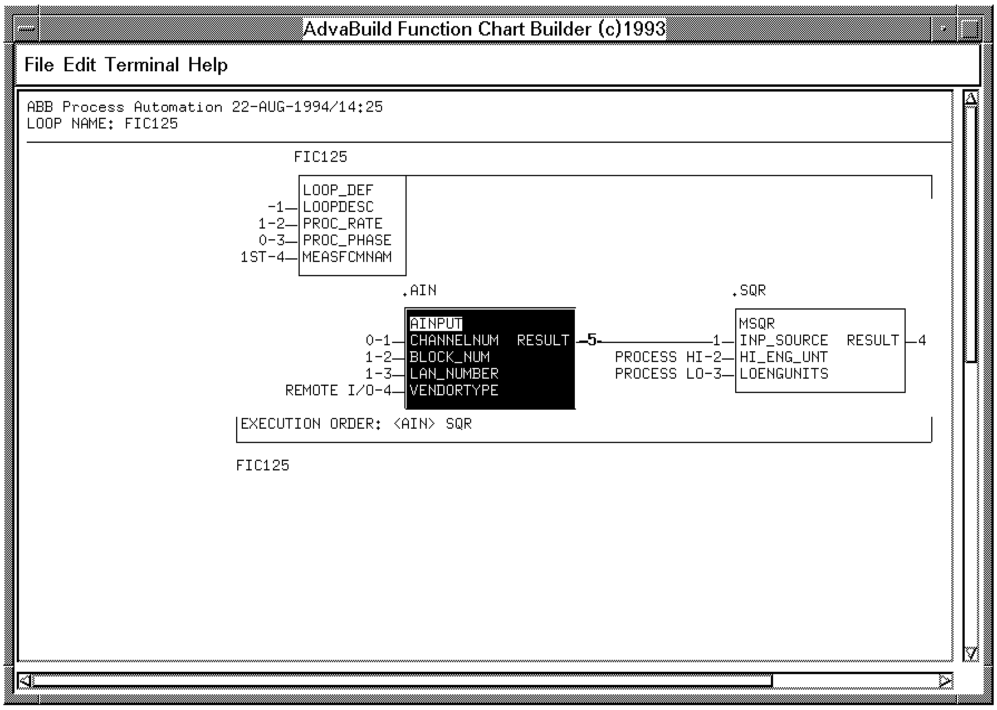


Figure 2-42. Function Chart Builder View of a Loop

These diagrams can be generated, printed and documented via the Function Chart Builder. Whether the loops are configured via the Template Builder or Function Chart Builder, the graphical representation of the loop is available in the Function Chart Builder. This saves the time and effort of having to manually generate loop diagrams in addition to the database configuration. By the same token, when a loop is configured in the Function Chart Builder, the configuration data are also available in the Template Builder view of that loop.

2.6.5 Typical Solutions

Typical Solutions are templates for frequently used process control functions. These solutions are built using a combination of conventional database objects that define the function of the Typical Solution, and special structural objects required by the Typical Solutions hierarchy.

A Typical Solution can be re-used (instantiated) as many times as your application requires. Each time you instantiate the Typical Solution, you have the opportunity to edit certain object attributes in the solution to customize the solution for a specific function.

2.6.6 On-Line Builder

On-Line Builder supports Compiling, Installing, Incremental Downloading, and Decompiling MOD 300 databases. The Advant Station connects to the MOD 300 Distributed Communication Network (via the Real Time Accelerator Board) and does processing required to support these functions.

Compiler

The compiler builds executable database files from the source files in the AdvaBuild database. These executable files are used by the installer to create the active database. The compiler also creates a report file with errors and warning messages generated during compilation. These errors can be easily corrected before the database is installed and downloaded with AdvaBuild's diagnostic tools. The user can compile an entire database or any portion of the database by selecting the applicable object in the project. More than one database can be compiled; however, only one compiled database can be installed and active at a time.

Installer

The installer makes the selected database active, ready for downloading to the subsystems. This database is automatically downloaded when a subsystem or control module is rebooted or reset. A copy of the installed database is maintained on the hard disk of the Configurator Data Processor (CDP). The installer also creates a report file with errors and warning messages generated by the installer.

During runtime, tuning changes made via the Loop/FCM Display and other RDP Displays are automatically entered into the installed database on the CDP. This way, the installed database matches the operational database so that tuning changes are still in affect when a subsystem or control module is rebooted. When the operator workplace environment is installed via the Environment Builder, database references in the environment are checked against the installed database.

Only one database can be active at a time. Therefore, if one database is active and another database is installed, the second database will replace the one that was installed originally.

Incremental Downloading

Downloading is the process by which the installed database is loaded into the memories of the subsystems. This occurs on a subsystem or control module basis whenever a subsystem or control module is rebooted. After initial downloading, the user can download new or modified control loops, device loops, or ladder logic templates on an individual basis.

Decompiler

Decompiling is the process by which tuning changes are entered into the database source file so that the source files match the installed database.

NOTE: You can compile, install, and download individual loops or all loops under a selected Control Block via one command: "LOAD" for Control Block level and "LOOP_LOAD" for individual loops. These commands are available via the Special Commands menu item in the Object menu of the Structure Builder.

2.6.7 Data Transfer Between MOD 300 Database Configuration Platforms

The Advant OCS with MOD 300 Software supports three platforms for database configuration. They are: the Advant Station w/AdvaBuild software, the IBM PC w/PC Template Generator software, and the Multibus-based configuration/data processor. The Structure Builder provides functions for transferring database configuration files from one platform to another via a serial interface.

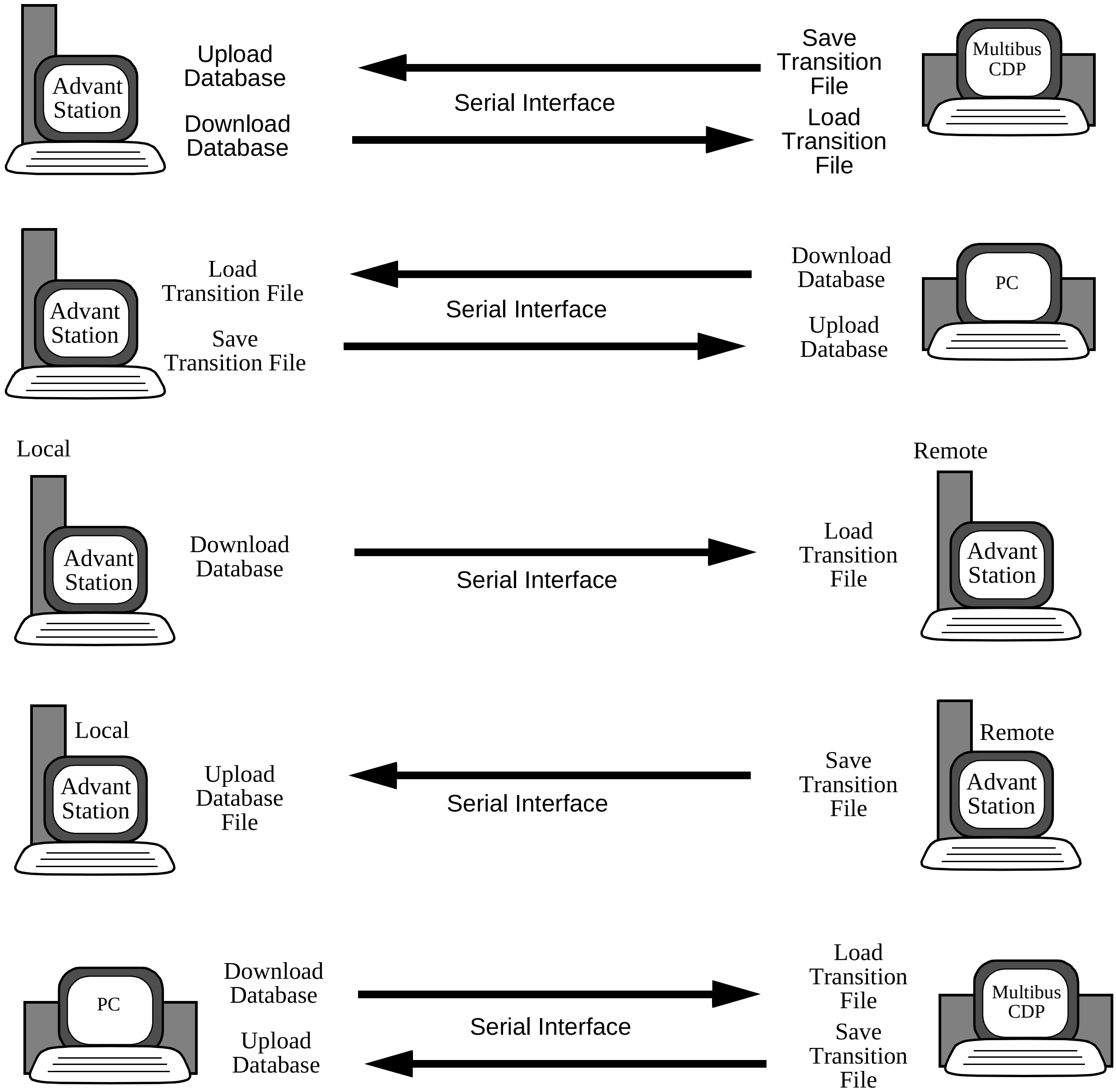


Figure 2-43. Data Transfer Between Database Configuration Platforms

2.6.8 Import/Export Utility

The Import/Export utility provides the means to import data from an ascii file into the Advant Station, and to export data from the Advant Station to an ascii file.

2.6.9 Oracle Reports

Oracle Reports provides system data documentation in report format. Oracle Reports provides ease-of-use with improved document formats, and standard pre-configured reports.

2.6.10 TCL Builder

The Taylor Control Language Builder is an advanced development environment for Taylor Control Language (TCL) and batch recipes. It supports editing, revision control, syntax checking, and downloading of TCL sequences and batch recipes. The TCL Builder is a powerful tool that simplifies the TCL software development process. Its powerful features allows the user to develop code faster, and with greater revision security.

Syntax Checking

Through windows, syntax checked code listings can be compared against the source code structure for easier debugging. This enables errors to be debugged and corrected before downloading a sequence to an on-line system.

The syntax checking creates a listing file that contains error and warning messages. This listing file can be viewed via the TCL editor, or by selecting the listing file in the Files selection box. It is recommended that syntax on a TCL source file be checked prior to downloading the file. By doing this the majority of errors prior to compilation will be eliminated and having to redownload the file later will be avoided.

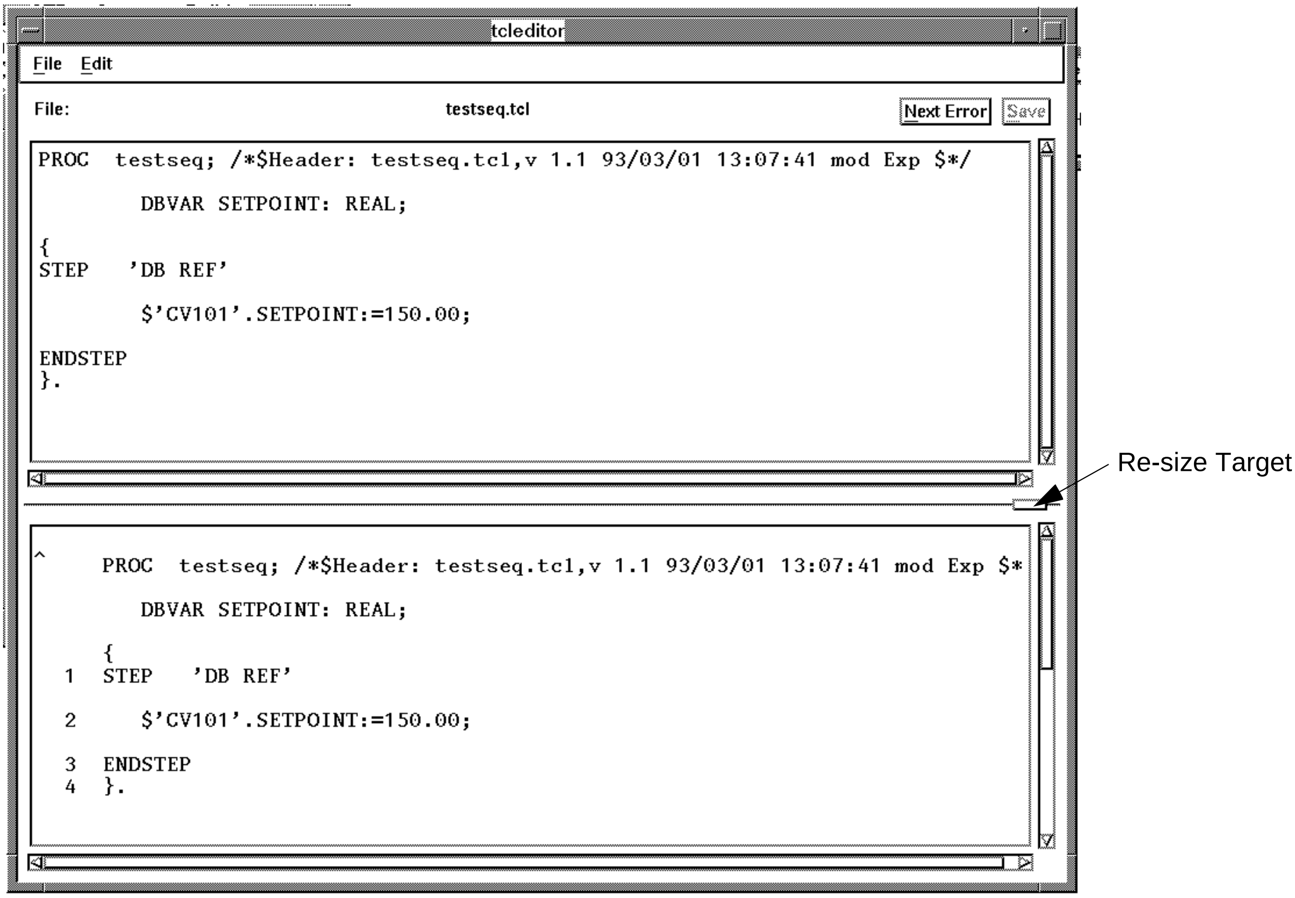


Figure 2-44. TCL Editor Window

Revision Control System

Version control automatically records all changes made to the source code, so that the changes do not have to be documented manually. When a modified program is checked into the revision control system, a new version is created so that the change can easily be tracked. This allows comparison between any two versions of TCL code or batch recipes to determine any differences.

Files that require revision control can be maintained in the Revision Control System. The Revision Control System provides the means for logging, retrieving, and comparing revisions of TCL source files and Batch recipes. A tree structure such as the one below is maintained for

each file stored in the Revision Control System. Base versions (1.1, 1.2, 1.3, 2.1, 2.2, and so on) form the trunk of the tree. A revision may have one or more levels of branches.

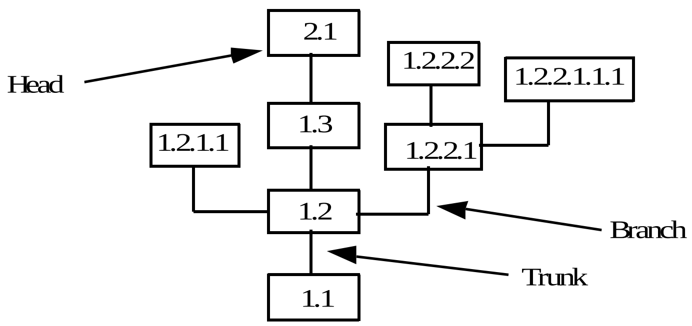


Figure 2-45. Revision Control Tree Structure

Use of the Revision Control System is optional. Files can be maintained independent of the RCS when revision control is not required.

Checking Revisions In and Out

Checking In a File

When the user checks in a file, the changes that were made while editing are recorded by the RCS. The RCS labels the file with the revision number, author, date/time, and changes made during the current editing session. There is the option of specifying a new revision number, state descriptor, symbolic name, and/or comments. The state and symbolic name are optional descriptors that can be used to label a file in more meaningful terms.

Checking Out a File

Check out retrieves a file from the Revision Control System.

The user can check out a file by specifying the state, revision (number or symbolic name), date, or author. At check out the user must specify whether to check out the file locked or unlocked. Check out a file unlocked for activities that don't involve editing such as viewing, syntax checking, and file transfer. Unlocked files cannot be checked back into the Revision Control System. If the user plans to edit the file it must be locked at check out. Locking prevents access conflicts. When a file is locked, no one else will be permitted to check the file out locked. Other users are permitted to check out the file unlocked for viewing or syntax checking, however they will not be permitted to edit and check in a new file.

Search

This command provides the means to search the current file for a specific text string. The following dialog box is displayed when the user selects **Search** for read/write files.

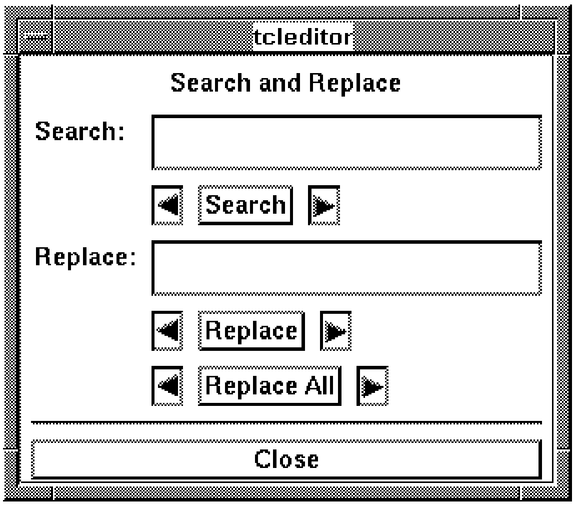


Figure 2-46. Search and Replace Dialog Box for Files with Write Permission

Showing Differences

The user can show differences between two revisions either with lines of context or without lines of context, as shown in the figure below. The Lines of Context format includes a specified number of lines before and after any revised lines. Without Lines of Context format shows just the revised lines.

Format with Lines of Context

```
***************
***10,12
              Wait (10);
   -          RCSID:= ì$Revision 1.5.1.1$î;
          Endstep
-----10,11-----
              Wait (10);
         Endstep
```

Format without Lines of Context

```
11d10
< RCSID:= ìRevision: 1.5.1.1$î;
```

Figure 2-47. Show Differences Example

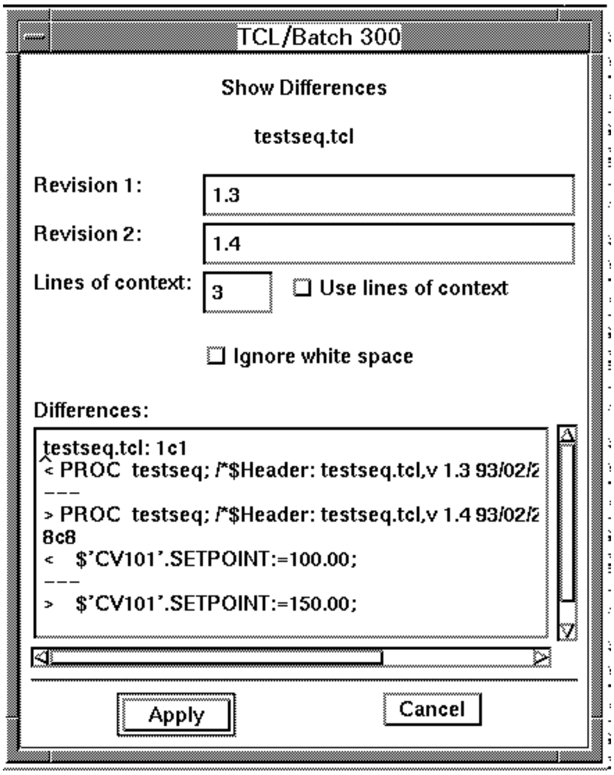
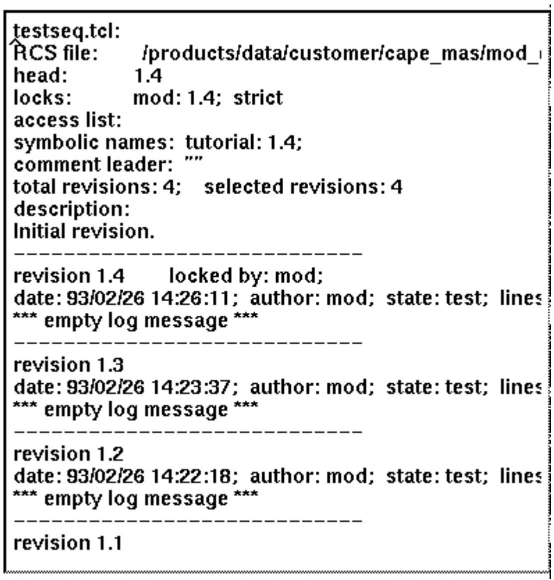


Figure 2-48. Showing Differences Dialog Box

Showing Change Log

The change log provides a history of changes for the selected file. This log provides the following file level information: file name, working file name, latest revision number on the trunk, access list, revision number of the locked revision (if any), list of symbolic names and their revision numbers, total number of revisions, number of revisions selected for the change log, and a description. For each revision, the following is provided: revision number, author, check in date/time, state, number of lines added/deleted with respect to the previous revision, user who locked the revision (if locked), and comments.



```
testseq.tcl:
RCS file:      /products/data/customer/cape_mas/mod_
head:          1.4
locks:         mod: 1.4;  strict
access list:
symbolic names:  tutorial: 1.4;
comment leader:  ""
total revisions: 4;    selected revisions: 4
description:
Initial revision.
----------------------------
revision 1.4       locked by: mod;
date: 93/02/26 14:26:11;  author: mod;  state: test;  lines
*** empty log message ***
----------------------------
revision 1.3
date: 93/02/26 14:23:37;  author: mod;  state: test;  lines
*** empty log message ***
----------------------------
revision 1.2
date: 93/02/26 14:22:18;  author: mod;  state: test;  lines
*** empty log message ***
----------------------------
revision 1.1
```

Figure 2-49. Example of Show Change Log

2.6.11 TLL Builder

The TLL Builder provides the user with the ability to create and maintain source code of the Taylor Ladder Logic (TLL) software. TLL implements industry standard ladder logic functionality. It can be used in place of a gateway and PLCs when ladder logic control is required. The TLL Builder uses the AdvaBuild database to maintain control over TLL objects.

TLL contains a full set of instructions for implementing all standard ladder logic functions such as relay manipulation, timer and counter manipulation, and input, output and comparison of large numbers of data points. The TLL Builder uses the visual editor and supports an extensive set of console displays providing an efficient means to produce, execute and maintain ladder programs. The TLL Builder displays provide a way to specify the scan rate for a node and build the structures such as counters, timers and files required by the ladder programs.

2.6.12 PLC Builder

The optional PLC Builder provides the user with the ability to configure the Multibus and SC Controller interface to programmable controllers when combined with the Advant OCS.

2.6.13 Display Builder

With the use of pop-up menus, multiple windows and an intuitive interface, custom (user-built) displays are created by defining, manipulating, and positioning display elements using the Display Builder software. A display element is any discrete unit that can be entered into the workspace. The display elements include process objects such as pumps, boilers, tanks, and so forth, as well as graphic symbols such as arcs, lines, rectangles and text. In addition, with no more effort than it takes to select “clip art”, 3-D style pieces can be combined to form realistic, easily recognized display elements.

Editing displays and manipulating elements is an easy task. Multiple displays can be edited at once, and cut-and-paste is possible between displays. Any element can be resized, scaled, rotated, grouped with other elements and moved. The user can zoom in to add detail or zoom out to get an overview. If the need arises, a Help feature can be accessed at any point.

Along with a choice of line and fill styles and line and fill colors, three palettes of 64 colors are available to produce up to 192 unique custom colors. Palette colors can be solid or flashing, and can be combined to simulate motion.

A substantial number of levels of display logic (up to 16) in an if/then format can be assigned to the element or text, causing it to flash, change color, or appear as if it has been invisible to indicate the device state.

All graphic displays are configured either by selection from a library of predefined display elements or by creating new elements using the drawing tools provided in a graphic tools palette.

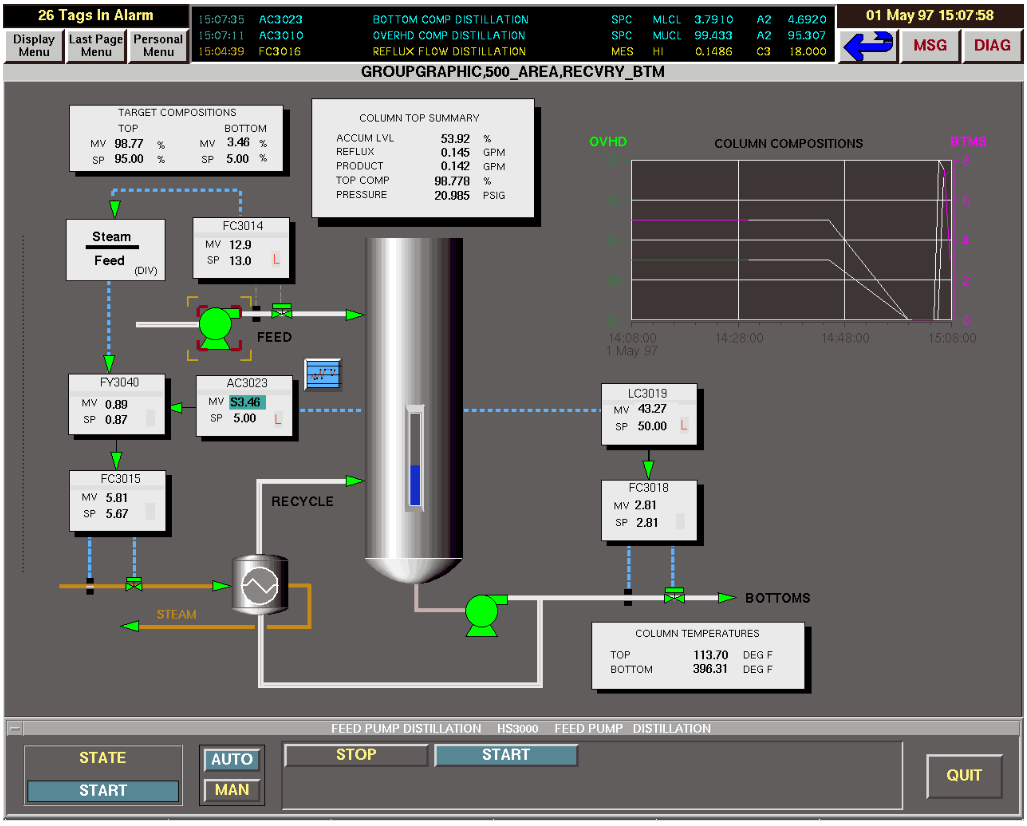


Figure 2-50. Example of Custom Graphic Display

The user can design display elements to be static or dynamic when the display is used at runtime. If an element is static, its graphic image does not change. If an element on a runtime display is dynamic, its appearance or content changes to reflect a change in a process variable. A dynamic object, graphic symbol or text element can change color, blink, become visible, and so on. Any item can be made dynamic, which means it can change based on process data.

After the user builds a display, the user can save it to disk in a library file to recall for modification as required. At console configuration time, the user can then choose to link your display to a specific runtime environment.

2.6.14 Environment Builder

The Environment Builder software is a configuration tool for building, installing, and maintaining environments for the Advant Station 500 operator workplace.

An environment is the operators view into the process. It is configurable and contains the displays associated with particular sections of a plant (multiple environments) or of the entire plant (a single environment).

2.6.15 AdvaBuild Configuration Guidelines

Table 2-28. AdvaBuild Memory and Disk Drive Requirements

Functionality	Minimum		Recommended	
	RAM	Disk	**RAM**	Disk
AdvaBuild (standalone)	96MB	3GB	128MB	3GB

2.7 Enterprise Historian Software

Enterprise Historian is a suite of software for managing historical and real-time process/production information, and integrating your various enterprise resource planning (ERP), manufacturing execution, and automation systems. Information management/integration capabilities include:

- collection and storage of historical process and production data.
- presentation of process and production information via reports and displays.
- data distribution. Data can be physically stored in several computers and databases; however, to the end-user it appears as if all data are stored in one database. Likewise, applications and tools can be executed in several computers; however, to the end user it appears as if all applications are executed in one computer.

This gives you up-to-the-minute production information from yesterday, last month, or even years ago; the type of information needed to manage your production. You can leverage your existing investments by simply integrating Enterprise Historian software into your current Advant Open Control System (OCS) and Manufacturing Execution System (MES).

Enterprise Historian is based on leading-edge IT open architecture, which includes plant based, component based, three-tiered, and distributed networks.

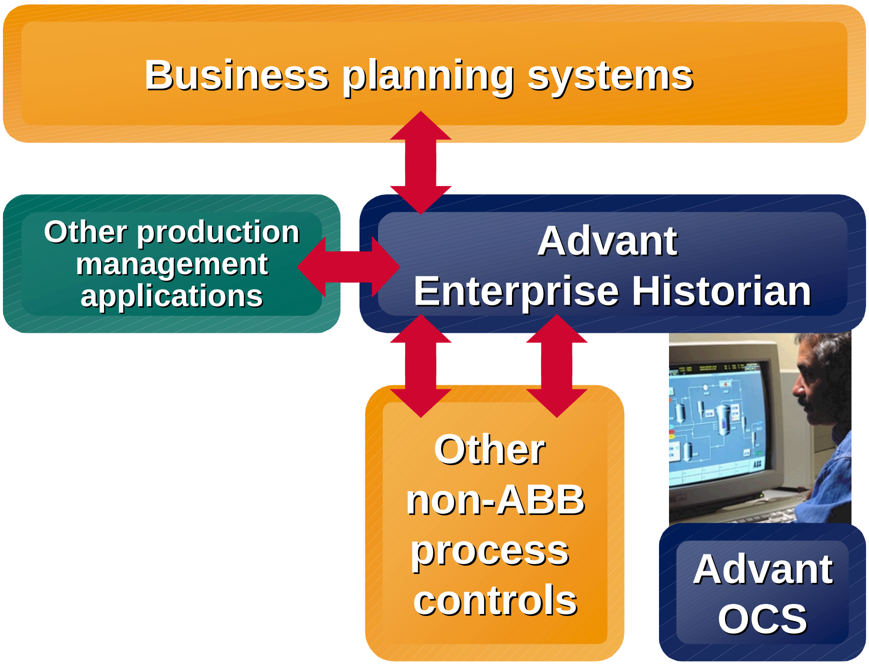


Figure 2-51. Enterprise Historian Architecture

The following is a brief introduction to Enterprise Historian. For further details, refer to the *Enterprise Historian Product Guide*.

2.7.1 How Can You Use Enterprise Historian?

Enterprise Historian (sometimes referred to simply as Enterprise Historian) is a management tool for process documentation and operations. It can consolidate information from multiple areas and sites, summarize operations, support regulated production records, and document both process and operator deviations.

Open System Features for Plantwide Integration of Information

Enterprise Historian is an information server for the Advant OCS, and for nodes on the TCP/IP Network. It is also a platform for integrating both your applications and third-party applications into the Advant OCS. Open system features based on international standards let you integrate information from all parts of the plant. You can access data consistently, whether the data resides in the local node where Enterprise Historian software is running, or on a remote node on either Advant OCS control network or plant network.

You can focus data by integrating business, simulation, and training systems, desktop access, process supervision and analysis, and production management. Enterprise Historian software supports mixed infrastructures: HP-UX, Windows NT, and hybrid applications. This makes it ideal for situations where HP-UX is acceptable for databases, but Windows NT is required for clients, or where Windows NT is mandated for all IT level functions.

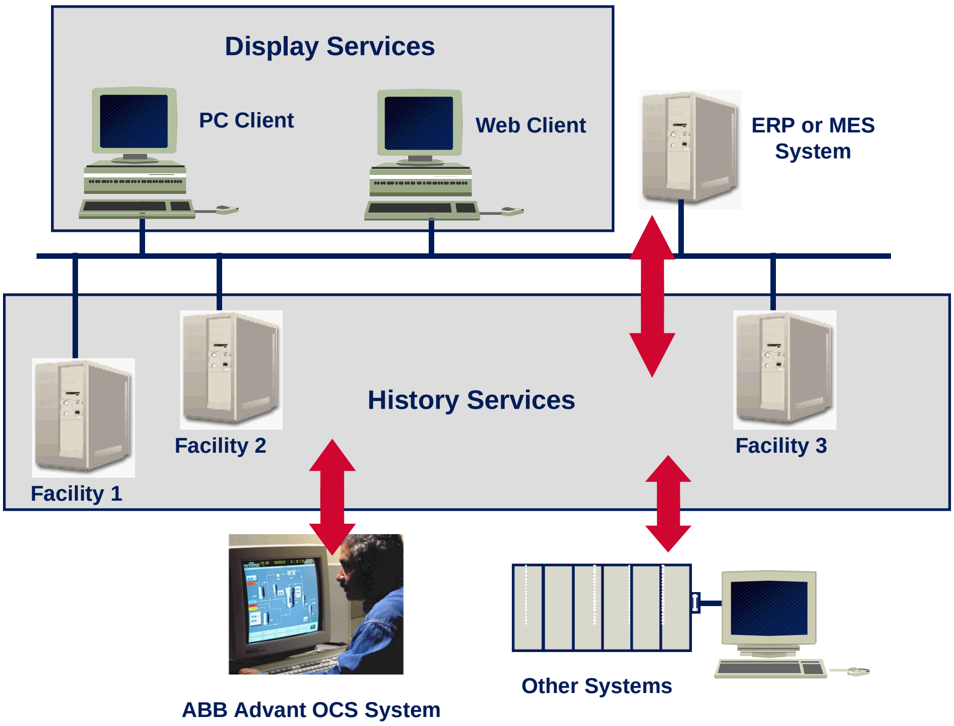


Figure 2-52. Enterprise Historian for Plantwide Integration

Uniformity, Portable Applications, and Easy Engineering

The user interface is built on standards such as Windows, X-windows and OSF/Motif, so the Enterprise Historian can act as a server for X-clients on the Plant Network (TCP/IP). Several users can simultaneously access Enterprise Historian functions from X-clients on the Plant Network. X-technology makes it possible for you to interact with applications that are executing in several nodes on the plant network.

Enterprise Historian software provides interfaces such as User API, AdvaBuild Object Type Builder, SQL, OSF/Motif that let you build portable applications.

Enterprise Historian software also provides graphical configuration tools, consistent error handling, NLS (Native Language Support) and On-Line Help.

2.7.2 Platforms for Enterprise Historian

Enterprise Historian software runs on the HP-UX-based Advant Station, and on Windows NT platforms. You can use either of these platforms in any one of the following modes:

- **Control Network Only Connection** lets Enterprise Historian applications access historical and real-time data from the Advant OCS control network.

  The node where Enterprise Historian software runs is connected via a Realtime Accelerator Board to the Advant OCS control network (DCN).

- **TCP/IP Network Only Connection** lets Enterprise Historian applications access and be accessed by other nodes that are enabled for TCP/IP network communications.

  The node where Enterprise Historian software runs is connected to the TCP/IP network, but not a control network (so it does not require a Realtime Accelerator Board).

- **Control Network & TCP/IP Network Connections** has the combined functionality of the Control Network Only, and TCP/IP Network Only modes.

  The node where Enterprise Historian software runs is connected to both the TCP/IP network, and a control network. It can access process values from a controller on the control network, and it can access or be accessed by other Advant OCS nodes that are enabled for TCP/IP network communications.

- **Stand-alone** is intended for situations when you want a dedicated off-line development node.

  The node where Enterprise Historian software runs is not connected to a control network, nor is it connected to the plant network. The Real Time Accelerator Board and the Advant OCS communication software are excluded.

NOTE

If you begin with a stand-alone version, and later need to connect the Enterprise Historian node to the control network, you can use an upgrade kit to install network communication software.

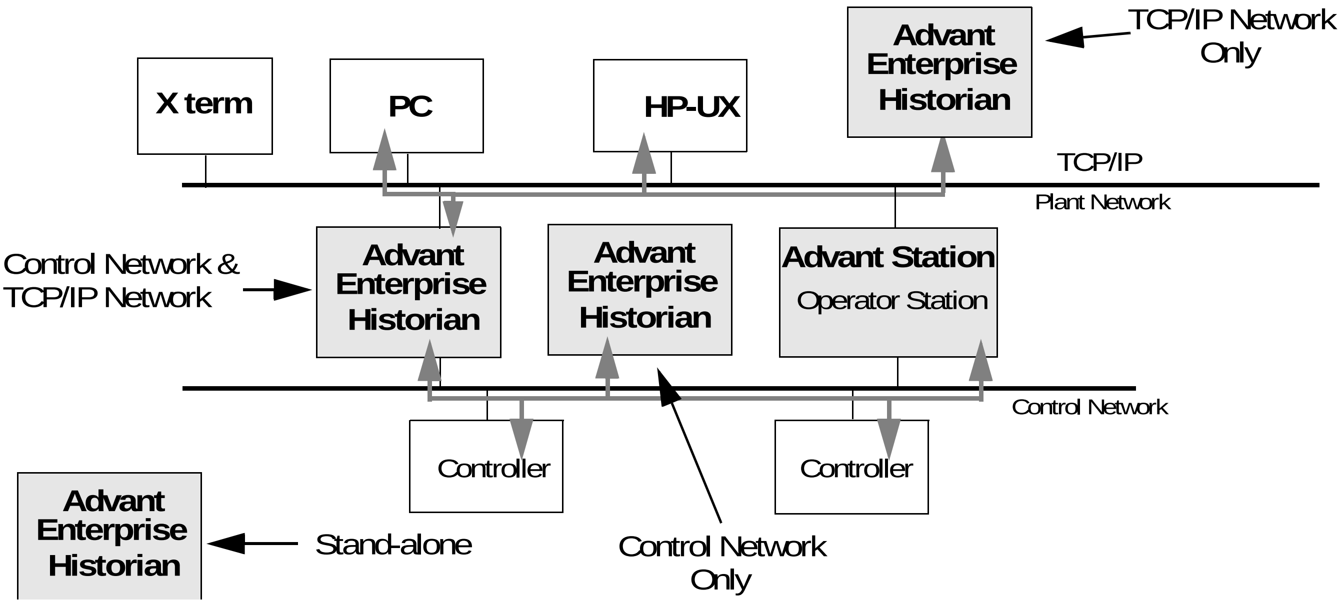


Figure 2-53. Enterprise Historian Network Configurations

2.7.3 Bundling Options

For HP-UX platforms there are two bundling options: Enterprise Historian *Select* and Enterprise Historian *Professional*. For Windows NT, Enterprise Historian Select is the only option.

2.7.3.1 Enterprise Historian Select

Enterprise Historian Select is a cost-effective solution for smaller system applications, such as PLCs. Enterprise Historian Select software includes:

- Enterprise Historian System Services on HP-UX or Windows NT platform with 250 real-time tag license
- Display Services for one server / one display client
- DataDirect client for integration with Microsoft Excel
- Web Server/Browser (HP-UX platform only)

Enterprise Historian Select may be used for the following applications:

- To provide a Windows NT or HP-UX node as a gateway for transferring data to third party historians such as OSI PI, and Aspen. This configuration requires the User API option.
- To provide a method for getting history data from ABB TTD and future PHL (primary history) logs, to the enterprise for display and manipulation via Display Services.
- To provide the application environment for Advant Open Control Systems.

2.7.3.2 Enterprise Historian Professional

Enterprise Historian Professional is a high-end information management solution for larger system applications with multiple platforms and distributed control. With Enterprise Historian Professional, you get all the Enterprise Historian Select software, plus History Services with 250 tag license.

2.7.3.3 Optional Software for Enterprise Historian

Table 2-29 lists the optional software for Enterprise Historian. Some options are not compatible with all versions and platforms.

Table 2-29. Optional Software for Enterprise Historian

Category	Software Package	Professional	Select	HP-UX	Windows NT
AdvaInform Software Options	ABB control network connection	X	X	X	X
	User API	X	X	X	X
	Additional client licenses and builders for Display Services	X	X	X(1)	X
	Additional client licenses for DataDirect	X	X		X
	Production Data Logger	X		X	
	SPC	X		X	
	SQL*Connect	X	X	X	
	Object Handling	X	X	X	
	SQL*NET and ODBC	X	X	X	
	SQL*Connect Programming	X	X	X	
	Programmer 2000 - Pro*C	X	X	X	
	Reports	X	X	X	
	Calculations	X	X	X	
	X-terminal Interface	X	X	X	
AdvaBuild Software Options	Object Type Builder	X	X	X	
AdvaTalk Software Options	Link to MATLAB	X	X	X	
	Link for HP RTAP	X	X	X	
	Batch Extensions	X	X	X	
Misc. Options	MOD 300 Computer Interface	X	X	X	

(1) HP-UX platform requires Windows NT connection for display building.

2.8 AdvaControl Loop Tuner for Windows

AdvaControl Loop Tuner for Windows is a software package for On-line and Off-line Auto-tuning of PI- and PID controllers in Advant OCS systems. It runs on personal computer under Windows 3.1, or higher. The AdvaControl Loop Tuner for Windows exchanges data with the target node utilizing the EXCOM protocol or DDE Server support. Via the Historical data handling re-tuning and advanced process model analysis can be done Off-line on raw data stored on disk. Closed loop simulation is done using either On-line identified process models or user defined process descriptions. User defined process models can also be used for tuning, that is, calculation of controller control parameters, giving you a possibility to get excellent default parameters for each loop prior start-up of plant.

AdvaControl Loop Tuner for Windows supplies optimum loop performance, giving you savings via less raw material use, higher product quality, less energy use, shorter start-up time, quicker grade change handling, less maintenance, loop optimization during plant production etc.

Figure 2-54 shows conventional tuning compared to the AdvaControl Loop Tuner for Windows tuning.

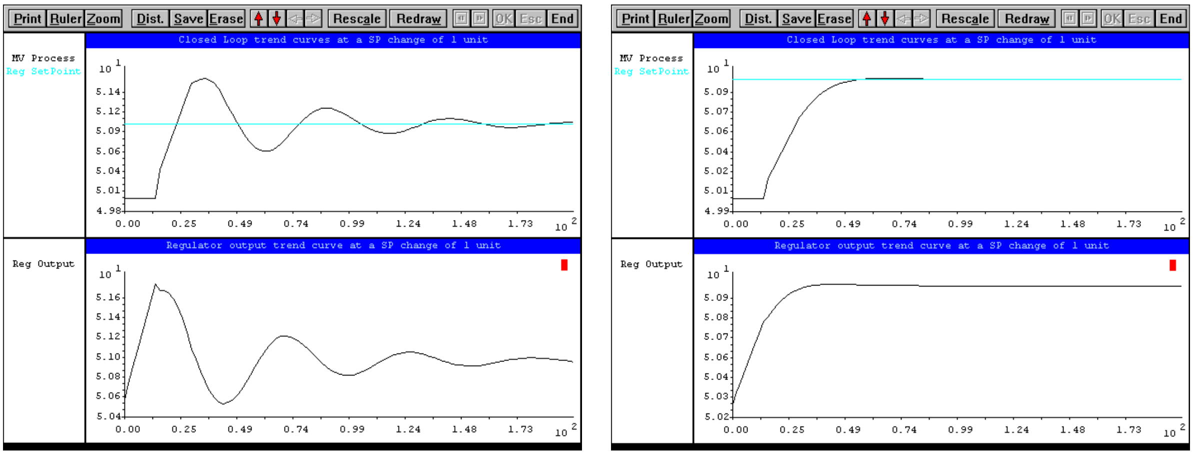


Figure 2-54. Left Window Conventional Tuning,
Right Window by AdvaControl Loop Tuner for Windows

In Figure 2-55, the principle connection for loop tuning is indicated, that is, how the data is acquired in the DB of the Advant OCS system.

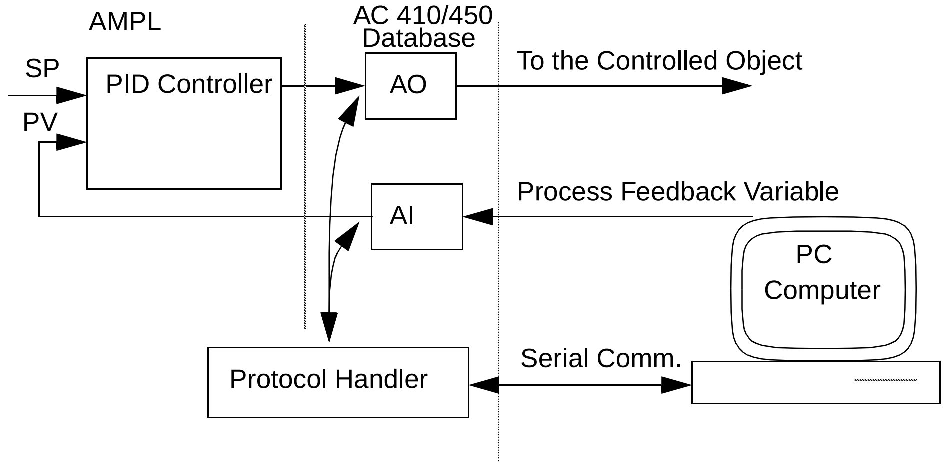


Figure 2-55. Principal Connection for On-Line Data Acquisition

Controller tuning can be done with the controller running in AUTO mode, that is, during normal plant production, or in MAN mode. The minor setups required for a full auto-tuning session can be automatically generated by the AdvaControl Loop Tuner for Windows or handled via the plant operator. It is possible from AdvaControl Loop Tuner for Windows to select the controller to tune. The found control parameters can also be written to the PI- or PID controller in Advant OCS. Using the AdvaControl Loop Tuner for Windows for these extended capabilities may require minor additional AMPL configuration in the Advant OCS system. Normal use does not require configuration in the OCS system.

The Process Analysis and Statistics toolkit supplies functions which facilitate extended process understanding. In Figure 2-56, the principal program structure is indicated.

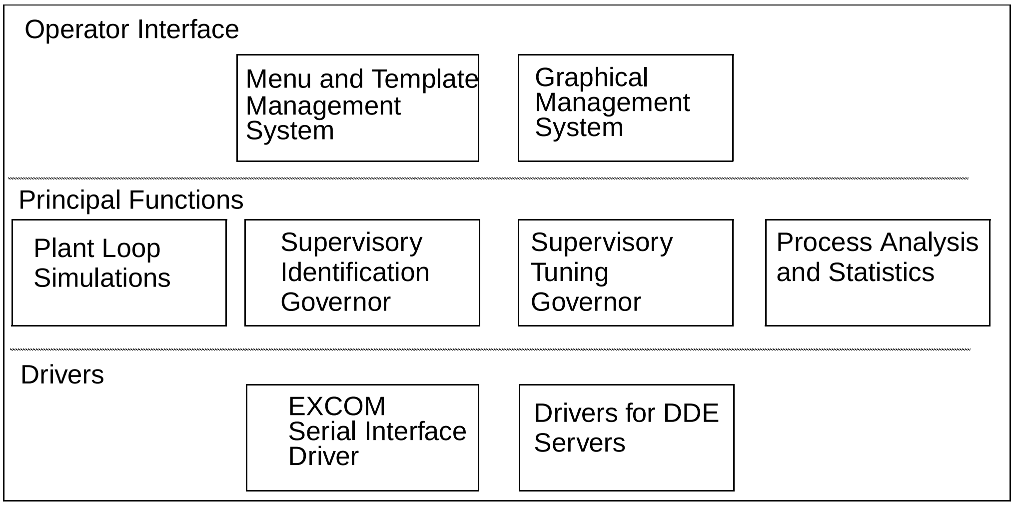


Figure 2-56. Principal Program Structure

2.8.1 Operator Interface

Via the Menu Management System On-line advice, information is immediately available for each menu option. The advising information contains up to nine lines of direct assistance. The Advising window is also available for each parameter in a template window. Thereby AdvaControl Loop Tuner for Windows supplies immediate assistance for each and every user action. Via the tab indicators in the menu window, you have direct observability of your position in the large menu tree. Via the macro key handling, complex work and program movements can be done in a very efficient manner. Repetitive work is easily done via the user defined macro handling.

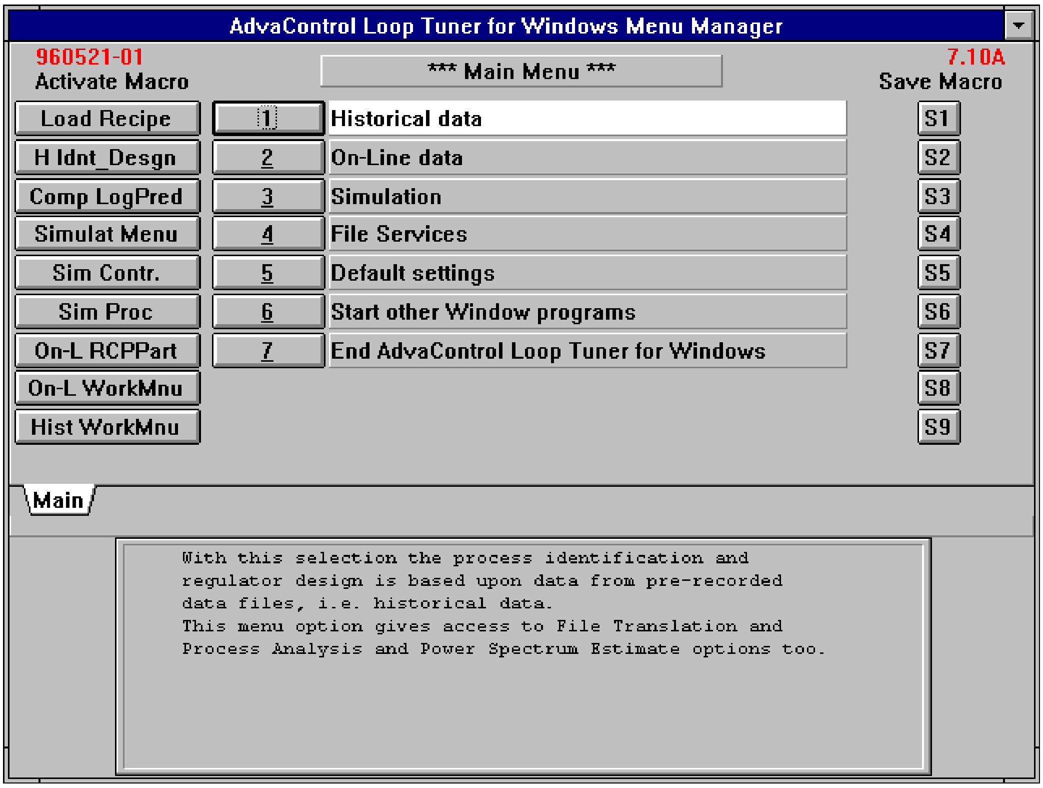


Figure 2-57. Main Menu Operator Interface

During On-line Data Acquisition, data are presented in multi-axis trend curves. Historical data are presented in a similar manner but automatically scaled for maximum resolution. Data Acquisition can be Event initiated. This means that the data used for process identification and controller design calculations can be controlled based upon a high or low level triggering. The triggering signal could be, for example, the control deviation, process variable, or any other signal logged during the session.

Information displayed in the Advising and the Message Box window is read from ASCII files, which make it easy to change explanation or language.

2.8.2 Principal Functions

Plant Loop Simulations

In the plant simulation mode, AdvaControl Loop Tuner for Windows not only supply closed loop simulation, but also process open loop simulations, advanced Bode analysis calculations and display together with closed loop system poles diagrams. Ruler and Zoom functions are available during trend data presentations. During Simulation mode, you have full access to all parameters of the process as well as the controller. This makes it easy to test how the current controller will behave if the process dynamics change.

Each closed loop analysis can be saved into a recipe description. This means that you can re-load such a recipe and directly re-tune the same plant loop once again based on new raw data from plant. Combined with the recipe data handling facility, a recipe report generator is available. The report generator prints all parameters used and identified as well as a user specified 10 line header. An extended calculation report generator is available giving you the ability to store multiple analysis results plus own comments to file for further penetration later on. Historical data can be translated to ASCII file data for further use in other environments. AdvaControl Loop Tuner for Windows also supply import of data stored as ASCII data, thereby making it possible to use the excellent facilities such as Process Identification, Controller Design, Process Analysis and Statistics and Plant Loop Simulation for more generic use.

In AdvaControl Loop Tuner for Windows, four different loop structures can be utilized. They are illustrated in the figure below.

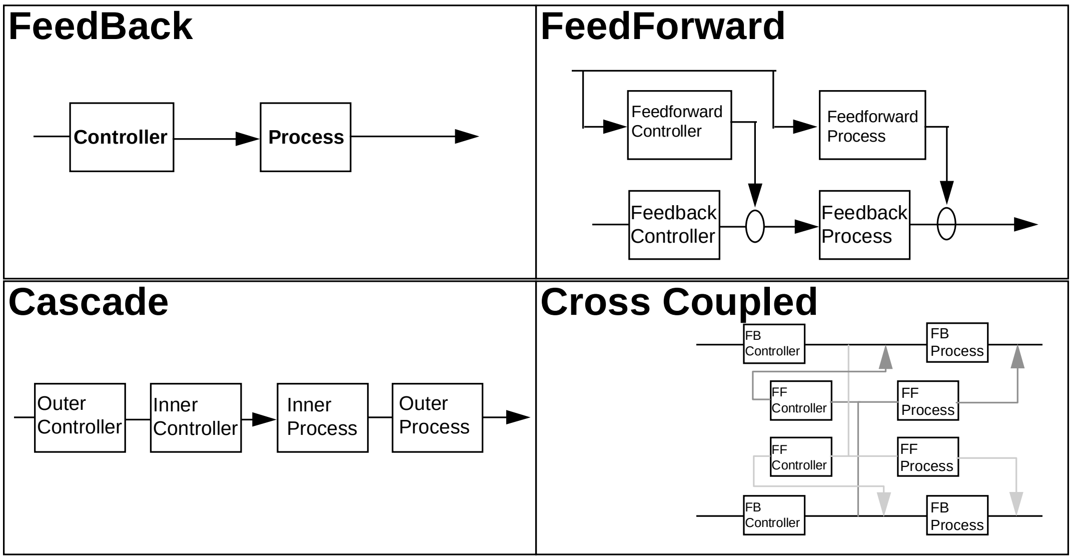


Figure 2-58. Four Different Loop Structures

Each of the four structures can be utilized also for on/off -line features as well as the simulation part. Most loops at site are based upon the feedback structure. The other structures are used to handle and improve quality and cost related factors. With more controllers active the complexity increase and thereby also the requirements.

AdvaControl Loop Tuner for Windows also contain a comprehensive training manual to facilitate the use of these complex structures.

Supervisory Identification Governor

The process model used for tuning the controller can be identified based on On-line or Historical data. It can also be user defined if prior knowledge is available. The process model identification is handled via the Supervisory Identification Governor, SIG. This means that you do not have to specify any specific parameter for the identification session. If you have knowledge and experience, it is possible to interfere and change any design parameter used by the SIG. The normal user let the SIG, based on its heuristical data base, take all necessary actions.

The major actions taken during a process model identification are:

- Dynamic regressor, Butterworth, filtering and Process deadtime identification
- Process model order identification via residual analysis
- Model order size is penalized via Akaike’s and Rissanen’s methods
- Least-Squares ARX process model parameters in both continuous and sampled form
- Process model validation via residual analysis in combination with heuristical criteria. The

result is also illustrated graphically as indicated in the figure below.

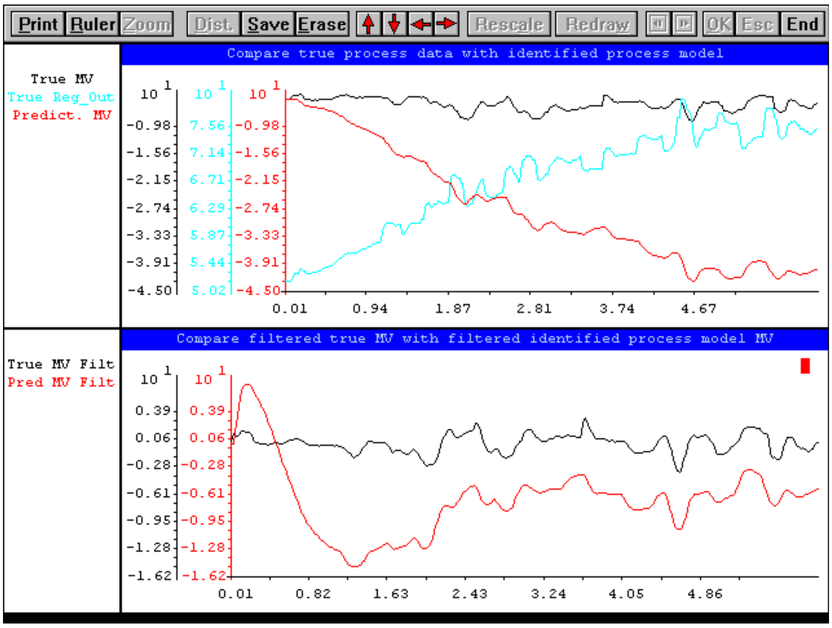


Figure 2-59. Process Model Validation. Top Unfiltered and Bottom Filtered.

Supervisory Tuning Governor

The Supervisory Tuning Governor, STG, makes use of the sampled process model description for generic PID controller tuning. You can select among three different closed loop performances: Fast, Normal, or Damped. This performance parameter defines the tuning criteria automatically. The Normal option give approximately an asymtotically stable closed loop performance. For the experienced engineering, each individual criteria can be manually adjusted. The main tuning algorithm is designated Dominante Pole Placement Method extended with Robustness Criteria, DPPM-RC. This advanced tuning algorithm is useful due to the exact description of the process provided by AdvaControl Loop Tuner for Windows. Other tuning methods are available and automatically selected by the STG, if needed. The tuning validation makes use of heuristical knowledge embedded in a Rule Based Tuning Algorithm. PID controller as PIDCON, PIDCONA or AMPL based PI controllers can be tuned via AdvaControl Loop Tuner for Windows.

Feedforward controller tuning utilizes a special form of the DPPM technique.

As a bonus extension, the Novatune controller is made available for use in the feedback loop structure form.

Process Analysis and Statistics

Process analysis will give an alternative to the more direct process model identification done via the SIG. Three different technologies are available, that is, Statistics, FFT, and Correlation. The statistical parameters representing various type of clustering such as: average, standard deviations, variance, median, kurtosis, etc. and are presented in a template window.

Via the Fast Fourier Transform, FFT, technology different type of frequency oriented analysis can be displayed. The Power spectrum analysis extended with the ability to remove the influence of only collecting a finite number of samples is also available.

Presentations of Auto- and Cross Correlation analysis can be used for different purposes. It can indicate if a minimum variance control has been achieved as well as to get an estimate of the process dead-time. Cross correlation is useful for finding how, and if, the dependent and the independent variable depend on each other.

2.8.3 Computer Requirements

- 486 CPU with math-coprocessor, 8MB Ram, 200MB disk
- 1 parallel and 1 serial port
- 1 floppy disk 1.44 MB
- 640x480 color monitor
- Windows 3.1 or higher

Additional requirements for on-line data acquisition:

Using EXCOM for data acquisition requires that the EXCOM protocol is available in the OCS system.

The use of DDE servers for data acquisition requires that a server is available and that it is supported. Integrated in AdvaControl Loop Tuner for Windows is a generic DDE server support. This means, a DDE server that the Windows Excel application can utilize is also useful for AdvaControl Loop Tuner for Windows. The AdvaInform DDE Server for AF 100 and GCOM is handled via the generic DDE Server support part. The MOD 300 DDE Server is supported specifically.

2.8.4 Order and Delivery

The order number for this product is 3BSC 690003R1.

The delivery includes:

- User’s manual
- Extensive Training Manual
- Cable for serial communication
- Floppy disk with compressed data
- Automatic Window installation program
- Hardkey protection.

2.8.5 Upgrade from DCS Tuner Product

Upgrades from the previous product designated DCS Tuner is handled via the Service organization.

2.9 Batch Software

The Advant OCS with MOD 300 Software provides standard features to meet the varying needs of batch processing applications. Depending upon the complexity of the process and size of the system, an optimal processing solution may be implemented by using either a Taylor Control Language (TCL) based application or Batch 300.

TCL based applications may be used for any batch application but are best suited for simple batch processes and for small systems. The unit relativity feature of the system allows sequences, graphics and reports to be written in a generic manner such that they may be reused on any similar unit without modification. This provides reduced engineering, debugging and maintenance time. In addition, application solutions may be based upon a previously developed and reusable ‘Flexible Batching’ Shell of TCL application code.

Batch 300 which is based upon the work of the SP88 committee and NAMUR guidelines, goes beyond traditional batch process control. It provides configurable Recipe Management, Production Scheduling, Process Management, Unit Supervision, and Production Information Management as standard features. It is a configurable layer above the modular TCL sequences which drive the process.

Batch 300 is best suited for batch processing applications which have a large variety of end products, varying procedures for manufacture of products, numerous product changeovers, dynamic equipment allocation and/or variable equipment routing.

2.9.1 Batch Control with Taylor Control Language

The Advant OCS with MOD 300 Software provides a real-time, high-level programming language for process control called the Taylor Control Language. The TCL software package includes development and runtime support facilities for developing and implementing custom programs. These programs or sequences run in conjunction with the Configurable Control Function software and the Taylor Ladder Logic software. Typical applications for TCL programs include:

- Sequential/batch control
- Complex arithmetic and logic functions
- Supervisory tasks such as startups and shutdowns
- Serial interfaces to third party equipment

TCL is a structured programming language modeled after Pascal. It includes many block programming structures such as compound statements, IF...THEN...ELSE statements, etc. In addition, TCL has unique programming structures that are specifically designed for process control and Advant OCS applications. The use of English-like key works and the specially designed programming structures allow users with relatively little programming experience to develop custom program for process control. Refer to Section 2.2 for further details of Taylor Control Language.

2.9.2 Batch 300

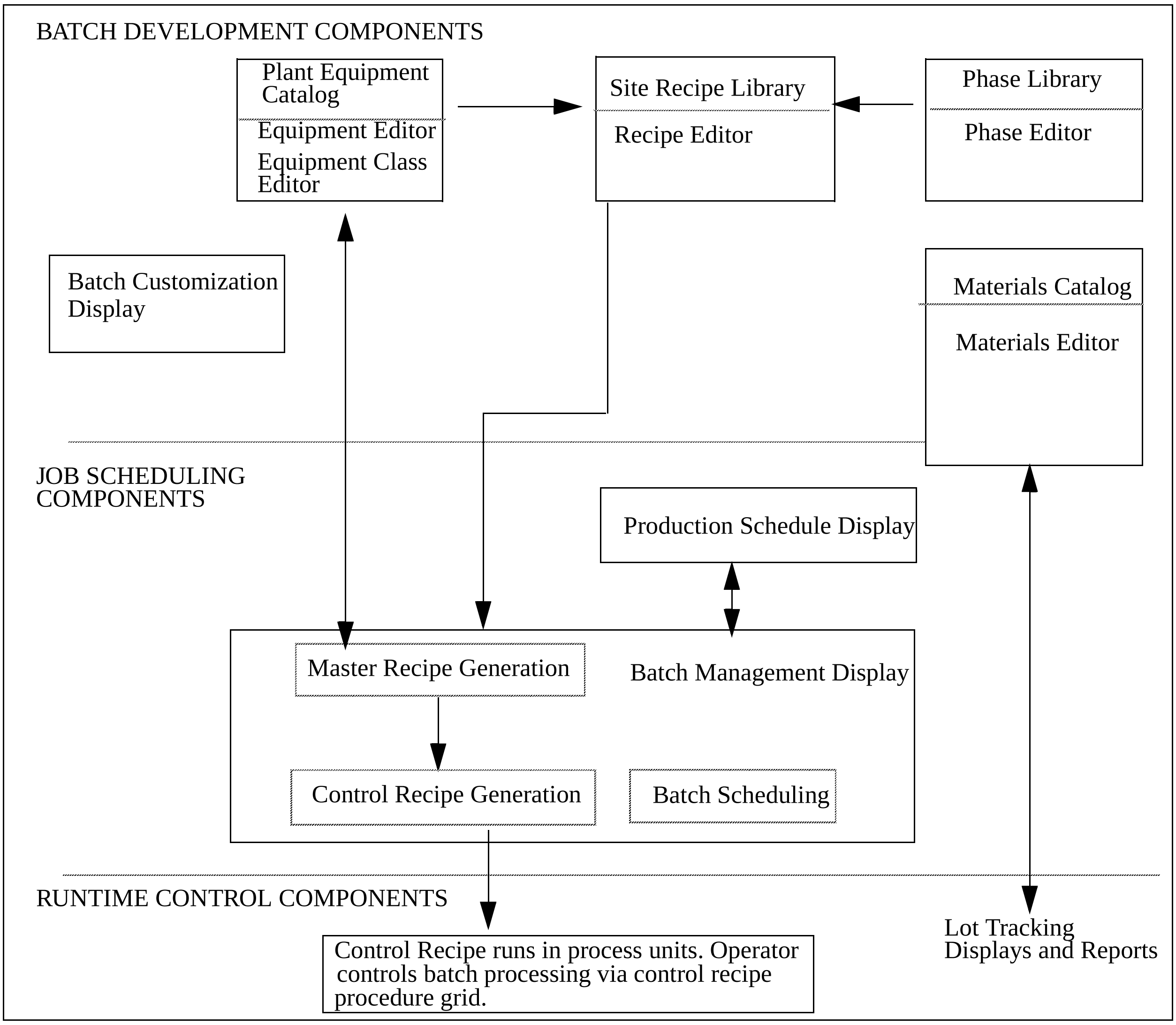


Figure 2-60. Batch 300 Components

The Batch 300 package is an integrated package that requires no special hardware for displays or control. The control software will run in the Advant Batch Station and Advant Controllers and works with any amount or type of I/O.

The Batch 300 package is based on the work of the Instrument Society of America (ISA) SP88 batch standard committee. This committee defines machine-independent solid approaches for designing and executing batch control strategies. In the same vein, Batch 300 follows the guidelines as set out by NAMUR.

The Batch 300 package configuration displays utilize easy-to-use pick lists and fill-in-the-blank formats. Batch 300's structure assures easy-to-modify and maintain batch project implementation. TCL modules, called phases, are used for sequential control of the process.

Batches are produced by using process modules and equipment classes that are standardized and pretested. Product variations are easily implemented and may include formulation, equipment or procedure changes in the recipe.

2.9.2.1 Recipe Management

The central part of the Batch 300 is its set of recipes. A recipe is basically a file with instructions for executing a batch. Among the information in a recipe are the names and processing order of references to TCL programs that execute the batch, formula variables used by the programs and the names (or characteristics) of the plant equipment (units) for the batch.

The developing ISA SP88 Batch Control standard work and NAMUR recommendations have been used as basis for the structure and nomenclature of the Batch 300 recipes. Three levels of recipe are provided:

Site

These recipes generally do not specify actual items of plant equipment, but refer to equipment requirements in terms of the class, subclass and characteristics described in the Resource Management section. However, the user does have the option to specify actual items of equipment. This would be the case, for example, if only one particular type of equipment item existed on the plant.

Site recipes are accessed via the Site Recipe Library display from which recipes can either be created or edited by the user.

Master

These recipes are specific to a job or order, and are generated from the Site Recipe by Recipe Management resolving equipment described by class and subclass characteristics into actual plant equipment. There may be several alternative equipment items that meet the process requirements for a particular logical unit. In this case the user has the option of making the final selection or allowing the system to make the selection based on the current availability of equipment.

The user may edit the master recipe, in which case any changes made are specific to the job.

Control

These are specific to a batch within a job and start off as copies of the master recipe. The user may request a control recipe to be generated manually in order to perform edits for a particular batch before it is actually started, perhaps because of some planned maintenance on site; or the system will generate them and run them automatically. Control recipes can be edited by the user during batch execution (run-time changes).

Any of the recipe types may be saved and stored on external medium. Control recipes may be saved as a record of how a particular batch was produced, where master recipes would be on a job basis. These recipes may be edited and can form the basis of new Site recipes. Site recipes may be modified and used repeatedly as new job orders are received for the same product.

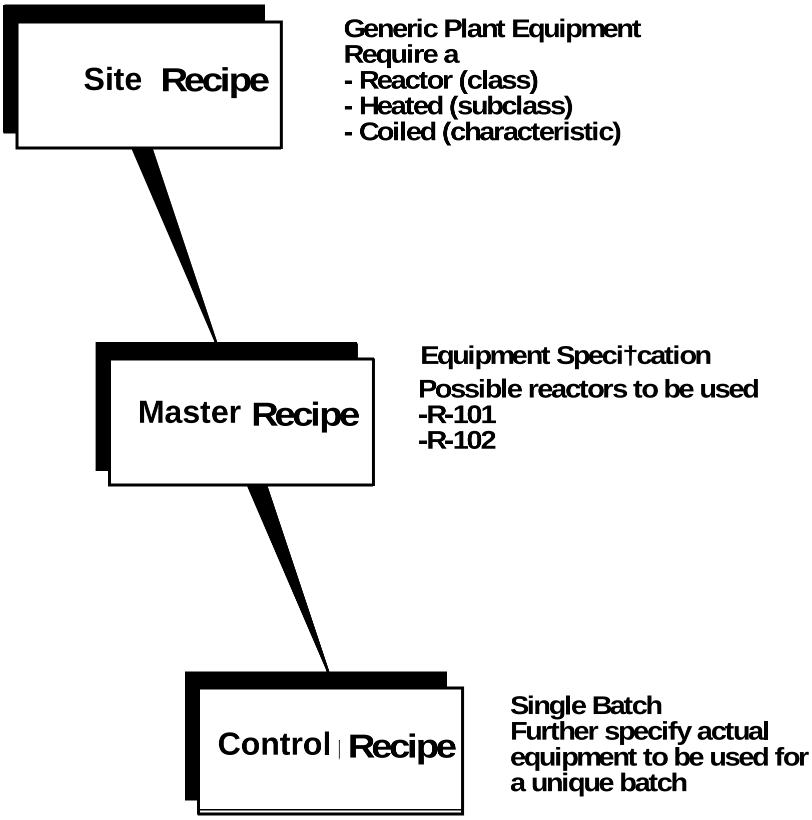


Figure 2-61. Recipe Transformation Example

RECIPE STRUCTURE

Each of the above recipe types share a common structure which has five sections:

- Header
- Equipment
- Procedure
- Formula
- Recording

Header section

This contains recipe identification (ID), anticipated batch yield, a record of recipe versions, and various user defined descriptor fields such as product name, and product code. This section is similar for all three types of recipe. Site recipes are identified by recipe ID as where Master recipes are identified by job ID and Control recipes by batch ID.

Equipment Section

Site Recipe - User named logical units, e.g. unit-1, are listed. Logical units are so called because the actual process unit to be used may not be known at this stage. Against each logical unit is specified the class, subclasses and associated characteristics, that are required by the process (these would have been defined in the Equipment Class Library). The user may specify actual process units, and alternatives, at this stage if desired.

For each characteristic, a value and test operator is entered that specifies the requirement for the particular process, e.g. volume > 1000 gals. Other qualifications relating to process unit usage may be entered, e.g... ‘job duration booking’ or ‘must book to start’.

Master Recipe - The equipment section is similar to that of the Site recipe except that each logical unit is resolved into actual plant equipment plus any alternatives. The only qualifiers remaining are those associated with process unit usage, such as ‘must book to start’.

Control Recipe - Identical to the Master recipe unless it has been edited for a specific batch.

Procedure Section

The procedure section contains information about the required phases (sequencing actions) to be used on the process units. In completing the procedure section the Phase Library may be used to select phases. The Phase Library contains a list of phase names such as ‘FILL’, ‘HEAT’ etc. The phases are generic, that is to say, the actual TCL sequence executed depends on the process unit that is used. For example, ‘HEAT’ used on process unit Reactor 2104, which has a steam coil, may use a different TCL program to that used on Reactor 2105, which has a hot oil jacket. Thus, for each generic phase listed in the Phase Library there is a corresponding list of appropriate process units, each associated with a TCL sequence.

There are no significant differences in the procedure section between Site, Master, and Control recipes.

Formula Section

This section contains variables that can be accessed by any phase using their item ID. Variables fall into the following headings:

Inputs - normally the ingredients of the recipe i.e. the material quantities.

Outputs - normally the intermediate or final product quantities of the process, written to by the phases.

Process variables - could be used to pass common data between phases, e.g. flags.

There are no significant differences in the formula section between Site, Master, and Control recipes.

Recording Section

This section records historical data for use in archiving, reports, and for exporting to external devices for further analysis. It specifies the type of reports to be generated for the job and its batches. It also allows you to specify some of the variables to appear on the reports.

Figure 2-62. Procedure Grid

2.9.2.2 Process Management

The production schedule allows the user to queue a job for execution. Jobs appear in time order, with the job that is due to start first appearing on top of the list. Jobs to be scheduled contain:

- Job ID
- Recipe ID
- Job goal
- Number of batches
- Job state
- Job start time.

The task of Process Management is to execute those jobs listed on the schedule. A Master recipe must be created for each job. Process Management requests Recipe Management to create a Master recipe from the Site recipe. Most entries on the Production Schedule are accessible to an external computer for both read and write purposes. This enables Batch 300 to interface with scheduling packages running on external computers.

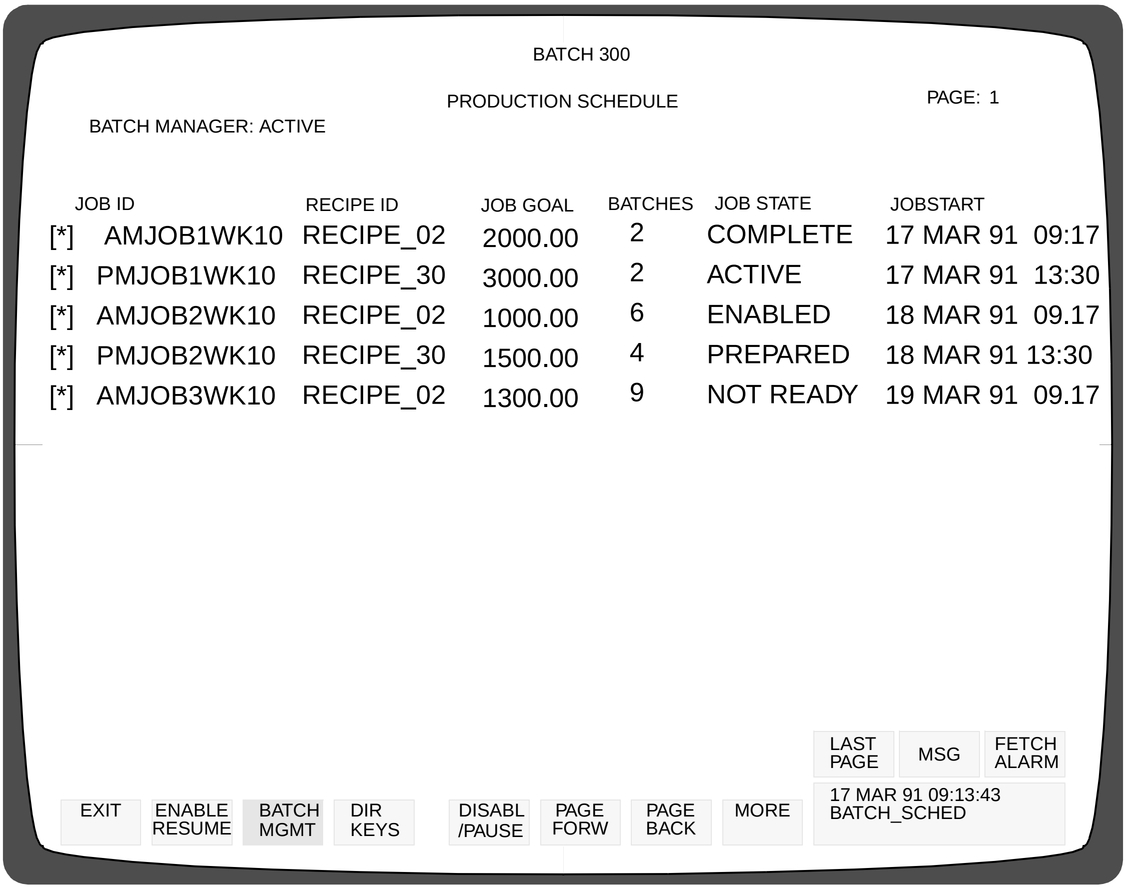


Figure 2-63. Production Schedule Display

Batch plants rely on Resource Management to keep track of equipment availability, enable correct use of equipment in terms of the process requirements, and to monitor material inventory. To achieve this, Resource Management provides standard displays to create, edit and monitor the following:

Equipment Class Library - This allows the user to describe the plant equipment according to various categories.

Classes- indicate the broad type of equipment, for example, reactor, filter, drier, etc. A list of classes pertinent to the user’s plant needs to be generated by the user.

Subclasses- these modify the class, for example, jacketed, coil, agitated, etc. An item of equipment may be described by several subclasses.

Characteristics - associated with each class or subclass, will be a number of characteristics. For example, material: glass lined, volume: 500 gals, max allowable pressure: 20 bar abs, design temp: 200° C, etc.

Plant Equipment Library - This allows the user to compile a list of site plant equipment described in terms of the data structures defined in the Equipment Class Library. Thus, the user might describe vessel R2401 by selecting the reactor class with subclasses jacketed and agitated. Reactor R2401 will inherit the characteristics that are defined for the reactor class along with the jacketed and agitated subclass characteristics. If inappropriate, characteristics may be modified for specific items of plant equipment.

Materials Library - This is used to create a material inventory which can indicate the stock levels of materials. Inventory data can be updated manually or by user written TCL sequences, e.g. ‘charge’ phases that may be run during batch execution.

There is an on-line lot tracking package included with the Batch 300 package. This package provides both forward and backward lot tracking. Forward lot tracking provides a list of all batches which used a particular lot of material. Backward lot tracking provides a list of all the materials and lot IDs used for a particular job.

Materials Handling - It provides the means for:

- storing and retrieving data related to material usage.
- archiving, printing, and deleting materials handling files.
- lot tracking.

Two levels of functionality are provided for Materials Handling through a Basic Package and an Enhanced Package

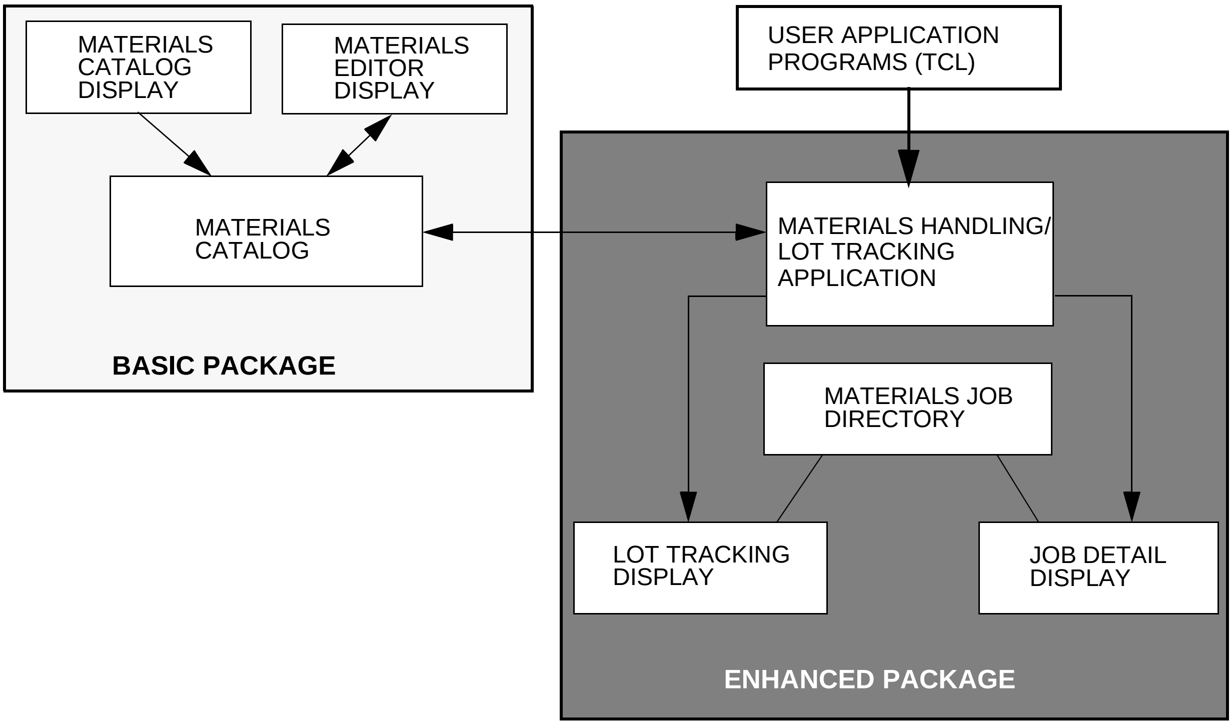


Figure 2-64. Materials Handling Overview

The Basic Package is fully integrated into the Batch 300 software. This package provides the means for establishing a catalog of materials that your process uses, and for manually updating the catalog as materials are used in the process. This functionality is supported by the Materials Catalog and Materials Editor displays.

The Enhanced Package consists of TCL sequences, interactive graphic displays, and reports (collectively referred to as Materials Handling/Lot Tracking Application) that support automated methods for storage, viewing, printing, updating, and handling of materials data files. The Enhanced Package is provided on a separate set of diskettes. You can load this package if your application requires the enhanced functionality.

Unit Management

Unit Supervisor gives operators and production management easy access to and control of batch production. Unit Supervisor coordinates the control actions on a set of equipment (unit). The grid, which forms the procedure section of a recipe, depicts the process units that are required for the batch. Each process unit shown on the grid has a Unit Supervisor which controls the sequence of phases that take place on that process unit.

It is the Control recipe that is executed when a batch is initiated. The Unit Managers control the execution of the grid, they provide a means for the user to oversee and interact with the sequence phases as the batch progresses, and they provide information to Batch Management and the Report /Recording facility.

There are three modes of batch operation: auto, semi-auto and manual.

Operator Interface

The Control recipe is updated with run time information when a batch is in progress. The grid section of the Control recipe indicates the state of phases, e.g. Active, Inactive, Complete, etc. by highlighting the phase on the display as appropriate.

The user can create custom graphics which contain batch information e.g. Job ID, Batch ID, Recipe ID, etc. Additional data could be obtained by TCL access to the recipe. A batch faceplate with batch information, is available that may be used on custom graphics. It can also provide a page link to the grid section of the Control recipe.

Operator Control of a Phase

A phase can have several states. The user may change the state of a phase from the Control recipe grid.

Operator Control of a Batch

The user may change the state of a batch from the Process Management display.

Failure Handling

If a phase responds to some abnormal condition by processing, this information can be relayed to other active phases so they may take appropriate action if required.

Interface to Process Management

Process Management must ensure that process units are used on the basis of availability specified on the recipe e.g. ‘must book to start’, ‘job share’, ‘job duration booking’. The Unit Supervisor will inform Process Management whenever the sequence phases on its process unit are completed for that particular batch.

Interface to Report/Recording

A TCL batch file is created at the start of each batch if Batch Recording is requested. Each Unit Supervisor will place information about selected grid items into this file.

2.9.2.3 Batch Execution Displays

When your system is equipped with an Advant operator workplace, you can use the following AdvaCommand batch execution displays to monitor and control batch execution.

Equipment Overview Display - This display provides a quick summary of the batch tasks and the equipment running in the plant. The functionality of this display is similar to the Equipment Catalog Display. The Equipment Catalog Display may also be used as a “home base” display for operators since it provides direct access to more detailed batch and unit information.

Batch Detail Display - This display focuses on a single batch and presents information concerning the loaded units in the batch.

Unit Supervisor Display - This display presents some of the unit procedure information provided on a Control Recipe Grid. It is associated with a particular TCL unit.

The advantages of the AdvaCommand-based Batch Execution displays are as follows:

- They follow OSF Motif standards and so have the common look and feel of other AdvaCommand displays.
- They do not rely on the disk in the Batch 300 node for information. Therefore these displays are operational even when the Batch 300 node is not.

Control functions for the Batch Execution displays are actually carried out via dialogs which are accessed via the Batch Execution displays. Batch Execution displays may be selected from the operator workplace Display menu. In addition, the displays may be accessed as either overlapping windows or new base displays from references built into custom graphics or function keys. References between the three displays may be accomplished by these means; no pre-defined links are imbedded in the displays.

Through the Batch Execution displays, the operator can manipulate the process via seven control dialogs:

- Equipment Control - provides the means to monitor and change the equipment state for a unit.
- Batch Control - provides the means to control state and mode of the selected batch. This display also provides a the ability to manipulate equipment availability after the batch has been shut down.
- Unit Supervisor Control - provides the means to control and monitor the state, status, and mode of a selected unit.
- Phase Control - provides the means to manipulate the mode and state of a phase in the recipe.
- Phase Parameter - enables the user to modify the phase parameter values.
- Phase Dependency - provides information on the dependency status of a given phase and allows the dependencies to be modified.
- Unit Comment - allows the user to enter a text comment related to the processing unit. (requires PDL in the information management workplace)

So that you can view separate groups of batch information on one screen, you can request multiple versions of each display (Equipment Overview, Batch Detail, and/or Unit Supervisor) on a single screen at the same time.

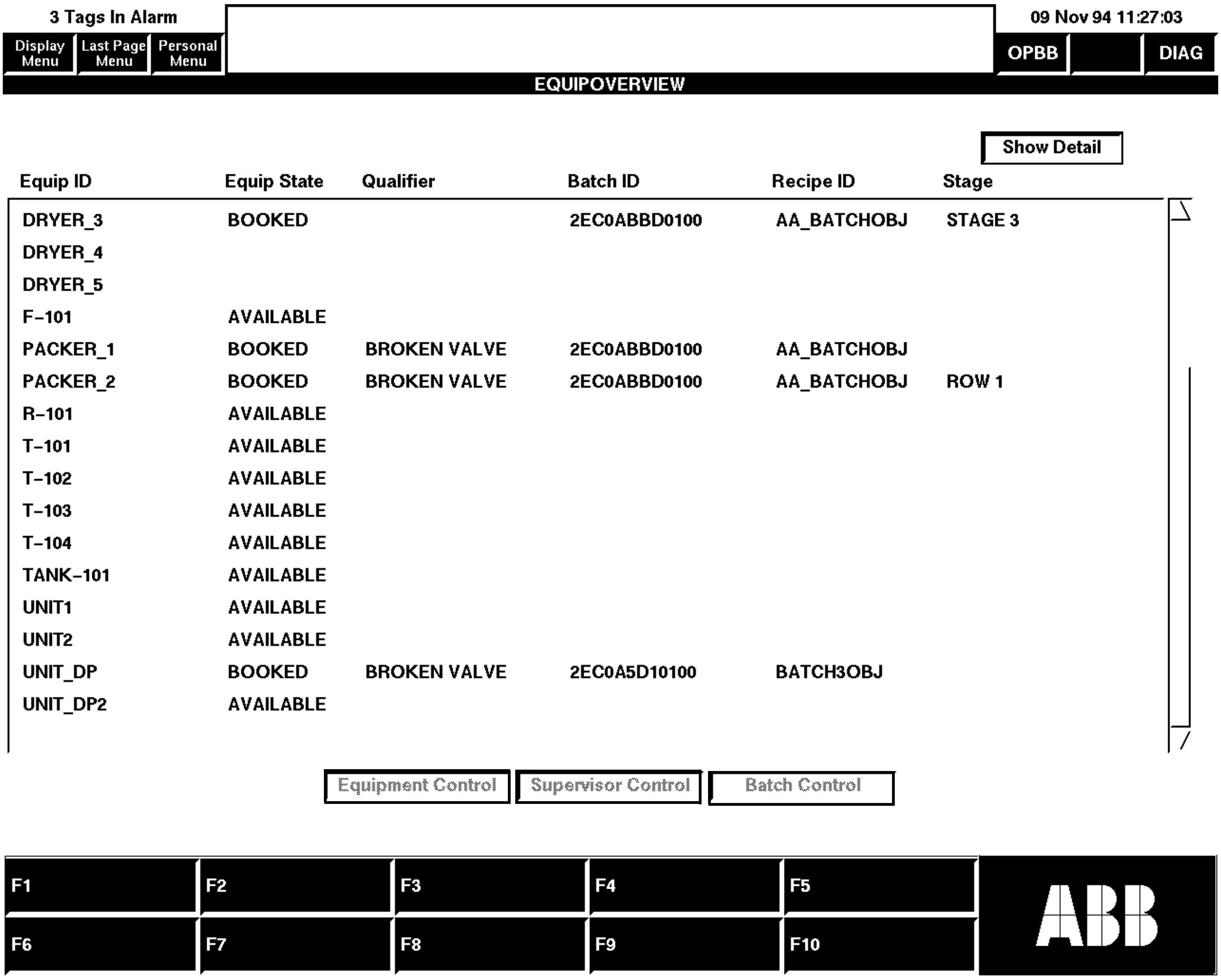


Figure 2-65. Equipment Overview Display

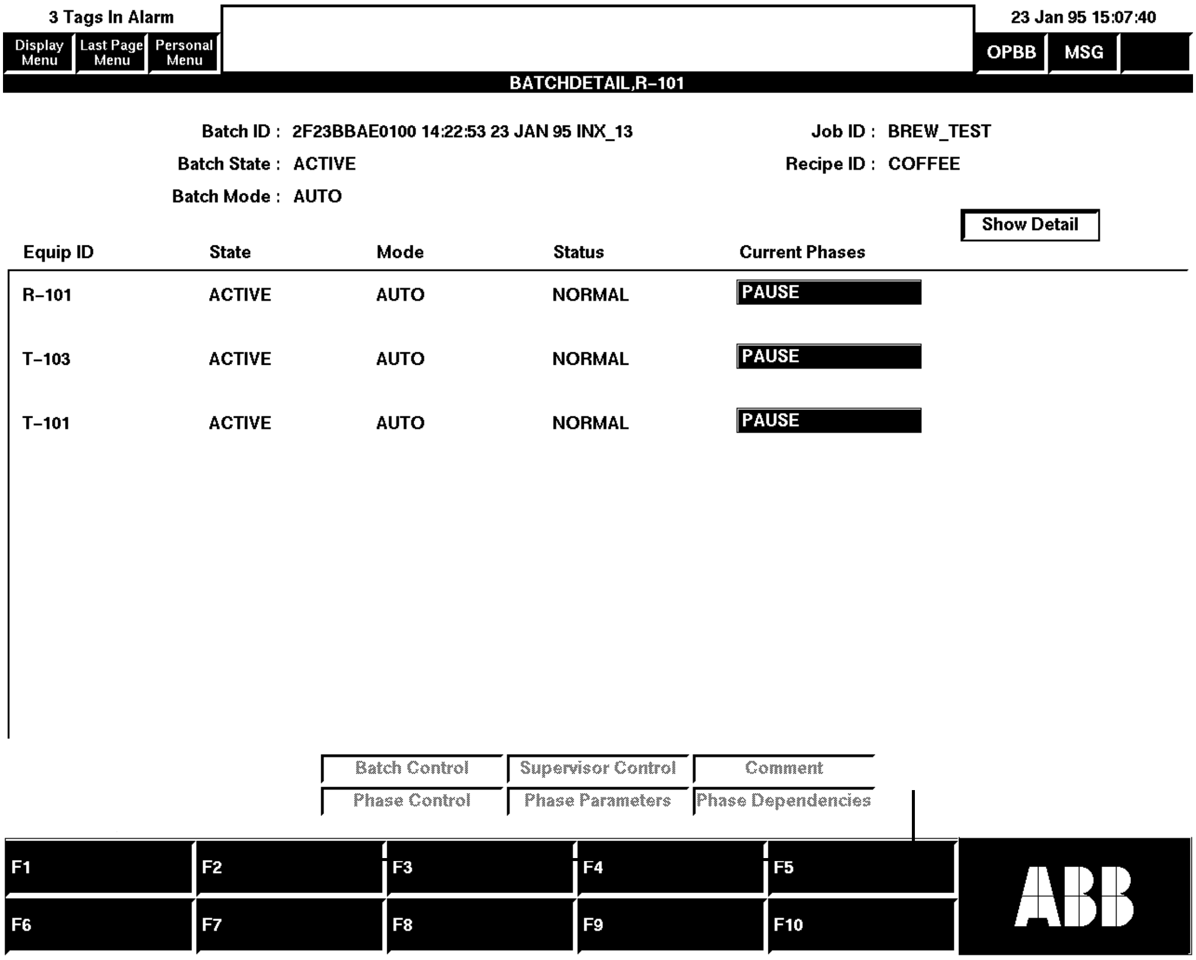


Figure 2-66. Batch Detail Display

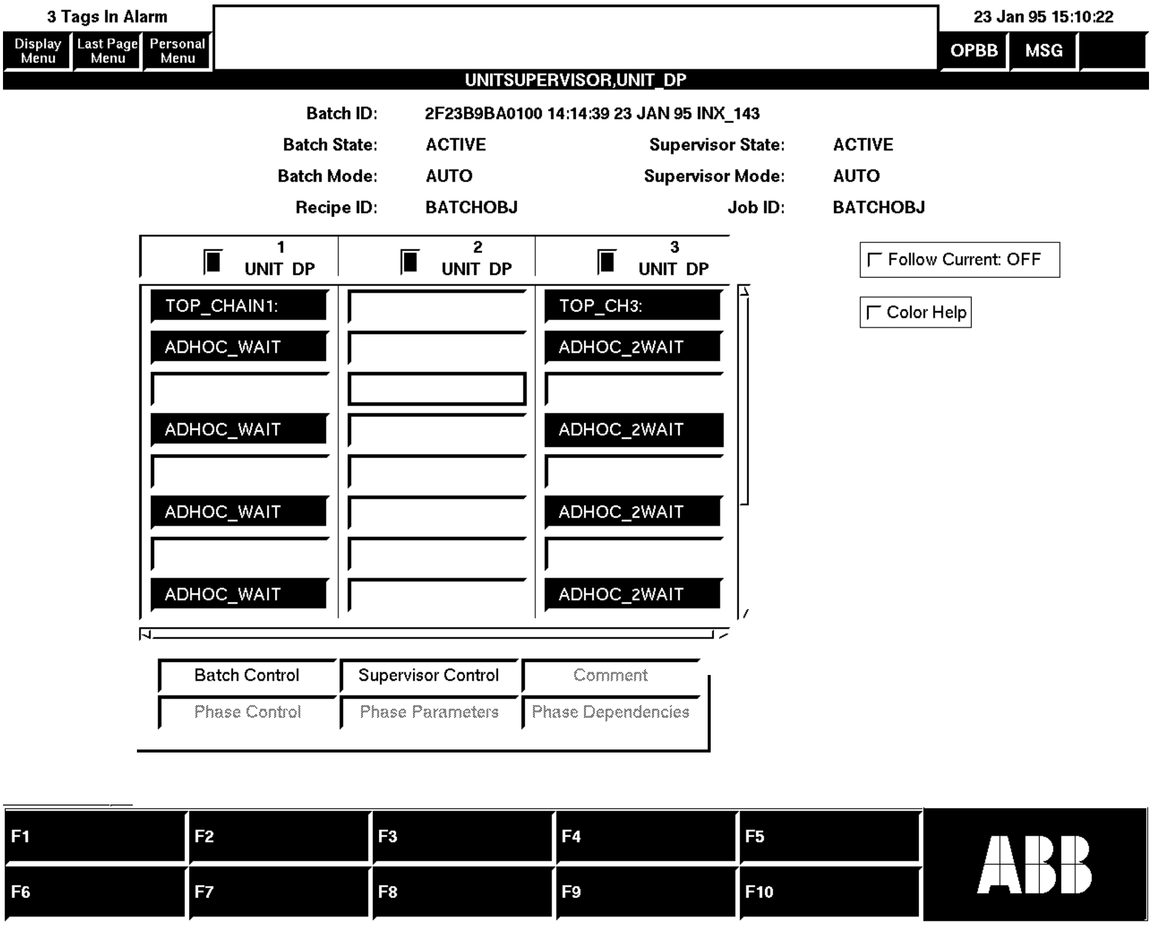


Figure 2-67. Unit Supervisor Display

2.9.2.4 Batch Recording/Reporting

Batch data, both solicited and unsolicited, is generated during each batch. Solicited data includes such items as actual quantities, times, temperatures etc. Unsolicited data includes alarms and events and billboard messages. This data can be recorded automatically by the History package. Other unsolicited data such as phase start times and equipment usage is generated during the phase execution. All of this data is available for inclusion in batch reports. Data may be extracted from the History package on a batch basis.

•Batch summary report

•Batch trace report

•Job report

•Production report

•Material consumption report

•Forward and backward lot tracking

A facility also exists for exporting recorded data to external devices for further analysis.

BATCH REPORT 28 NOV 94 19:35

BATCH IDENTIFIERBATCH2_AMJOB1WK10

JOB IDENTIFIERAMJOB1WK10

Variable Values

BATCH START26 NOV 94 14:09

BATCH END   26 NOV 94 19:30

Equipment Trace

Parameter Trace

EQUIPMENT	DESCRIPTION	VALUE AND UNITS	
*R-1010	BOOKING		26 NOV 94 14:44
*R-1020	JOB SHARE BOOK		26 NOV 94 14:45
*R-1010	CHECK ( )	4 PARAMETERS	26 NOV 94 15:03
	DOSING RATE	5.00 KG/S	26 NOV 94 15:03
	MAX STIR SPEED	98 RPM	26 NOV 94 15:03
	AVG STIR SPEED	90 RPM	26 NOV 94 15:03
	AVERAGE TEMP	120 DEGC	26 NOV 94 15:03
*R-1020	CHECK ( )	4 PARAMETERS	26 NOV 94 15:35
	DOSING RATE	4.00 KG/S	26 NOV 94 15:35
	MAX STIR SPEED	80 RPM	26 NOV 94 15:36
	AVG STIR SPEED	55 RPM	26 NOV 94 15:36
	AVERAGE TEMP	120 DEGC	26 NOV 94 15:36

BATCH ALARM EVENT MESSAGES

26 NOV 94 14:04	*****BATCH CONTROL STATION START*****
26 NOV 94 14:20	AVE TEMP H1P1 TA5353 MANUALLY ADJUSTED

Figure 2-68. Batch Report Example

If your system includes an information management workplace, Batch 300 can send data to the Production Data Log which will store the task, variable, resource, and history information and provide a means to execute batch reports on Advant operator workplaces (refer to AdvaInform History - Chapter 5).

2.10 System Communications

The design of the communications system for the Advant OCS with MOD 300 Software is aimed at facilitating the transmission of data between process control and information devices. High levels of security and reliability are also crucial to the design. Within the system, different management and control devices must all abide by certain rules or standards in order to communicate effectively. The system provides standard protocols and interfaces as the primary means of communication within and among the dissimilar devices.

The design approach calls for a layered structure of independent communications functions. In this structure, subfunctions which are closely related are grouped together to form a layer. Each layer functions is designed separately and is relatively independent of the other layers. The layers are then arranged in a logical hierarchy, and are integrated to provide a total set of services in a comprehensive communication system.

2.10.1 Distributed Communications Network (DCN)

The basic structure of the Advant OCS with MOD 300 Software is a “backbone” ring, known as the Distributed Communications Network (DCN), with various subnetworks connected to it, and gateways allowing connection to other vendors’ equipment (such as Programmable Controllers and host computers). The fact that it has been designed using available models and standards set by the ISO and IEEE is significant. It means that the system is capable of embracing existing installations and proprietary networks as well as encompassing future developments in networking standards. This allows the matching of capabilities and costs with the control and information requirements of process plants.

Each subsystem provides the functional elements and supporting operations for a portion of the overall plant control and management scheme. The DCN is the communications medium which allows the functional and geographical distribution of these subsystems.

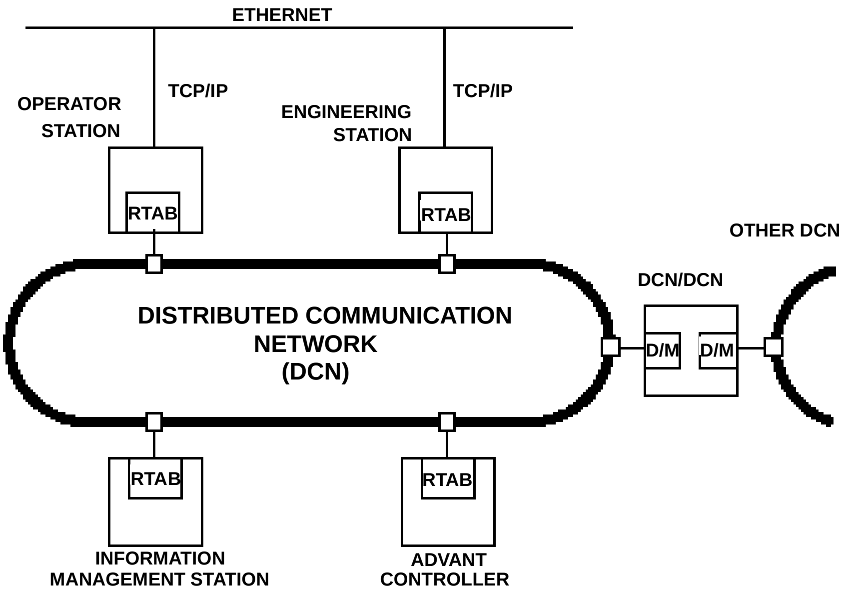


Figure 2-69. Typical DCN Ring Structure

Token Passing Ring

The method of access control for the Advant OCS is based on IEEE 802.5 token-passing ring. This involves the circulation of a special bit pattern, called the token, around the ring. A node gains access to the ring (or communication path) when, and only when, it possesses the token. The node may then transmit its messages. Conflict between two or more nodes wishing to transmit at the same time is eliminated. Destination of the message will be specified, and each node on the ring will check the message being passed to verify whether or not it is addressed to them. When the transmission is finished, it passes the token on to the next node. Transmission is limited to one message of a maximum specified length, and the token must be handled by all nodes in sequence around the ring to complete the cycle. In this manner, each node is guaranteed the opportunity to transmit once each cycle.

2.10.1.1 Physical Structure

The DCN is made of up communications devices called nodes, and communication paths between the nodes called links. The ring-style topology permits more effective implementation of critical network control strategies.

The DCN is a ring-type network around which messages travel from node to node. Physically, it is either a twin-axial or fiber optic cable interconnecting the nodes.

The dual DCN functions simultaneously and provides parallel communications paths for data travelling through the system. The use of this dual ring can improve average response time by as much as 50%. In addition, it provides a high degree of security, as a failure of one of the cables causes the remaining one to automatically assume full service, with switchover time being virtually nonexistent.

2.10.1.2 Message Routing

With the existence of the dual DCN rings, it would seem that a decision must be made as to which DCN will be used for transmission of a particular message. In the system, bus selection for message transmission is an internal function of the communication system and it totally transparent both to the human operator and the Application Programs (APs, any program which is a direct user of the communications system, such as TCL or Display Builder packages). Because this is a software function and not hardware dependent, it affords an additional measure of security should one of the cables be obliged to assume full service upon failure of the other.

The Network layer of the communications protocol is responsible for deciding which DCN media will be used for a given message. If both paths are possible, then the communications load is split by alternating messages on one media, then the other. If one path is not available, then the Network layer must send the message on the path that is still valid. The Network layer remembers which nodes are available on which paths through the use of a Population Table.

2.10.1.3 Population Table

Every two seconds each node in the system generates a short message that tells other nodes that it is functioning on a particular DCN media. Each node receives this message, and remembers which nodes are active. This information is collected and maintained for each of the DCN cables that the node is connected to.

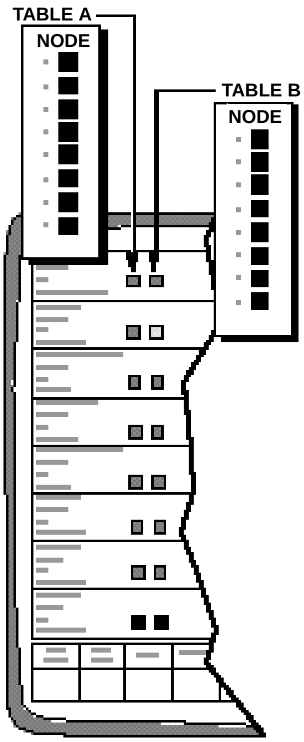


Figure 2-70. System Status Display with Population Tables

One of the uses for this population table is to generate the status information for the System Status Display. The Status Display shows all configured nodes, their status, and the status of each of the two DCN media. This provides the user with a dynamic view of the communications system’s status, as well as a way to get more detailed information about any particular node.

The preceding figure shows two tables, Labeled A and B. These two tables indicate which nodes have reported in with status information recently. Nodes that are unavailable are indicated in the diagram by an empty square. Active nodes are indicated with a filled in square. On the actual System Status display active paths are shown in green and inactive or unavailable paths are shown in red.

The following figure shows a three node system and the various population tables. A fault is shown with the connection from Node 3 to Media B. Note how this fault is indicated in the three different population tables for Media B. Node 3 shows that it is able to communicate with itself, but no other nodes. Both of the other nodes are able to communicate with each other (1 and 2), but show Node 3 unavailable on Media B.

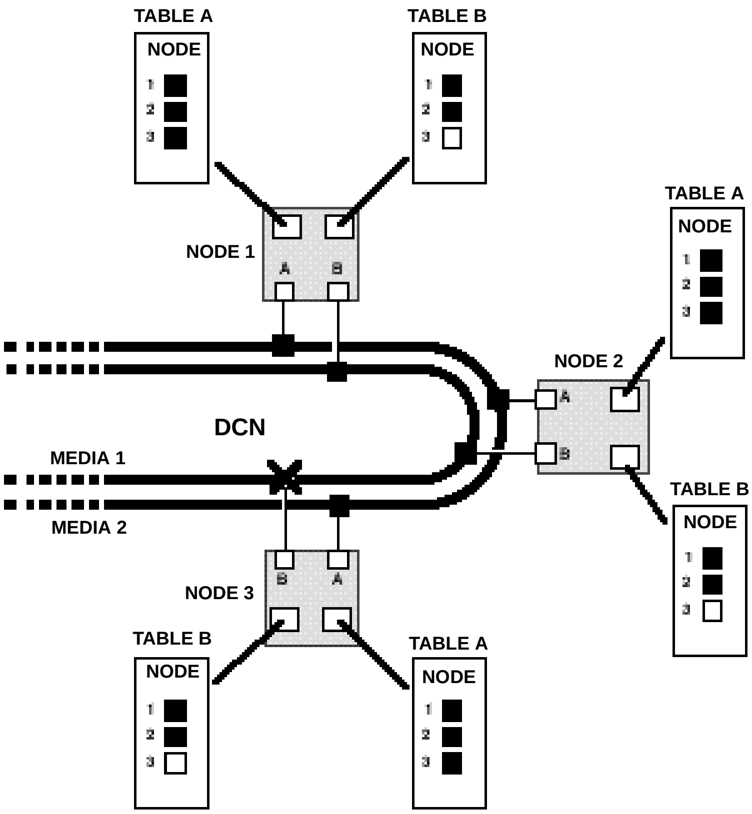


Figure 2-71. Population Tables Showing a Communication Fault

The primary purpose of the population tables is to enable the communications software to isolate and avoid problems in the physical connections between nodes. The Network layer, with its responsibility for message routing, maintains and uses this function. If a message was sent from Node 1 to Node 3 then the Network layer of Node 1 would choose to send the message on Media A. Media A is the only available path between these two nodes. A message from Node 1 to Node 2 could take either path, and the load would be split between the two media.

It is critical to note that all of the routing decisions occur automatically, without operator or application program intervention. If it is possible to send the message, then the communications system will take one of the available paths. If it is not possible, then the operator or application program is notified that the message was not sent, or the proper response was not received.

2.10.1.4 Communications Protocol

Messages are passed around the DCN using the token-passing protocol with each node acting on messages bearing its particular address. Each node is responsible for recognizing its own address and accepting only messages addressed to it. When a message goes out onto the ring, it is seen by all nodes at essentially the same time. The node originating the transmission removes the message from the ring when a complete cycle has been made. Every node is guaranteed access once per cycle by limiting the number of messages to one per token possession, and the message length to 2048 bytes.

The transfer of information (as a message composed of data bits) involves a series of coordinated activities and functions, the collection of which makes up a communication "service." Each communication service provides a different class or level of activities, but all use the same means by which data is actually transferred between the user AP and the communication system. In general, a data transfer is initiated by an originating user AP via the issuance of a data transfer request to the communication system. The user AP completes the data transfer process via issuance of a data receive request. The destination user AP inquires about the availability of incoming data and read the data if available. The communication system is set up to signal the user AP of the availability of incoming data. There are three basic types of data transfer services: Inform, Notify and Petition. Each class involves a different amount of service overhead or burden (number of transmissions and log entries) on the communication system. The user is able to select the type of service best suited for the level that the application demands, while minimizing the burden on the communications systems.

2.10.1.5 Multiple Ring Topology

The ability to interconnect two or more DCN rings makes it practical to have very large systems. Because the multiple ring structure does not imply any hierarchy (that is, no one ring has higher communication priority than any other), the choice of how many rings to use and which nodes should reside on each may be made on virtually any logical basis, such as:

- Geographic (various plant or process areas)
- Functional (groups of similar processes, unit train operations)
- Control system geographics (control room and process)
- System performance (localize high density traffic to improve access or response time)
- Fault tolerance (segment to localize fault impact)

This high degree of flexibility is possible due to the nature of the communications system. No matter how the rings are interconnected, the entire network appears to the users and APs as a single logical ring.

A typical example of multiple ring topology is shown in the following figure using a DCN-to-DCN interface. A condition of this interconnection is that once a media has been selected, there cannot be two paths. This eliminates the need for a means of path selection and its associated overhead. Availability is increased by the use of dual DCN rings and dual DCN-to-DCN.

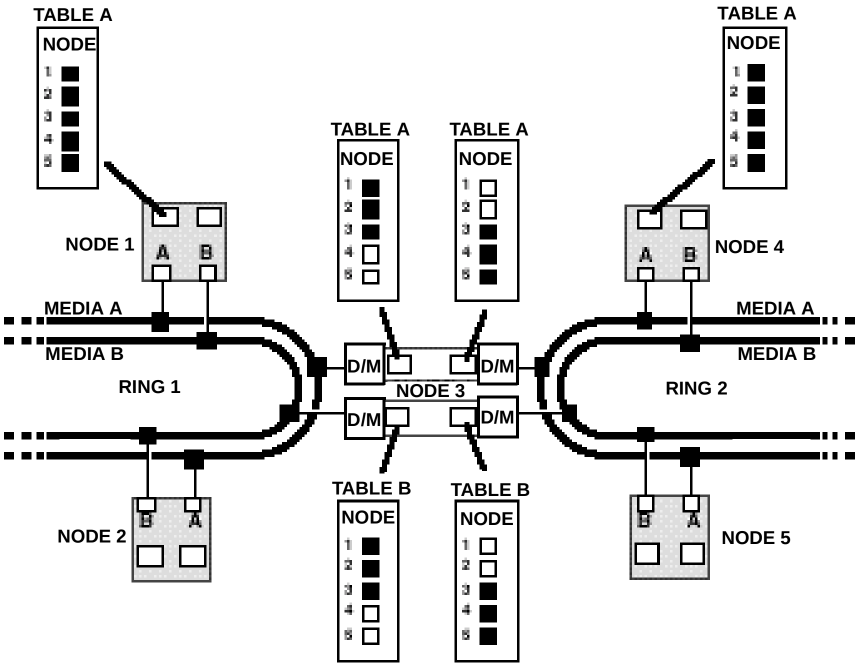


Figure 2-72. DCN-to-DCN Interface

The DCN-to-DCN interface fully supports the communications software of the system and provides message routing service between rings. This means that any node on any ring can send a message to any node on any other ring. The interface also provides time domain isolation; that is, the various rings operate independently and non-synchronously.

The functionality of the population table is used to determine when a message needs to be repeated to the “other side”, and when it does not. The multibus-based DCN-to-DCN interface has a D/M module for each ring, for each media. A normal interface would have four D/M modules, as shown in he diagram. There is a population table for Ring 1, Media A and one for Ring 2, Media A. The table associated with Ring 1 indicates all nodes that are active on that ring, including the DCN-to-DCN interface. The table associated with Ring 2 has all nodes active on the second ring. The only device that is aware that there is more than one ring present is the interface itself. All other nodes can not distinguish between the two sides.

When the various nodes transmit their status messages to indicate they are functioning, the DCN-to-DCN interface is able to note which message came from which side. The status messages are collected in the DCN-to-DCN interface and transmitted in a single message on to the opposite ring as a Gateway Access List.

If Node 1 sent a message to Node 5, the Network layer would determine that a path did exist, and it could actually send it on either Media A or B. The DCN-to-DCN interface would recognize that a message on Ring 1, destined for Node 5, must be repeated on Ring 2. It would make this determination since Node 5 is not present on Ring 1, but is present on Ring 2. The message would be repeated. If any reply was required from Node 5, the reverse process would take place, and Node 1 would receive the reply after it was repeated by the DCN-to-DCN interface.

This DCN-to-DCN approach is completely transparent to the user, and to application programs. It is even transparent to all communications programs with the exception of the interface itself. This approach also works whether there are two rings or twenty.

2.10.2 Control System Level Communications

The DCN together with the communications software and the Data Base Manager (DBMS) provide the means of sharing the functional and processing intelligence resident in each node, resulting in a truly distributed architecture with the capability to access information from any point in the system.

The communications software provides the services for data transfer between physical devices (nodes) across the DCN. It manages communications resources on the DCN, while the local operating system provides services to manage the local operating environment for each subsystem.

2.10.2.1 Data Base Manager

The Advant OCS with MOD 300 Software is based on a functionally and geographically distributed system architecture. The data base itself is distributed across the nodes according to functionality, performance, reliability, etc. For example, information required to scan a process variable and perform a controller function could be resident in any node, while extended plant histories for user selected process conditions would reside at the node performing the data processing function. To support real-time internode sharing of this data base, a general access mechanism is required. This is known as the Data Base Manager.

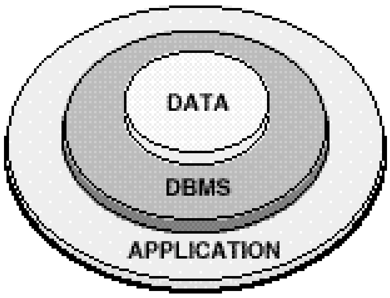


Figure 2-73. Data Base Manager Structure

The Data Base Manager is resident in every node of the system, and communicates with itself to obtain required data, regardless of where that data is stored. In other words, operators, engineers and managers need not concern themselves with data type, organization, access technique, location of the data, or whether the organization or location of the data has changed. One merely requests the information; the Data Base Manager does the rest. This is known as data independence.

The other main functions of the DBMS provide data security, data integrity, and real-time access to the data base. Data security is the protection of data against unauthorized destruction or modification. The Data Base Manager accomplishes this through the use of access or authority levels for identified users. These access levels for identified users are configurable, and may be applied to human operators as well as application processes.

Data Integrity is the maintenance of data correctness in a system where multiple users are permitted access and share the data base. The DBMS verifies the write access, consistency, and value of conditions which must be satisfied before a request is filled.

The DBMS is also responsible for knowing where in the system the requested data reside. If it is located in another node, the request is passed to the portion of the DBMS resident in that node. If on receiving a request the local DBMS does not know where the information is located, it searches through the system nodes until it finds where the data resides. This location information is then stored locally for future reference. This minimizes run-time overhead and helps to provide real-time access to system information.

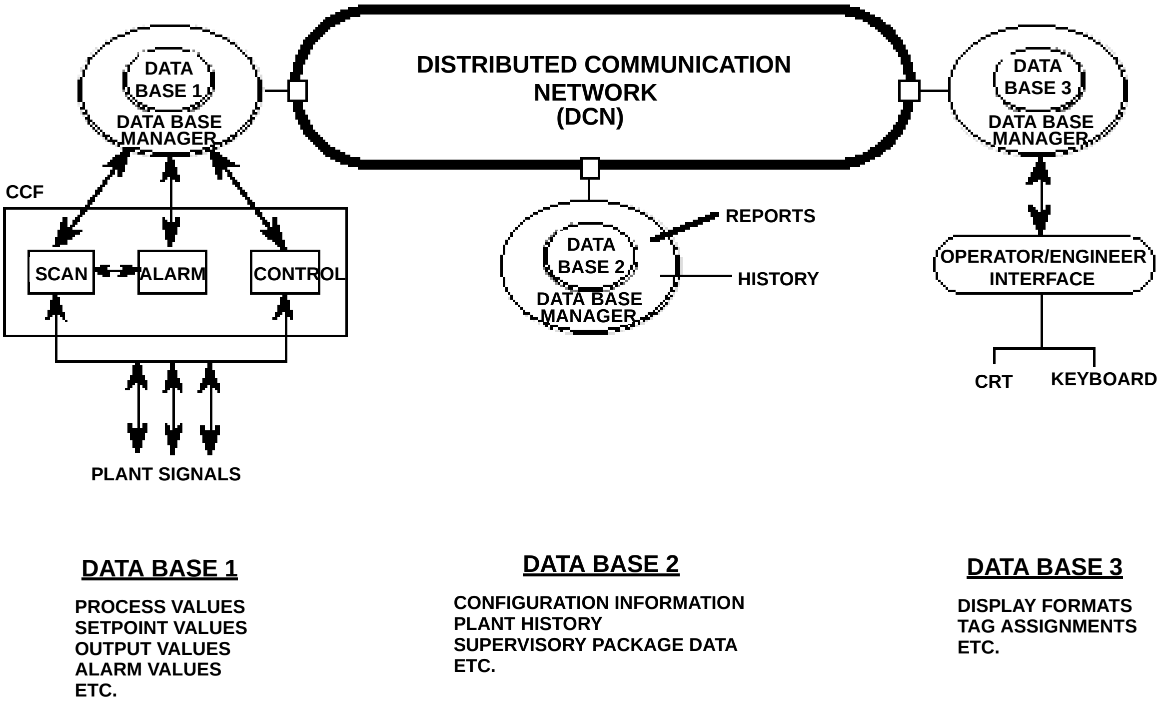


Figure 2-74. Data Base Manager Example

The example shown above demonstrates the manner in which the DBMS interacts with the communications software to provide ease of operation from the console. In this case, the operator wishes to change the gain of PID controller in the Controller Subsystem.

- The operator keys in the gain change.
- The console display software issues the instruction to the local DBMS.
- The local DBMS assembles the instruction and routes it to the proper destinations.
- When the token is received, the message is sent out onto the DCN where it is handled by the system communications software.
- The communications software in the Controller subsystem recognizes its address and accepts the message.
- The local DBMS reads the instruction and verifies the operator’s access authority and the loop status. If there is no discrepancy, it instructs the TCL or CCF software to make the change.
- The message is also sent to the subsystem performing the Data Processor functionality, so that the system data base can be updated.

2.10.2.2 TCP/IP (Transmission Control Protocol/Internet Protocol)

Description

For interconnection of Advant Station 500 Series stations, as well as communication with external computers, services on top of the TCP/IP protocol are used for tasks such as display transfer, X window access, data base networking using SQL*Net, and file back up. No actual control is done over the TCP/IP network.

The Transmission Control Protocol (TCP) is based on the DARPA standard. TCP provides nonduplicated, in-sequence data delivery.

Because TCP is a connection-based protocol, it requires more initial overhead than a datagram-based protocol. TCP also provides flow control. The amount of data sent can be controlled so that the sender does not overload the receiver.

The Network layer in the OSI model implements the Internet Protocol (IP) based on the DARPA standard. IP is a connectionless delivery mechanism for internetwork packet routing. It defines an internet addressing scheme which can uniquely identify multiple networks as well as a node within a single network.

At the Physical and Data Link Layers the IEEE 802.3/Ethernet Driver is used. In order to access other TCP/IP networks, standard IEEE 802.3 communication bridges or routers can be used, thus allowing for wide-area networks (WAN).

Network configurations

Maximum number of connections are 100 and 300 for 10base5 and 10base2 respectively.

Performance

The communication speed and total throughput depends on the computers concerned, the data exchange on the network and the communication net itself.

2.10.2.3 Advant Controller Multi Vendor Interface (MVI)

The MVI Interface provides a communication link between the Advant Controller and other manufacturers' control systems. The Advant Controller can be connected to one or more units and acts as a master station. The MVI is available in binary and ASCII modes and the transmission speed is configurable from 150 to 38.4K baud.

Traffic on the MVI link is controlled by the master station. Direct communication is possible only between the master and the slaves. Stations connected via the MVI appear to the system as stations on a local control network.

The MVI personality module is installed in the Advant Controller. The personality module is equipped with two independent RS 232 asynchronous communication ports. Up to two MVI modules can be used per Advant Controller 410, which provides for a total of four serial ports. Up to four MVI modules can be used per Advant Controller 460, which provides for a total of eight serial ports.

Chapter 3 Hardware Descriptions

3.1 Advant Controller 400 Series

The Advant Controller 400 Series is designed to simplify system integration tasks. It is scaleable from small to large applications and is designed for easy integration with other systems. The controllers run MOD 300 system software, CCF, TCL, TLL, and are completely compatible with existing MOD 300 system installations.

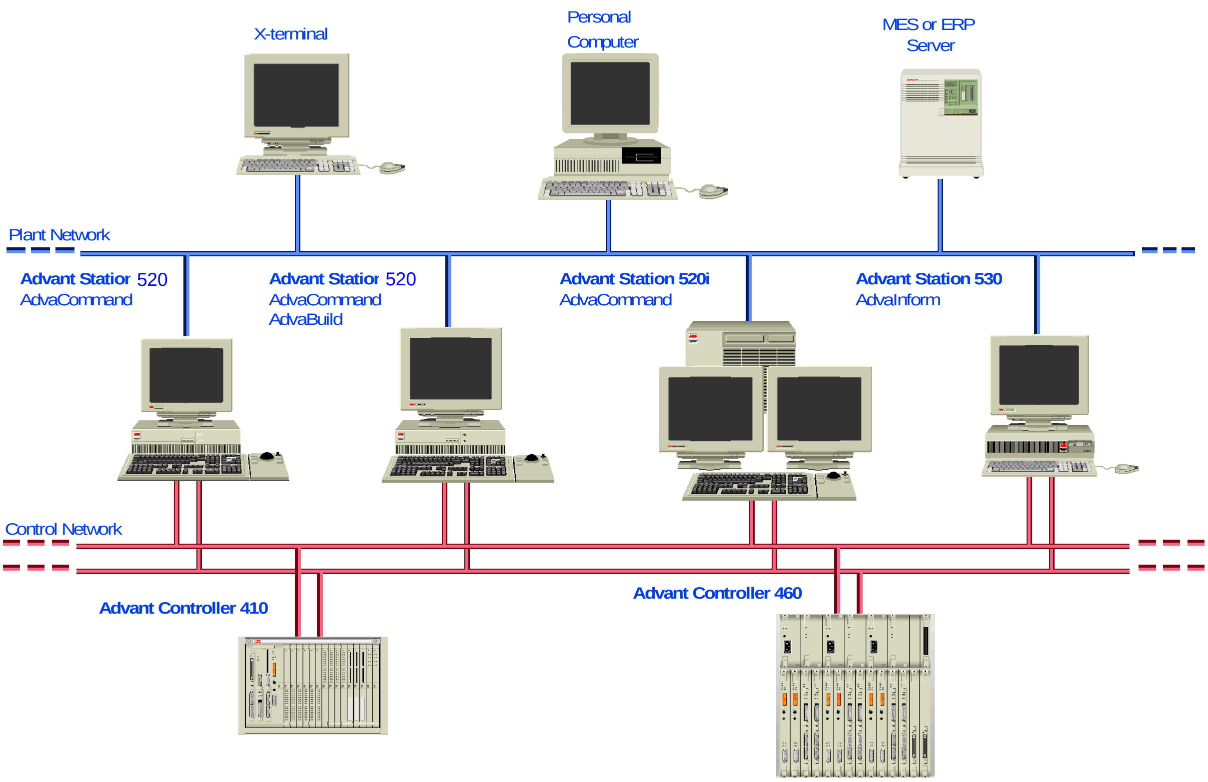


Figure 3-1. System Architecture

The Advant Controller 460 is a high-end controller that can be used in many different situations. When loaded with MOD 300 control software, it is ideal for functionally demanding solutions which may need redundancy.

The Advant Controller 410 is for use in small to medium-sized applications not requiring redundancy.

Compatibility

Advant Controllers are compatible with existing installations. The 6000 Series, SC and Advant Controllers can all co-exist on the same DCN and share data in a seamless manner. All of the benefits that the MOD 300 software brings with its application packages, CCF, TCL and TLL, are available on the Advant Controller 400 Series.

3.1.1 Advant Controller 460

The Advant Controller 460 provides high processing capability and wide-ranging communication capabilities. The Processor Module is based on the Motorola 68040/25MHz. The Controller Processor Modules are available with 8MB of RAM (Approx 4MB for applications) or 16MB of RAM (Approx 11MB for applications). It supports 1:1 redundancy. Each Advant Controller 460 card file holds up to three controllers. The controller Processor Modules can be configured as three pairs of redundant controllers, three single non-redundant controllers, or any combination of redundant and non-redundant (up to three). Each pair of redundant Controller Processor Modules sit side-by-side in the rack.

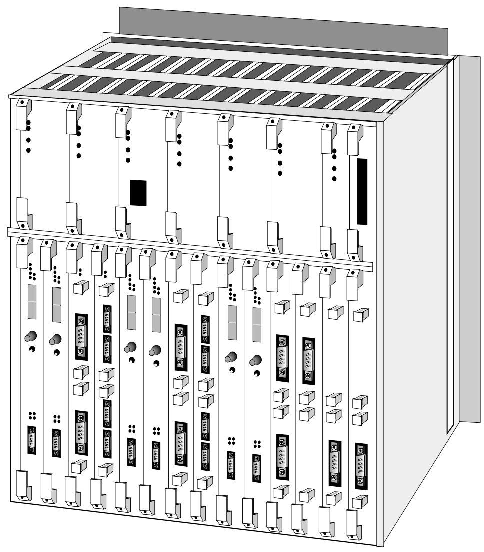


Figure 3-2. Advant Controller 460

The Advant Controller 460 node consists of a RF522 14-slot subrack with a FutureBus+ backplane. The controller Processor Module executes algorithms, supervises applications, and manages data. SC510 Carrier Modules bring information into the system. Two Personality Modules plug into each carrier module to support S800 I/O, S100 I/O, TRIO, and/or integration with other system via the Multi-Vendor Interface (MVI). The controller connects to the DCN through SC540 Carrier Modules with DCN Personality Modules installed. Redundant SR511 Power Regulators ensure that the backplane receives proper voltage and current should a failure occur in one of the regulators.

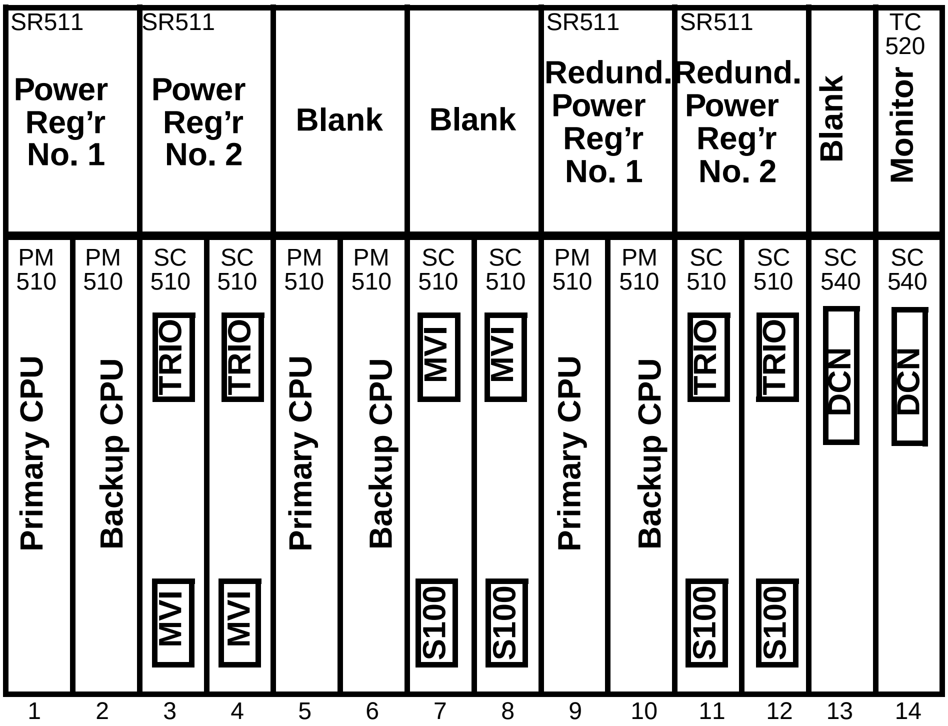


Figure 3-3. Advant Controller 460 Cardfile Layout

The Advant Controller 460 has an optional one-to-one Processor Module redundancy scheme. The reliability of the Advant Controller 460 is maximized by a design incorporating redundancy of Processor Module, process I/O, communications and power. Each component is individually backed up so that in the event of a failure, the backup takes over and carries out the function.

Advant Controller 460 Processor Module Redundancy

The backup Processor Module runs in parallel with the primary Processor Module, mirroring and updating the database at least once every five milliseconds through a high-speed communications link. Should a primary Processor Module fail, the backup Processor Module detects the failure, and the control functions are transferred (switch-over time approx. 25 msec. from detection to controlling). All software application programs are transferred to the backup, which then becomes the primary Processor Module (guaranteeing that all functionality is preserved). The failed Processor Module can be removed and replaced while the system continues to operate. Once replaced, the new Processor Module automatically becomes the backup Processor Module, and it mirrors and updates it's database from the primary Processor Module.

Carrier Module Redundancy

The carrier modules (with Personality Modules) follow a redundancy scheme similar to that of the Processor Modules. Each pair of redundant carrier modules sit side-by-side in the rack. If redundancy is implemented, the redundant pairs of Personality Modules can reside on separate carrier cards for added protection.

Distributed Communications Network (DCN) Redundancy

The DCN is a dual, high-speed, local area network used for communications throughout the various system nodes. The dual DCN scheme means that there are two rings operating in parallel. This scheme ensures that no single malfunction will prevent communications between the operator and the process or between any two system components.

3.1.1.1 Power Supplies and Power Supply Redundancy

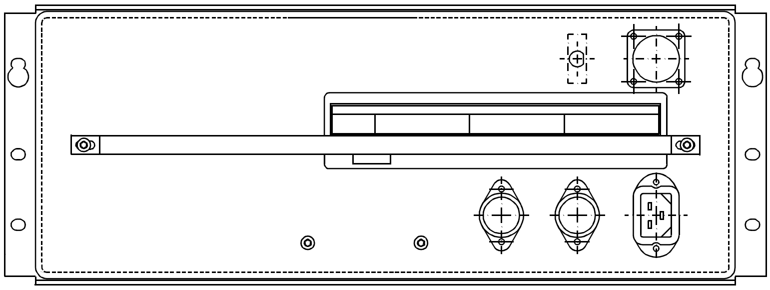


Figure 3-4. SA1xx Power Supply

SA1xx is a series of power supply units which convert single phase AC to 24VDC power.

Electric installation: Plug-in contacts. Primary connector EN 60 320; C20.

Mechanical installation: 19” Rack or wall mounted.

Table 3-1. Power Supply

Consists of	Description
SA167K11/12	Unregulated Power Supply: For Controller and Subrack 1 Input: 120 V ac Output: 24 V dc, 25A
SA161K01/02	Unregulated Power Supply: For Subrack 2 Input: 120V ac Output: 24 V dc, 10A

Table 3-1. Power Supply (Continued)

Consists of	Description
SA167K02/04	Unregulated Power Supply: For Subrack 2 and 3 Input: 120 V ac Output: 24V dc, 25A
SA168K11/12	Unregulated Power Supply: For Controller and Subrack 1 Input: 230V ac Output: 24 V dc, 25A
SA162K01/02	Unregulated Power Supply: For Subrack 2 Input: 230V ac Output: 24 V dc, 10A
SA168K02/04	Unregulated Power Supply: For Subrack 2 and 3 Input: 120 V ac Output: 24V dc, 25A

NOTE: The power supply part number designates single/redundant supply mounted in a RE5xx cabinet. Variations of the above part numbers exist for power supplies mounted in MOD 300 rack cabinetry.

Technical Data

Table 3-2. SA1xx, Individual Technical Data

Parameter	SA161	SA162	SA167	SA168
Mains voltage a.c., nominal	120V	230V	120V	230V
Mains voltage variation	85 - 110V			
Mains load VA	450 VA		900 VA	
Mains load W	320 W		705 W	
Efficiency factor	85% typ.			
Output voltage at max. current	26V, 10 A		25V, 25 A	
Ripple 100 Hz, peak-to-peak	2V max		1V max	
Maximum load	10 A / 260 W		25 A / 600 W	

Safety Classification:
Class I according to IEC 536; (earth protected)

Environmental Protection Rating:
IP20 according to IEC 529 (IEC 144)

Insulation:
Rated insulation voltage 400V a.c.
Dielectric test voltage 3250V a.c., 50/60 Hz

Physical Data:
Dimension:

width	482 mm (19”)
height	177 mm (7”), corresponds to 4 U height modules in a cabinet
depth	255 mm (10”)

Weight:

SA161/162	15 kg (33 lbs.)
SA167/168	24 kg (53 lbs.)

Voting Unit

For redundant applications, any two of the above mentioned units can be connected together if a Voting Unit is used. Two versions of the Voting Unit are available:

DSSS170 - Used for redundant field power or AC410 and S100 I/O subrack with single regulator.

DSSS171 - Used for redundant power to AC410 or S100 I/O subrack with redundant regulators.

Table 3-3. Voting Units

Consists of	Description
DSSS 170	Voting Unit for automatic switching between redundant power supplies A and B (with single regulator)
DSSS 171	Voting Unit for automatic switching between redundant power supplies A and B (with redundant regulators)

Power Regulator Redundancy

The Advant Controller 460 can use up to four power regulators. Each subrack has two primary voltage regulators, and can have one or two redundant voltage regulators. The first regulator provides power to the odd-numbered slots; the second provides power to the even-numbered slots. The third and forth regulators can be added for redundancy.

Table 3-4. Regulators

Consists of	Description
SR511	Regulator for the Advant Controller 460 Output: 5V, 35 A

AC460 Connections

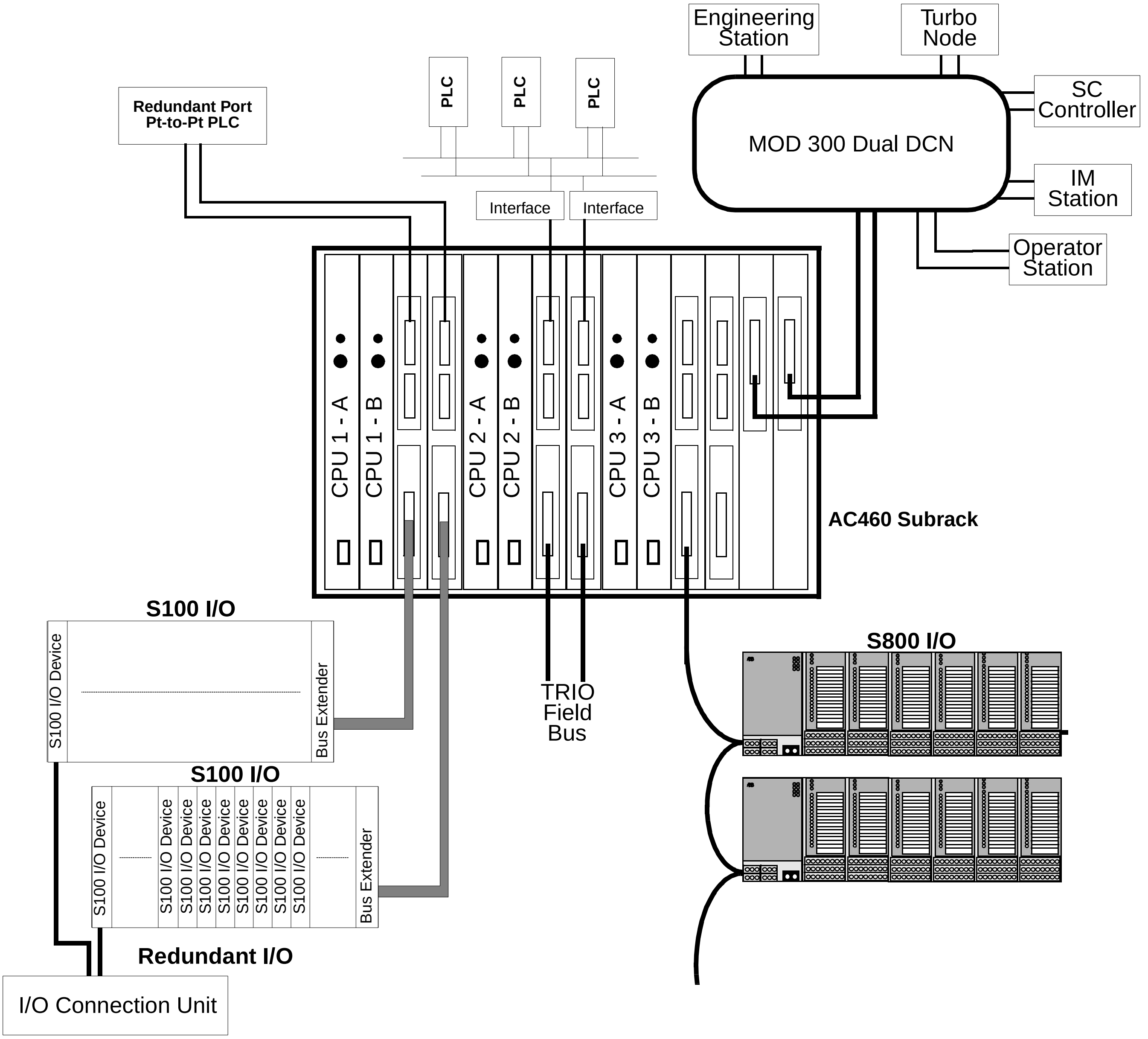


Figure 3-5. Typical Advant Controller 460 Connections

3.1.1.2 PM510 Processor Module

Memory Calculation

The PM510 Processor Module provides sufficient RAM for most applications. Up to 11 MByte is available for application programming. Memory is generally not a limiting factor when sizing the system; however, it is advisable to do a memory calculation to verify that your application does not exceed the memory capacity. Use the following Table 3-5to estimate the memory usage requirements.

Table 3-5. PM510 Processor Module User Memory Requirements

Category	Memory Requirements (BYTES)
Base Overhead for CCF & TCL	24,000
Dynamic Memory Table for Display Lists, etc.	50,000
CCF Loops	
Overhead (Control loop, measurement loop, device)	250
PID FCM	350
Trend (Standard - 300 entries)(1)	340
Trend (Primary History Log - 300 entries)(2)	1300
Misc. FCMs (nominal)	100
TCL - Configured Items	
Max. Active Sequences	960
Max. Parameters	16
Max. Abnormal Subroutines	28
Max. Actions	10
Max. Events	58
Mailbox	128
Message	144
Waiter	88
Integer/Real Unit Variable	212
String Unit Variable	244
Array Unit Variable +	258
1 byte data	1
2 byte data	2

Table 3-5. PM510 Processor Module User Memory Requirements (Continued)

Category	Memory Requirements (BYTES)
Integer/real data	4
String data	40
TCL - Loaded Sequence	
Number of IDs	32
Number of String Variables	40
Number of tag-fcm.attribute refs (string)	30
Number of tag-fcm.attribute refs (non-string)	128
TCL Statements (nominal per statement)	100
Number of STEP statements	142
Number of STEP_ACTIVITY/CONDITION statements	225
Number of STEP_TRANSITION statements	290
Number of Sequences	1148
String Constant Lengths	[26 + (no. of str cons x 4) + actual string lengths]
Bus I/O	
Each TRIO LAN	8600
S100 I/O Boards (total number per Processor Module)	Total x 248 bytes
Plus per S100 Board: AI130	1008
AI133	1792
AI145	1792
AI151	896
AI155	952
AO110	240
AO120	480
AX110	928
DI110	1792
DI115	1792
DO110	1984

Table 3-5. PM510 Processor Module User Memory Requirements (Continued)

Category	Memory Requirements (BYTES)
DX180	1984
DP150	728
S800 I/O Database (per Processor Module)	80
S800 LAN	(#LANs x 1154) **+** (Highest LAN# Configured x 640)
S800 I/O Station	#STNS x 151
S800 I/O Devices (modules)	# Devices x 124
AF 100/S800 Bus Data	#LANs x #STNS x 1536
TLL	
Ladder Logic Overhead	4 bytes per I/O
Registers	58
Counters	64
Timers	66
Files	566
Sequences	60 + 98/step
I/O Points	80
Ladder Elements (average)	85

(1) Memory Size = M x (38.25 + N); Where M = number of trends and N = entries per trend.
(2) Memory Size = M x (96.25 + (4 x N)); Where M = number of trends and N = entries per trend (3200 entries max.).

Processor Module Load Calculation

The Processor Module load calculation is not intended to give absolute values but rather to indicate the magnitude of the load generated by the different parts. The calculation also provides a basis for determining where optimization would be most effective, and if it is necessary to lower the Processor Module load.

Base load @ Base rate	Approx. 11.5% at 250 ms
No. of PID loops/sec.	Approx. 0.25%
No. of indicator loops/sec.	Approx. 0.035%
No. of device loops/sec.	Approx. 0.025%
PHL at 0.1 sec.[1]	Approx. 0.082%
TCL (per statement)	Approx. 0.03%
TLL (per element)	Approx. 0.0003%
External Communications	Approx. 5.0%
Reserve	Approx. 20.0%
	Total ≤ 100%

1. Primary History Log collection rate.
Rates of 1-6 sec. are the same as standard trends.

Figure 3-6. PM510 Processor Module Load Calculation Method

When calculating or estimating Processor Module load, include common frequently used circuits in the calculation. You can generally approximate complex and infrequent circuits using additional PID loops. Include the relevant I/O in the calculation/estimation.

How to Reduce Processor Module load

Analyze the application to determine where you can reduce the Processor Module load most effectively. Areas of concern when reducing the Processor Module load are:

- A slower base rate
- Slow down scan rates on CCF loops
- Phase of loops
- Slow down TLL scan rate.

Basic Unit

The minimum configuration for the Advant Controller 460 is provided by the basic unit which consist of:

Table 3-6. Advant Controller 460 Basic Unit

	Description	Qty.
RF522	Subrack and Backplane	1
SR511	Primary Power Regulator	2
TC520	Monitor	1
SC540	DCN Communications Submodule	2
CS512	DCN Interface Module	2
RA102	ESD Board and equipment	1
TK451	Cable, 24V - Rack	1
TK456V021	Cable, 24V - Fan	1
TK458	Cable, Fan - TC520	1
RC510	Fan	1

NOTE: Two Carrier modules maximum per Processor Module.

Power Supply Requirements

Below is a quick guide for power consumption to be used in a preliminary phase of a project work or whenever you need an estimated figure.

Table 3-7. Estimated System Power Consumption

Controller and I/O subrack (no.)	Power Consumption
AC460 Subrack only	15.6 A @ 24 V dc
AC460 and S100 I/O Subrack No. 1	20.88 A @ 24 V dc
S100 I/O Subrack No.2	5.28 A @ 24 V dc
S100 I/O Subrack No.3	5.28 A @ 24 V dc

NOTE

The above estimates are based on fully loaded subracks. S100 I/O subracks may require separate power supplies when using large quantities of analog output and/or digital output boards. Refer to S100 I/O Product Guide Supplement for power requirements of each board and connection unit.

3.1.1.3 Subrack Mounting Dimensions

AC460 Subrack

Most of the controller components are installed in a subrack:

Table 3-8. AC460 Subrack Dimensions

Data	Value
Width	482.6 mm (19")
Depth	325.5 mm(1) (12.8")
Height	449 mm (17.7") 584 mm, 9S (fan included) (23")

(1) A free space of 75-100 mm (3-4") should be left in front of the subrack for cables etc.

S100 I/O Subrack

An S100 I/O subrack can be included in the controller cabinet (or adjacent cabinet):

Table 3-9. S100 I/O Subrack Dimension

Data	Value
Width	19 inch (482.6 mm)(1)
Depth	335 mm (including DSSR 120/122) (13.2") 345 mm (including DSSR 170) (13.6")
Height	347 mm (including cable duct) (13.7")(1)

(1) Dimensions of swing panel for S100 subracks when used in RE5xx cabinets need to be used for vertical spacing. Swing panel width = 609 mm (24"), height = 400 mm (15.75").

Power and Cooling

The table provided shows the power and cooling values that can be used when designing a AC460 system.

Table 3-10. AC460 Power and Cooling

Device	5 Volts	24 Volts	Cooling Load (BTU/H Typical)
PM510	5.0 A	1.49 A	208
SC510	1.8 A	0.54 A	75
SC540	1.8 A	0.54 A	75

Table 3-10. AC460 Power and Cooling

Device	5 Volts	24 Volts	Cooling Load (BTU/H Typical)
CS512	0.5 A	0.15 A	21
CI540	0.5 A	0.15 A	21
CI560	0.5 A	0.15 A	21
TC520	0.05 A	0.0 A	0.85
SR511	N/A	0.5 A	41
RC510	0	1.0 A	82
SA167	N/A	N/A	340

CE Marking

CE kits must be ordered for Advant Controllers 460 housed in cabinets which will be delivered to Europe. These kits contain special isolation hardware which allow the equipment to comply to CE requirements, along with the CE label. All RE5xx cabinets and MOD 300 cabinets are verified for CE Marking. The cabinets for use in CE Marking applications will be designated in the Price Book.

NOTE: The RE5xx cabinets must be ordered separately. A hardware kit is then added to the cabinets to meet CE certification.

NOTE: The MOD 300 cabinets 6050E and 6051E must be ordered separately. A hardware kit is then added to the cabinets to meet CE certification.

3.1.2 Advant Controller 410

The Advant Controller 410 is for small to medium-sized applications that do not require redundancy. The Processor Module is based on the Motorola 68020/25MHz. The Controller Processor Module has 8MB of RAM (Approx 4MB for applications). and runs the complete library of MOD 300 software.

The Advant Controller 410 consists of a 21-slot backplane, the same backplane that is used for Series 100 I/O. The first six slots are occupied by the Processing Module.

The Processor Module has four slots for Personality Modules, two of which are for connection to the DCN. The remaining two slots can be used to connect to Taylor Remote I/O (TRIO), or other systems (ie. PLCs).

The remaining slots are for inserting up to 15 Series 100 I/O modules, with the capacity to support up to 480 process signals depending on the I/O type. Series 100 I/O cards are field-proven and can be used for analog, digital, pulse inputs, RTD, and thermocouple connections to field devices.

Note: The AC410 is a stand-alone cardfile, therefore, it does not support expansion to additional S100 I/O cardfiles.

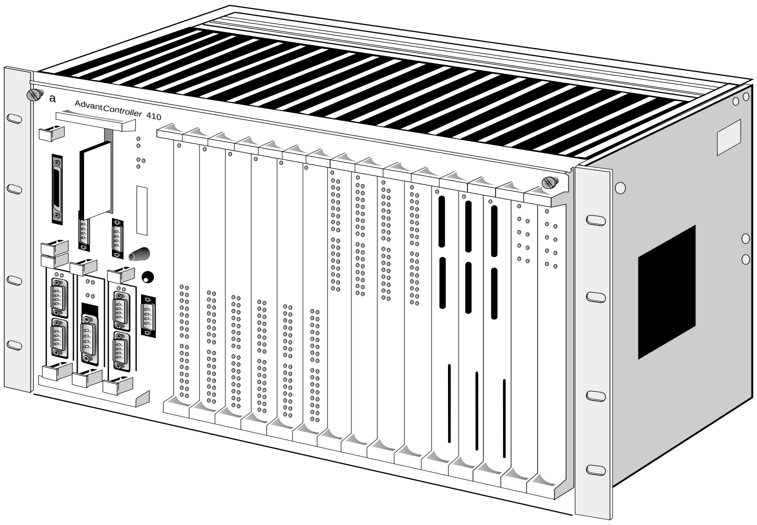


Figure 3-7. Advant Controller 410

Connecting to the Advant Controller 410

The Advant Controller 410 supports two DCN interfaces. It uses the same Personality Modules (S800 I/O, TRIO or MVI) as the Advant Controller 460. The Advant Controller 410 will support up to two AF 100, TRIO field buses, or MVI Personality Modules. Each AF 100 can support 32 S800 I/O stations, so a total of 64 stations can be supported by each AC410. Since each TRIO interface supports 30 TRIO blocks, the AC 410 can support up to 60 non-redundant TRIO blocks. This assumes that no MVI Personality Modules are used.

3.1.2.1 Power Supplies

The AC410 uses a subset of the power supplies used for the AC460. Refer to the AC460 Section for specific power supply details.

Table 3-11. Power Supply

Consists of	Description
SA167K11/12	Unregulated Power Supply: For Controller and Subrack Input: 120 V ac Output: 24 V dc, 25A
SA168K01/02	Unregulated Power Supply: For Controller and Subrack Input: 230V ac Output: 24 V dc, 25A

NOTE: The end portion (K01/02) of the power supply part number designates single/redundant supply mounted in a RE5xx cabinet. Variations of the above part numbers exist for power supplies mounted in MOD 300 rack cabinetry.

Power Regulators

Power regulators are mounted on the back of the rack. Power supply redundancy is obtained by choosing a redundant regulator basic unit and an additional power supply.

Table 3-12. Regulators

Consists of	Description
DSSR 122 (without redundancy)	Regulator for Advant Controller 410 Output: 40 A
DSSR 170 (n+1 redundancy)	Redundant regulator for Advant Controller 410 Output: 20 A

NOTE: Regulators are part of the AC410 Basic Unit.

3.1.2.2 PM150 Processor Module

Memory Calculation

The PM150 Processor Module provides sufficient RAM for most applications. At least 4 MByte is available for application programming. Memory is generally not a limiting factor when sizing the system; however, it is advisable to do a memory calculation to verify that your application does not exceed the memory capacity.

Use the following table to estimate the memory usage requirements.

Table 3-13. PM150 Processor Module User Memory Requirements

Category	Memory Requirements (BYTES)
Base Overhead for CCF & TCL	24,000
Dynamic Memory Table for Display Lists, etc.	50,000
CCF Loops	
Overhead (Control loop, measurement loop, device)	250
PID FCM	350
Trend (Standard - 300 entries)(1)	340
Trend (Primary History Log - 300 entries)(2)	1300
Misc. FCMs (nominal)	100
TCL - Configured Items	
Max. Active Sequences	960
Max. Parameters	16
Max. Abnormal Subroutines	28
Max. Actions	10
Max. Events	58
Mailbox	128
Message	144
Waiter	88
Integer/Real Unit Variable	212
String Unit Variable	244
Array Unit Variable +	258
1 byte data	1
2 byte data	2
Integer/real data	4
String data	40
TCL - Loaded Sequence	
Number of IDs	32
Number of String Variables	40

Table 3-13. PM150 Processor Module User Memory Requirements (Continued)

Category	Memory Requirements (BYTES)
Number of tag-fcm.attribute refs (string)	30
Number of tag-fcm.attribute refs (non-string)	128
TCL Statements (nominal per statement)	100
Number of STEP statements	142
Number of STEP_ACTIVITY/CONDITION statements	225
Number of STEP_TRANSITION statements	290
Number of Sequences	1148
String Constant Lengths	[26 + (no. of str cons x 4) + actual string lengths]
Bus I/O	
Each TRIO LAN	8600
S100 I/O Boards (total number per Processor Module)	Total x 248 bytes
Plus per S100 Board: AI130	1008
AI133	1792
AI145	1792
AI151	896
AI155	952
AO110	240
AO120	480
AX110	928
DI110	1792
DI115	1792
DO110	1984
DX180	1984
DP150	728
S800 I/O Database (per Processor Module)	80
S800 LAN	(#LANs x 1154) **+** (Highest LAN# Configured x 640)

Table 3-13. PM150 Processor Module User Memory Requirements (Continued)

Category	Memory Requirements (BYTES)
S800 I/O Station	#STNS x 151
S800 I/O Devices (modules)	# Devices x 124
AF 100/S800 Bus Data	#LANs x #STNS x 1536
TLL	
Ladder Logic Overhead	4 bytes per I/O
Registers	58
Counters	64
Timers	66
Files	566
Sequences	60 + 98/step
I/O Points	80
Ladder Elements (average)	85

(1) Memory Size = M x (38.25 + N); Where M = number of trends and N = entries per trend.
(2) Memory Size = M x (96.25 + (4 x N)); Where M = number of trends and N = entries per trend (3200 entries max.).

PM150 Processor Module Load Calculation

The Processor Module load calculation is not intended to give absolute values but rather to indicate the magnitude of the load generated by the different parts. The calculation also provides a basis for determining where optimization would be most effective; and if it is necessary to lower the Processor Module load.

Base load @ Base rate	Approx. 13% at 250 ms
No. of PID loops/sec.	Approx. 0.6%
No. of indicator loops/sec.	Approx. 0.067%
No. of device loops/sec.	Approx. 0.05%
PHL at 0.1 sec.[1]	Approx. 0.082%
TCL per statement	Approx. 0.06%
TLL per element	Approx. 0.0006%
External Communications	Approx. 5%
Reserve	Approx. 20%
	Total ≤ 100%

1. Primary History Log collection rate.
Rates of 1-6 sec. are the same as standard trends.

Figure 3-8. PM150 Processor Module Load Calculation Method

When calculating or estimating Processor Module load, include common frequently used circuits in the calculation. You can generally approximate complex and infrequent circuits using additional PID loops. Include the relevant I/O in the calculation/estimation.

How to Reduce Processor Module Load

Analyze the application to determine where you can reduce the Processor Module load most effectively. Areas of concern when reducing the Processor Module load are:

- A slower base rate
- Slow down scan rates on CCF loops
- Phase of loops
- Slow down TLL scan rate.

Power Supply Requirements

Below is a quick guide for power consumption to be used in a preliminary phase of a project work or whenever you need estimated figures.

Table 3-14. Estimated System Power Consumption

Controller and I/O subrack (no.)	Power Consumption
AC410 Subrack with S100 I/O	18 A @ 24 V dc

NOTE

The above estimate are based on a fully loaded subrack. Some S100 I/O may require separate power supplies when using large quantities of analog output and/or digital output boards. Refer to S100 I/O Product Guide Supplement for power requirements of each board and connection unit.

Power and Cooling

The table below shows the power and cooling values that can be used when designing a AC410 system.

Table 3-15. AC410 Power and Cooling

Device	5 Volts	24 Volts	Cooling Load (BTU/H Typical)
PM150	2.3 A	0.05 A	44
CS512	0.5 A	0.15 A	21
CI560	0.5 A	0.15 A	21
DSSR122	N/A	2.7 A	19
DSSR170	N/A	1.0 A	79
SA167	N/A	N/A	340

S100 I/O and TRIO Capacities

Practical limits must be considered when the data below is applied:

- Space in the cabinet.
- Processor Module load
- Integrity aspects
- Availability aspects

Table 3-16. Capacity S100 I/O

Data	Value
Number of busses per Processor Module (built in)	1
Number of I/O boards per subrack	max 15
Number of DI boards (incl. DSDP 110) DI signals	15 480
Number of DO boards DO signals	15 480
Number of AI boards AI signals	15 480
Number of AO boards AO signals	15 480

Table 3-17. Technical Data of Field Bus to TRIO

Data	Value
Number of busses per Processor Module	2
Number of TRIO Blocks (non-redundant bus)	30 per bus Total = 60
Number of TRIO Blocks (redundant bus)	max 30
Length of field bus	max 1066.8 m (3500 ft.)

NOTE: Longer I/O connection cables can now be ordered. In addition to the 3m DSTK I/O connection cables, 15m and 30m lengths are available. These cables connect between the I/O module and the connection unit. The new longer length cables can be ordered from the Advant OCS Spare Parts Price List.

AC410 Subrack Dimensions

An AC410 subrack can be included in the controller cabinet (or adjacent cabinet):

Table 3-18. AC410 Subrack Dimension

Data	Value
Width	19 inch (482.6 mm)(1)
Depth	335 mm (including DSSR 120/122) (13.2") 345 mm (including DSSR 170) (13.6")
Height	347 mm (including cable duct) (13.7")(1)

(1) Dimensions of swing panel for AC410 subracks when used in RE5xx cabinets need to be used for vertical spacing. Swing panel width = 609 mm (24"), height = 400 mm (15.75").

CE Marking

CE kits must be ordered for Advant Controllers 410 housed in cabinets which will be delivered to Europe. These kits contain special isolation hardware which allow the equipment to comply to CE requirements, along with the CE label. All RE5xx cabinets and MOD 300 cabinets are verified for CE Marking. The cabinets for use in CE Marking applications will be designated in the Price Book.

NOTE: The RE5xx cabinets must be ordered separately. A hardware kit is then added to the cabinets to meet CE certification.

NOTE: The MOD 300 cabinets 6050E and 6051E must be ordered separately. A hardware kit is then added to the cabinets to meet CE certification.

3.1.3 Advant Controller Interfaces & Personality Modules

The Advant Controller family of products was designed for easy integration with other systems. Personality Modules, used for communication with I/O and other systems, easily plug into the Advant Controller 410 Processor Module and the Advant Controller 460 Carrier Module.

The Personality Module (sometimes called a Submodule) contains the protocol profile. When a new interface is needed, a different Personality Module can simply be plugged into the slot. With this visionary architecture, emerging technologies such as fieldbus and high speed fiber-optic can easily be integrated into the system. Integration with programmable logic controllers and other digital devices is also simplified.

The Advant Controller architecture makes it easy to bring data into the system global database. Once in the system, data can be accessed from any node, including the Advant Station 500 Series information management workplace and operator workplaces. The Personality Modules allow easy insertion of field information into the MOD 300 database from a wide variety of sources.

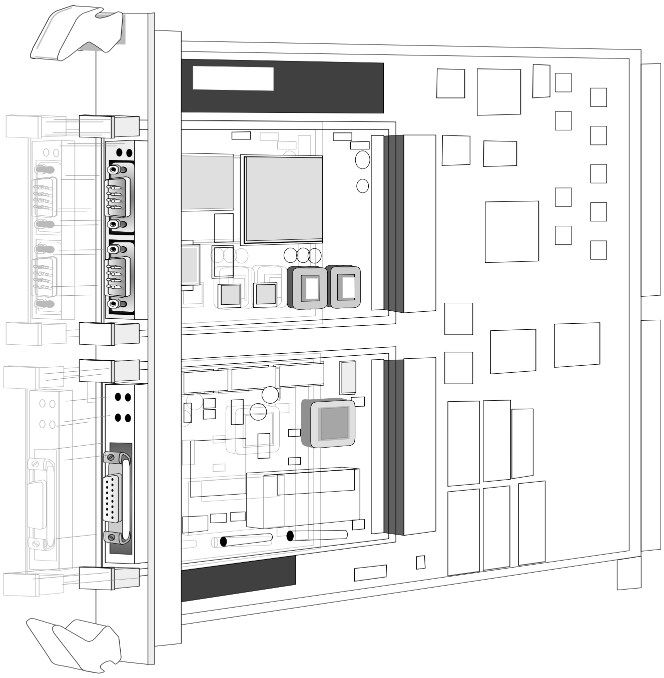


Figure 3-9. Advant Controller Carrier Module with Personality Modules

Table 3-19. Personality Modules

Type Designation	Description
CI540	Interface to S100 I/O (AC460 only)
CI520V01	AF100 interface to S800 I/O (Dual Media)
CI560	Interface to TRIO
CI532V02	Interface to MODBUS device
CI532V04	Interface to Allen-Bradley device
CI532V05	MVI to Generic/Termchar device
CI532V06	Interface to Smart Platform
CI537V01	Interface to Modbus Plus
CS512	Interface to DCN

S100 I/O Connection

The CI540 S100 I/O Personality Module uses one of the two available positions on a Carrier Module and can support up to five S100 I/O Subracks.

When pairs of S100 I/O Personality Modules are installed, they may be configured either as one redundant S100 I/O Bus or as two independent, non-redundant S100 Buses. Normally, a redundant pair of S100 I/O Personality Modules would reside on separate Carrier Boards when using the AC460.

S800 I/O Connection

The CI520 S800 I/O Personality Module uses one of the two available positions on a Carrier Module and can support one twisted pair or one dual media twisted pair AF 100 LAN (up to 32 S800 I/O Stations).

Taylor Remote I/O (TRIO) Connection

The CI560 TRIO Personality Module uses one of the two available positions on a Carrier Module and supports one TRIO Field Bus LAN (up to 30 TRIO blocks).

Two TRIO Personality Modules can be configured to be used as either one redundant LAN or as two non-redundant LANs. Normally, a redundant pair of TRIO Personality Modules would reside on separate Carrier Boards when using the AC460

MVI (Multi-Vendor Interface) Connection

The CI532V MVI Personality Modules provide a serial interface to external devices such as PLCs. There are two serial RS-232 ports per MVI module. Each MVI uses one of the two available Carrier slots.

Up to two MVI modules can be used per Advant Controller 410, which provides for a total of four serial ports. Up to four MVI modules (in Carrier Modules) can be used per Advant Controller 460 Processor Module.

When a pair of MVI modules are installed, they may be configured either as one redundant interface or as two independent, non-redundant interfaces. Normally, a redundant pair of MVI modules would reside on separate Carrier Boards when using the AC460.

The communications protocol must be the same for both ports on the same MVI module. The baud rate is configurable per port (150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400).

Communications protocols are implemented in firmware on the MVI Personality Module and the appropriate protocol must be specified when ordering the MVI option. Separate versions of the MVI support the following communication protocols:

- CI532V02 MOD Bus B(inary)
- CI532V04 Allen-Bradley
- CI532V05 Generic/Termchar
- CI532V06 Smart Platform
- CI537V01 Modbus Plus

The MVI is accessible to ABB MOD 300 interface software products such as the Programmable Controller Interface or by user applications written in TCL.

Allen-Bradley MVI Submodule

The Allen-Bradley MVI plugs into the Carrier Module slots of the AC 400 Series Controller. It supports standard Allen-Bradley Data Highway communication protocol.

The Advant OCS can perform up to 7 write commands per second to an Allen-Bradley PLC, or up to 200 (2 byte) words per second of data input from a PLC on the data highway.

MODICON MVI Submodule (MODBUS B & MODBUS PLUS)

The system can perform 10 read/write commands or 250 (2 byte) words per second to a MODBUS device. These values are at an optimum and assume that the PLC is not running ladder logic.

Table 3-20. MVI Submodule Configurations and Compatibility

Parameter	MODICON 584, 884, 984	Allen-Bradley PLC-2, PLC-3, PLC-5, SLC-504
Speed	9600, 19200	9600, 19200
Data Bits	8	8
Parity	Even	Even
Stop Bits	1	1
Mode	Master	Master
Redundant Communications	Yes	Yes
Redundant PLC	Yes	Yes
Multi-drop	No (MODBUS B)(1) Yes (MODBUS PLUS)	Yes
Point-to-Point	Yes	No
Output Grouping	Yes	Analog only

(1) Works with MODBUS B and MOD 30 XL.

NOTE: MODICON group writes should be limited to 119 words maximum.

The MODBUS Plus MVI implements a standard MODBUS Plus interface. All of the generic information about the MODBUS Plus protocol applies, allowing the interface to talk to any device that supports MODBUS Plus (not only Modicon PLCs). Modbus Plus communicates at 1 Mbaud and supports up to 32 devices per network. It supports multi-drop connections and LAN distances are up to 1500 feet without repeaters and 6000 feet with repeaters. These distances can be increased with the use of fiber optics. More information on MODBUS Plus protocol can be found at http://www.modicon.com/.

Redundant DCN Interface Personality Modules

Two DCN Interface Personality Modules provide a (redundant) DCN control network interface for the Advant Controller 410 and 460. Included are: (2) DCN Communication Personality Modules, (2) T-Boxes, and (2) Cables. The DCN Personality Module plugs into the Advant Controller 410 Processor Module or the Advant Controller 460 Carrier Module.

3.1.3.1 Smart Device (HART) Interface

The Advant Smart Device (HART) Interface is part of the Advant Controller 410 or Advant Controller 460 subsystem and is used to view and manipulate variables from attached smart devices.

The Advant Smart Device (Hart) Interface is a software module resident in the Processor Module of the Advant Controller 410 (AC 410) and Advant Controller 460 (AC 460). It provides a method for CCF and TLL to have access to raw input values from a smart device, and a method for sending parameters to the smart device.

An AC410 node can be equipped with either one or two CI532V02 ModbusB Multi-vendor Interface(s) (MVI), which have two ports each. Each RS-232 port is provided by connection between these modules, a SHIM, and up to eight smart devices connected to each SHIM. If an RS-232 to 485 converter is used, then up to 31 SHIMs can be connected to a port with up to eight smart devices connected to each SHIM, depending on performance requirements.

An AC 460 node can have up to three redundant PM510 Processor Module sets with up four CI532V02 ModbusB Multi-vendor Interface(s) (MVI) per PM510 Processor Module set. Each RS-232 provides a connection between a SHIM, and up to eight smart devices connected to each SHIM. If an RS-232 to 485 converter is used, then up to 31 SHIMs can be connected to a port with up to eight smart devices connected to each SHIM, depending on performance requirements.

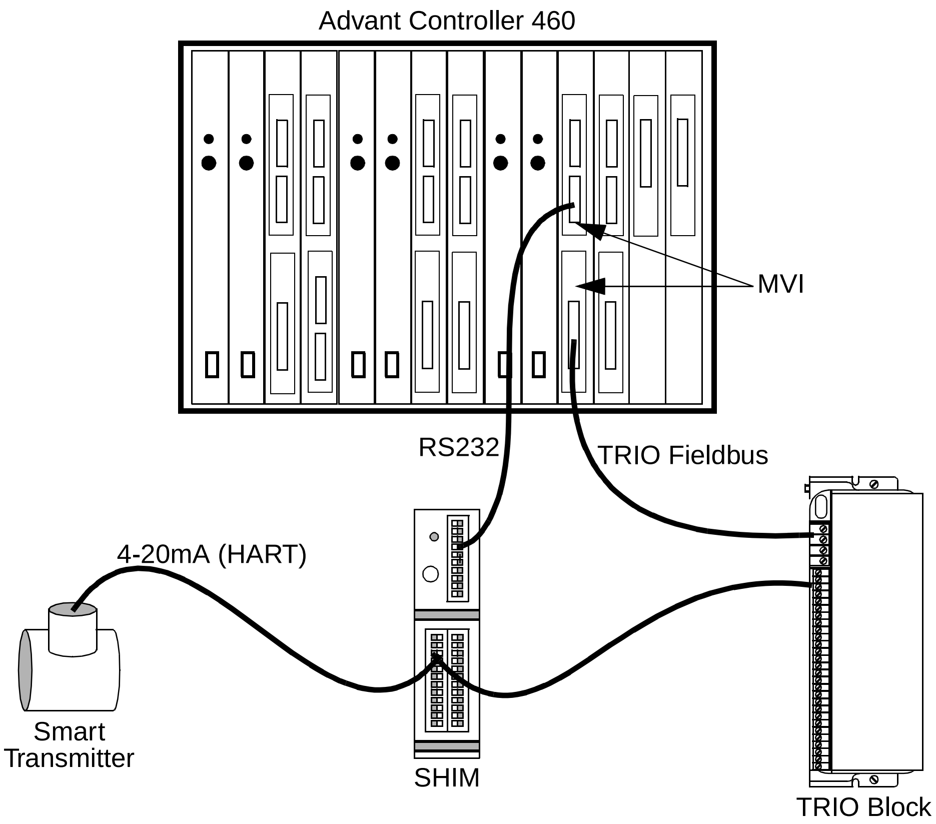


Figure 3-10. Advant Smart Device (HART) Interface Overview

The Advant Smart Device (HART) Interface allows an Advant Controller to read or write data to smart devices or other compatible devices. Data is mapped into CCF points for control purposes. Transfer of smart device variables to the Advant OCS data base via CCF loops that receive the variables can provide the following functions within the Advant OCS:

- Processing of smart device variables by the CCF loops that receive them, or by other CCF loops.
- Trending of smart device variables.
- Interaction with TCL programs.
- Inclusion of smart device variables in reports produced by the Report Services software.
- Inclusion of smart device variables in displays produced by the Display Builder software.
- Storing of smart device variables by the Historical Services software.
- Generation and logging of alarms for smart device variables.

The Advant OCS is able to read the Primary, Secondary, 3rd, and 4th variables form a smart device. The data contained in each of these variables may vary for each smart device manufacturer.

3.1.3.2 Smart Platform (AccuRay) Interface

The Advant OCS Smart Platform Interface is a software application. When configured properly, it aids Taylor™ Control Language (TCL) to communicate and exchange information between the Advant OCS and the standard AccuRay® Smart Platform™, which is integrating the signals from standard AccuRay sensors.

Up to 4 Smart Platform Interfaces can be configured per Advant Controller. Each MVI can connect to 2 separate Smart Platforms. The AccuRay Smart Platform only communicates using current loop or RS-485 communication protocols. The Advant Controller 410 (AC410) or Advant Controller 460 (AC460) nodes do not support either of these communication protocols. Therefore, you must provide a two-way signal converter which will convert RS-232 signals from the CI532V06 Multi Vendor Interface (MVI) to either current loop or RS-485 destined for the AccuRay Smart Platform, and vice versa.

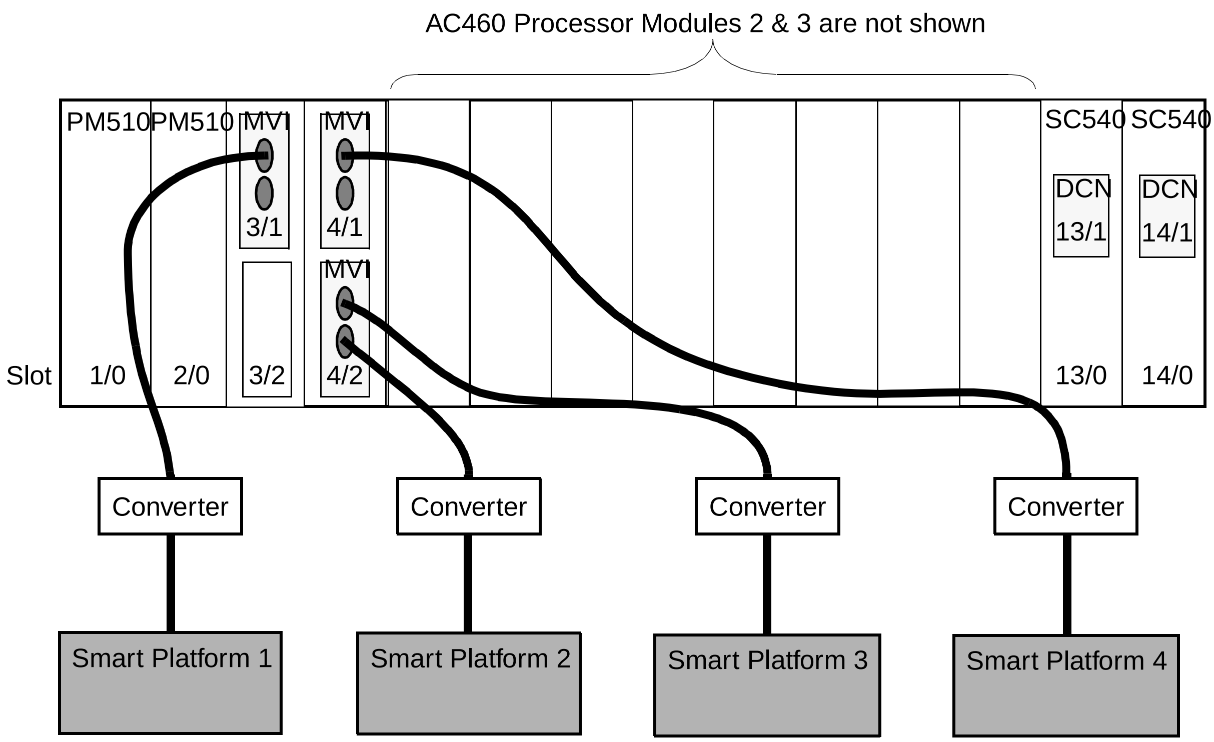


Figure 3-11. Advant Controller 460 with Smart Platform Interface Configuration

The Smart Platform Interface does not support data transfer rates larger than 100 AccuRay sensor measurements per second for 12 AccuRay sensors with the requesting interval of 5 seconds at a baud rate of 19.2 K.

3.1.4 DCN to DCN Interface

The AC410A14 DCN to DCN Interface (D/D) connects a traditional MOD 300 DCN (token passing) ring to another DCN ring.

The configuration of the D/D is described in Table 3-21, and one cardfile is shown in Figure 3-12; the second cardfile layout is the same.

Table 3-21. AC410A14 DCN to DCN Interface Components

Type Designator	Description	QTY.
DSRF 185	19-inch cardfile with 21 slot backplane	2
PM150V08	Motorola 68020-based Processor Module with 8 MB RAM, System Software (MTOS, DBMS, Communications, Diagnostics, CCF, TCL, TLL) runtime licenses	2
DSSR122	Voltage regulator	2
SB171	Battery Charger Power Unit	2
----	Plug-in Unit for T-Boxes	2
CS512	DCN Communication Submodule	4
TC530K01	DCN T-Box with Interface Cables	4

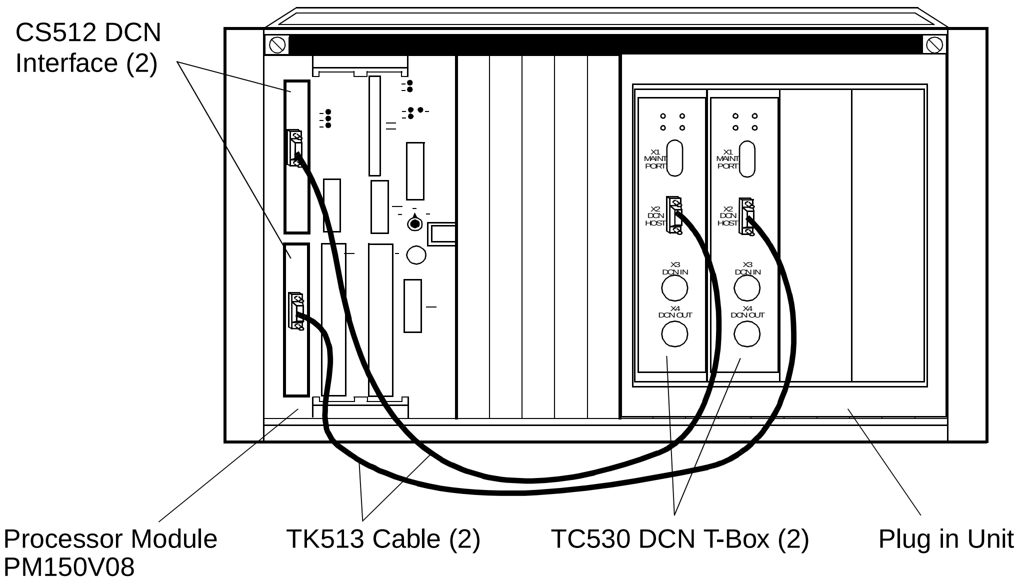


Figure 3-12. AC410A14 DCN to DCN Interface (D/D), Cardfile 1 of 2

3.1.4.1 PM150 Processor Module

The PM150V08 Processor Module unit is based on the Motorola 68020 processor and has 8 MB of RAM. The processor runs at 25MHz.

The front of the CPU board has LED indicators for diagnostics. A four-position rotary switch is provided for start-up and for selecting the operating mode, and a push-button is provided for restart.

3.1.4.2 CS512 DCN Interface

The D/D communicates on the MOD 300 Distributed Communication network (DCN) via the CS512 DCN Interface submodule. The basic unit comes with four DCN interfaces for redundant DCN communications.

To interface to a wire MOD 300 DCN, the TC530K01 DCN T-Boxes and Interface Cables supplied must be used. Each TC530K01 consists of:

- TC530 DCN T-Box
- TK513 T-Box to DCN Interface Cable (3m)

If a fiber optic DCN is used TC532 Fiber-optic DCN T-Boxes must be used instead of the TC530's (must be ordered separately).

Connection to the DCN is made via the TC530 T-Boxes (or TC532) and the TK513 DCN Interface cables, Figure 3-13.

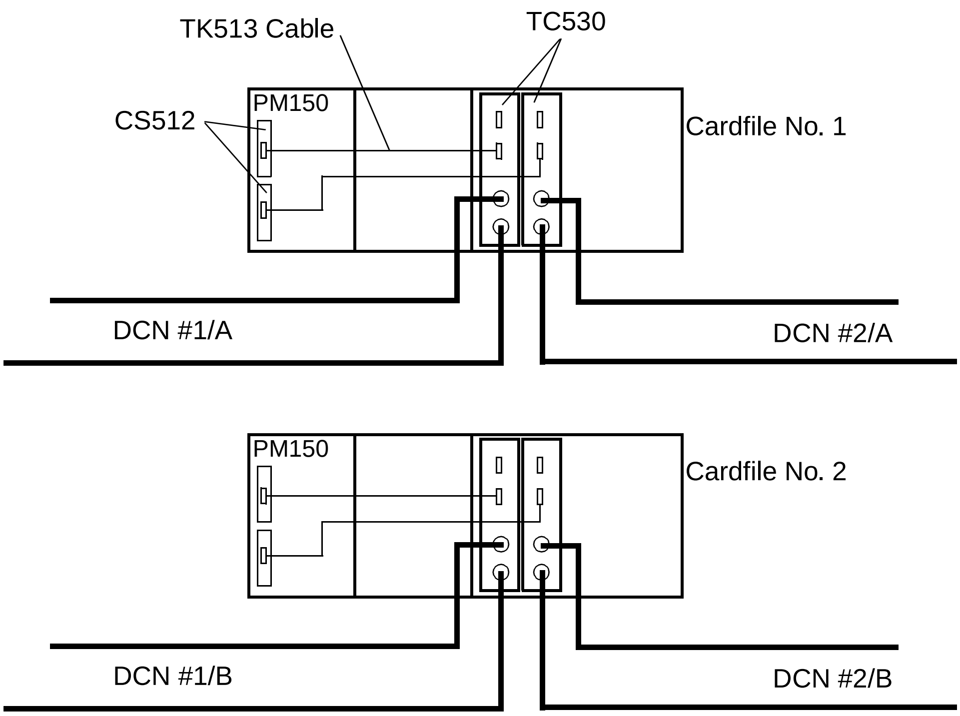


Figure 3-13. D/D Redundant DCN Connections

3.1.5 Flexible Packaging

Advant Controllers 460 and 410 can be mounted in enclosures at the ABB factory or they can be fabricated locally by the end-user or system integrator. In many cases, when customers are integrating systems, they want to mount components from a variety of manufacturers in the same enclosure. With the Advant Controllers, customers can purchase systems completely fabricated and tested, or they can buy the individual components and then complete assembly at the final destination.

ABB offers cabinets with several degrees of protection: ventilated, radio-proof, tropical and sealed, with or without cooling. Detailed information on cabinet options is described later in this section.

3.2 Process I/O

Advant OCS with MOD 300 Software supports a wide variety of I/O options. I/O strategies can be selected independent of the choice of control techniques, and any combination of I/O strategy and control language is valid. The following local and remote I/O options are available:

- S100 I/O
- S800 I/O
- TRIO

3.2.1 S100 I/O

The local I/O system, S100 I/O, is used for the Advant Controller 400 Series.

The S100 process interface can be used with either the Advant Controller 410 or Advant Controller 460. The interface consists of one or more I/O racks with several I/O boards, connection units and cables covering a wide variety of applications and specific needs. The I/O boards are divided into groups, depending on their function. Within each group, there are several I/O boards with differing functionality and complexity. The following table provides an overview of all available I/O boards.

Table 3-22. S100 I/O Modules

Model	Channels	Range	Redundant
DSAI 130	16	0-10V/0-20 mA, differential	
DSAI 133	32	0-10V/0-20 mA	
DSAI 145	31	Pt 100 RTD (3-wire)	
DSAI 151	14	Pt 100 RTD (4-wire)	
DSAI 155	14	Thermocouple	
DSAO 110	4	+/-10 V/+/-20 mA, Isolated	
DSAO 120	8	+/-10 V/0-20 mA	

Table 3-22. S100 I/O Modules

Model	Channels	Range	Redundant
DSAX 110	8 In, 8 Out	0-10 V/0-20 mA	Yes
DSDI 110A	32	24/110 V dc, 120/230 V ac, w/ time filter	
DSDI 115	32	24/110 V dc, 120/230 V ac	
DSDO 110	32	24-250 V ac or V dc, Relay	
DSDX 180	32	Universal Digital I/O	Yes
DSDP 150	12	Pulse Input, 10KHz, 5/12/24 V dc	

With the Advant Controller 460, each I/O subrack can contain up to 20 I/O boards and up to three I/O Subracks can connect to each AC460 Processor Module. The Advant Controller 410 can support up to 15 I/O boards and can not be expanded.

Each circuit board is connected to the rear plane of the rack. One or several connection units with disconnectable screw terminal blocks, individually or in groups for connection of the process cables, are provided for each I/O module. The connection units are connected with the I/O module via standard cables and are normally mounted on the rear wall of the RE5xxx cabinet or in the 6050E full-depth or 6051E half-depth MOD cabinet.

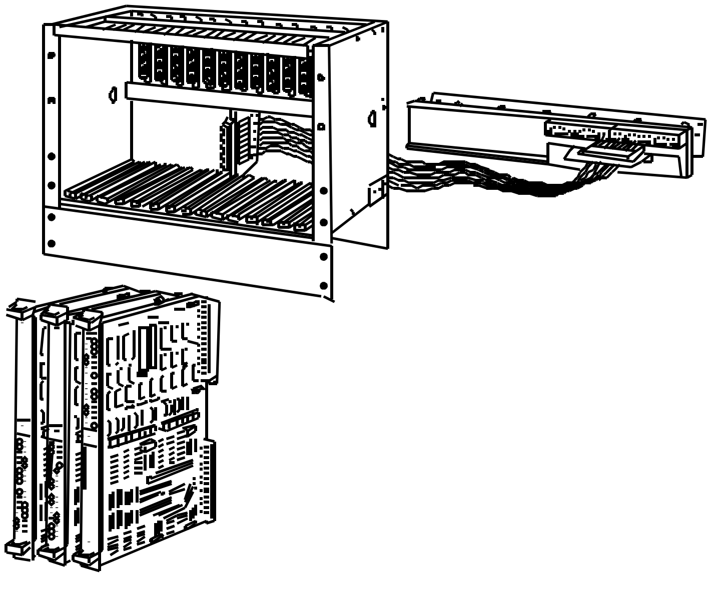


Figure 3-14. S100 I/O Subrack Configuration

The connection units have additional terminals for power distribution to sensors and actuators. For analog inputs the connection units also include current shunts. This feature makes it possible to exchange analog input modules without breaking current loops.

Digital I/O modules have LED indicators showing the status of each channel. Analog input units have a LED indicating the successful completion of each A/D conversion.

Diagnostic functions are executed for all I/O modules at system start-up and during normal operation. Any fault detected is indicated by a LED on the relevant I/O module, and by a system error message reported to the operator workplace(s).

I/O modules can be exchanged while the system is running. New modules can also be inserted live. A newly inserted module is taken into operation within 10 seconds.

The DSAX110(Analog) and the DSDX180(Digital) provide both input and output capabilities along with an optional redundancy feature.

3.2.1.1 Power Supply

I/O Series 100 can be connected to the following types of power source:

- 120/230 V ac, 50/60 HZ
- 24/48 V dc via a dc/dc converter, providing galvanic isolation between the power line and I/O Series 100.
- 24 V dc (without dc/dc converter) will be grounded in the I/O Series 100 cabinet.

The power supply system in I/O Series 100 can be provided with redundancy by doubling the unregulated power supplies (or dc/dc converters) and by using a special voltage regulator.

Normally a single regulator is used but when redundancy is demanded a regulator with three stabilizing units connected in parallel are used. When the redundant regulator is used a failed unit can be replaced while the I/O Series 100 is under full operation.

All essential functions in the power supply system are supervised and the status is indicated on LEDS. An extra power supply can be mounted in the cabinet for supply of sensors, limit switches, extra relays, etc.

3.2.1.2 S100 I/O Modules

The total range of I/O modules in S100 I/O is presented in the following tables. An I/O set consists of an I/O module, a cable and one or several connection units. The reason for presenting the I/O Series 100 in sets is that the functions are defined by a module and its connection units.

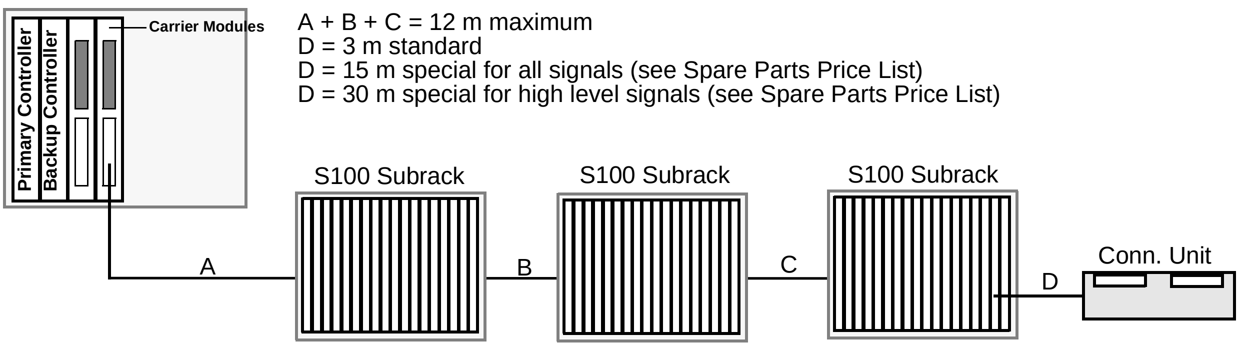


Figure 3-15. S100 Cable Distances

Table 3-23. Analog Input Sets for Local I/O

I/O Set	Description
DSAI 130 DSTA 131 DSTK 150	16 channels, resolution 12 bit, differential 0 to ±10 V or 0 to ±20 mA, shunt 250 ¾ 0.1% CMV 100 V, CMRR > 100 dB (50 Hz)
DSAI 133 2 x DSTA 002 DSTK 152	32 channels, resolution 12 bit, single-ended 0 to +10 V or 0 to +20 mA, shunt 250 ¾ 0.05%
DSAI 145 DSTA 145 DSTK 202	31 (+ 1 ref.) channels for Pt100, 3-wire, resolution 12 bits, -100/ +320 or -200/ + 640 °C
DSAI 151 DSTA 151 DSTK 160	14 (+ 2 ref.) channels for Pt100, 4 wire, resolution 12/13 bits, -40/ +40 or -100/ +320 or -200/ +640 °C
DSAI 155A DSTA 156 DSTK 187	14 (+ 2 ref. + 1 compens.) channels for thermocouples, resolution 12 bits, measurement ranges B, C, E, J, K, R, R1680, S, T, T385 for thermocouples with grounded output signal, CMV 16 V, CMRR > 100 dB (50 Hz)

Table 3-23. Analog Input Sets for Local I/O

I/O Set	Description
DSAI 155A DSTA 156 DSTK 186	14(+ 2 ref. + 1 compens.) channels for thermocouples, resolution 12 bits, measurement ranges B, C, E, J, K, R, R1680, S, T, T385 for thermocouples with floating output signal
DSTA 155	Connection unit for compensation of the cold junction. Used between the thermocouples and DSTA 156

Table 3-24. Redundant Analog Input Sets for Local I/O

I/O Set	Description
2 x DSAI 133 2 x DSTA 002 2 x DSTK 152	With redundancy: 32 channels, resolution 12 bits, single-ended 0 to + 10Vor 0 to +20mA shunt 250 ¾ 0.05%

Table 3-25. Analog Output Sets for Local I/O

I/O Set	Description
DSAO 110 DSTA 160(1) DSTK 153	4 channels, resolution 12 bits, 0 to ±10 V or 0 to ±20 mA, galvanic isolation.
DSAO 120 DSTA 170(2) DSTK 153	8 channels, resolution 12 bits, 0 to ±10 V or 0 to ±20 mA.

(1) DSTA 160: length 80 mm (3.2”)
(2) DSTA 170: length 160 mm (6.3”)

Table 3-26. Analog Input/Output sets for Local I/O

I/O Set	Description
DSAX 110 DSTA 001 DSTK 153	8 input channels, resolution 12 bits, single-ended, 0 to +10 V or 0 to +20 mA, shunt 250 ¾ 0.05%. 8 output channels, resolution 12 bits, 0 to +20 mA or 0 to +10 V (over shunt 500 ¾ 0.1% on DSTA 001)

Table 3-27. Redundant Analog Input/Output sets for Local I/O

I/O Set	Description
2 x DSAX 110 DSTA 001 2 x DSTK 153	For redundancy, 8 input channels, resolution 12 bits, single-ended, 0 to +10 V or 0 to +20 mA, shunt 250 ¾ 0.05%. 8 output channels, resolution 12 bit, 0 to +20 mA or 0 to + 1O V (over shunt 500 ¾ 0.1% on DSTA 001)

Table 3-28. Pulse Counting Sets for Local I/O

I/O Set	Description
DSDP 150 DSTD 150A DSTK 160	Pulse Counting Set 12 ch., 5/12/24 V d.c. max. 10 kHz

Table 3-29. Analog Isolation Amplifier

I/O Set	Description
DSTY 101(1)	**Analog isolation amplifier** to be mounted on mounting bar DSRA 110. Input/Output: 0 to ±10V or 0 to ±20 mA, single-ended. Accuracy: 0.1% Isolation voltage: 3 kV Supply Voltage: 24 V d.c.

(1) DSTY 101, length 53 mm (2.1”)

Table 3-30. Digital Input Sets for Local I/O

I/O Set	Description
DSDI 110A DSTD 150A DSDK 150	32 channels, 24 V d.c., controlled by scanning or interrupt, pulse extension
DSDI 110A DSTK 165 DSTD 195[1] DSTD 196[1] DSTD 197[1] DSTD 198[1]	4 x 8 channels, input voltage according to connection unit, controlled by scanning or interrupt, pulse extension - Connection unit for 8 channels, 24 V d.c. all channels galvanically isolated - Connection unit for 8 channels, 24 V d.c. - Connection unit for 8 channels, 110 V d.c. or 120 V a.c. - Connection unit for 8 channels, 230 V a.c.
DSDI 115 DSTK 165 DSTD 195[1] DSTD 196[1] DSTD 197[1] DSTD 198[1]	32 channels, input voltage according to connection unit, controlled by scanning - Connection unit for 8 channels, 24V d.c. all channels galvanically isolated - Connection unit for 8 channels, 24 V d.c. - Connection unit for 8 channels, 110 V d.c. or 120 V a.c. - Connection unit for 8 channels, 230 V a.c.

(1) DSTD 195, 196, 197, 198: length 120 mm (4.7")

Table 3-31. Digital Output Sets for Local I/O

I/O Set	Description
DSDO 110 DSTK 165	32 channels, 24- 250 V a.c./d.c. N.B. Without connection units. For connection units, see DSTC 108/108L below
DSTD 108[1]	Connection unit with 8 relay channels Input: 24 V d.c. Output: 24-250 V a.c./d.c. Relay data see NOTE 1
DSTD 108L[1]	Connection unit with 8 relay channels Input: 24 V d.c. Output: 24-2 50 V a.c./d.c. relay data see NOTE 2

(1) DSTD 108 and DSTD 108L: length = 120 mm (4.7”)

NOTE 1 Relay data
Load current: max 3 A, min 0.1 A at 24 V or 2.5 VA
Breaking capacity: a.c. max 720 VA at cos F > 0.4
d.c. max 44 W at L/R < 40 ms
NOTE 2 Relay data for L version
Load current: max 100 mA, min 5 mA or 2.5 VA
Breaking capacity: a.c. max 100 mA or 5 VA at cos F > 0.4
d.c. max 100 mA or 5 VA at L/R < 40 ms

Table 3-32. Digital I/O Sets for Local I/O

I/O Set	Description
DSDX 180	32 channels, 24VDC, 120&240VAC
DSTL 152	2 connection units 16 channels each
2 x DSTX 180	Inputs/Outputs determined by Conditioning Modules. (See Table Below)

Table 3-33. Digital Input Conditioning Modules

Conditioning Module	DI010	DI015	DI020	DI012
Data	**Input DC (white)**	**Input AC (yellow)**	**Input AC (yellow)**	**Input Dry Contact (white)**
Input Voltage (nominal)	24 V dc	120 V ac	240 V ac	24 V dc
Voltage range	0 - 30V dc	0 - 140V ac	0 - 264V ac	24 V dc
Input current at maximum input voltage	8.5 mA	10 mA	7 mA	5 mA
Isolation (input to output)	4 kV ac	4 kV ac	4 kV ac	4 kV ac

Table 3-34. Digital Output Conditioning Modules

Conditioning Module	DO010	DO015	DO020
Data	**Output DC (red)**	**Output AC (black)**	**Output AC (black)**
Line Voltage (nominal)	24/48 V dc	120 V ac	240 V ac
Voltage range	5 - 60V dc	24 - 140V ac	24 - 280V ac

Table 3-34. Digital Output Conditioning Modules

Conditioning Module	DO010	DO015	DO020
Output current (rms)	1 A	2 A	2 A
Power Dissipation	1 Watt/Amp	1 Watt/Amp	1 Watt/Amp
Isolation (input to output)	4 kV ac	4 kV ac	4 kV ac

NOTE: Longer I/O connection cables can now be ordered. In addition to the 3m DSTK I/O connection cables, 15m and 30m lengths are available. These cables connect between the I/O module and the connection unit. The new longer length cables can be ordered from the Advant OCS Spare Parts Price List.

Mounting Bars

The S100 I/O Connection Units are fastened to mounting bars which screw to the cabinet rails. The mounting bars are available in two styles:

- RA121 - 24” for use in RE5xxx cabinetry
- RA120 - 19” for use in MOD 300 cabinetry.

S100 I/O Capacities

Practical limits must be considered when the data below is applied:

- Space in the cabinet.
- Processor Module load
- Integrity aspects
- Availability aspects

Table 3-35. Capacity S100 I/O

Data	Value
Number of busses (bus extension) per Processor Module	4
Number of I/O subracks per bus	max 5
Length of each bus extension	max 12 m
Number of I/O boards per subrack	max 20
Number of DI boards (incl. DSDP 110) DI signals	48 max 1536

Table 3-35. Capacity S100 I/O

Data	Value
Number of DO boards DO signals	48 max 1536
Number of AI boards AI signals	32 max 1024
Number of AO boards AO signals	32 max 1024

NOTE: For more details and I/O specifics, refer to the S100 I/O Technical Supplement.

3.2.1.3 S100 I/O with Redundant Communications

The AF 100 can support, on each twisted pair cable segment, a maximum of 32 stations. The recommended minimum twisted pair cable length between stations is 4 meters; shorter lengths can cause communication problems.

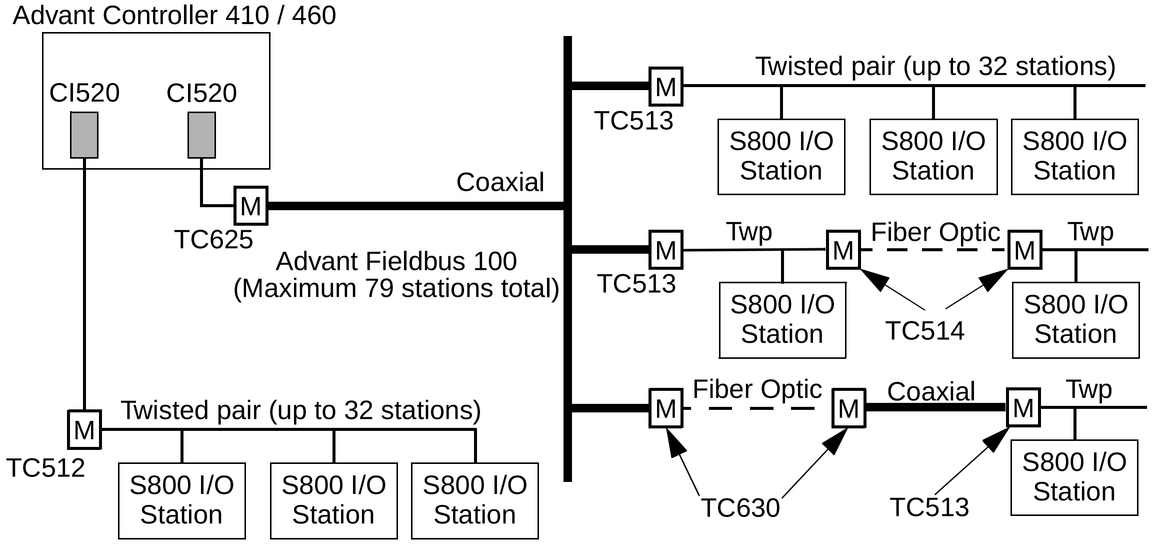


Figure 3-16. AF 100 Cabling Example

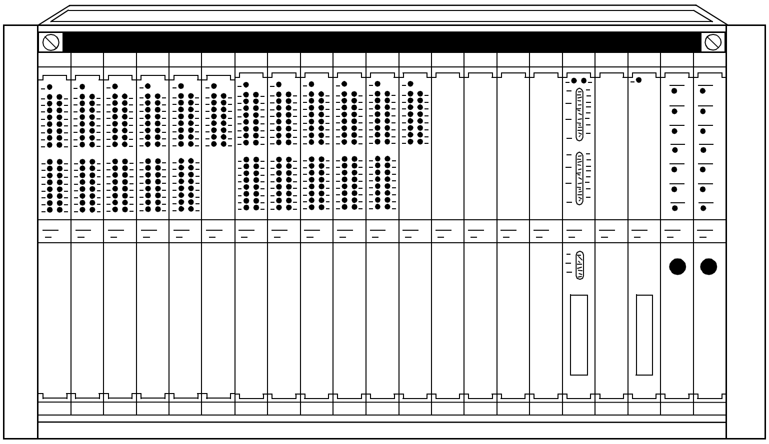


Figure 3-17. I/O Subrack with two Bus Extender Boards DSBC 175 for Redundancy.

In a redundant communication configuration, two CI540 submodules in the AC 460 are used, and two DSBC 175 Bus Extender Boards are inserted into the last two positions of the I/O subrack. Together, they interface between the Controller's main Processor Module and the backplane bus on the I/O subrack.

You can connect up to five I/O subracks in a chain. When using communication redundancy, two bus extender slave boards are required and up to 19 I/O boards can be inserted. Two external bus extender master boards (CI540) connect the I/O subracks to the Controller's main Processor Module.

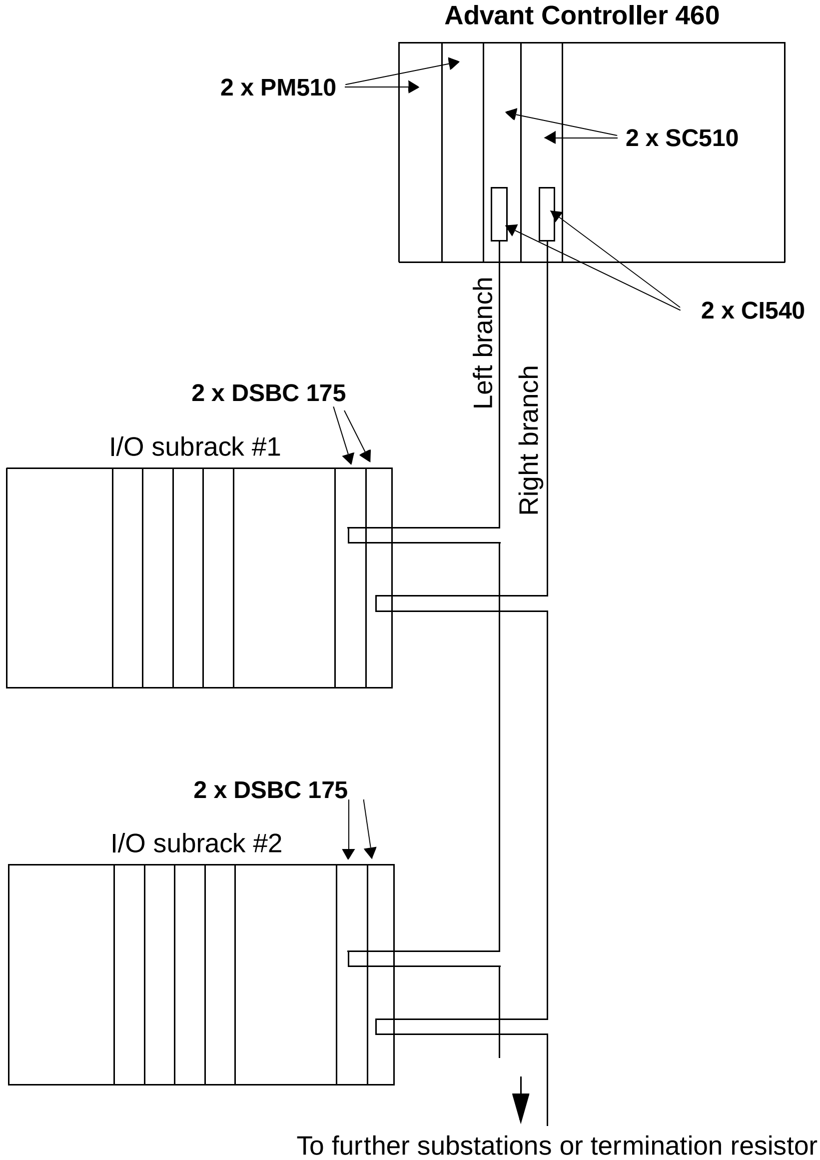


Figure 3-18. Redundant Configuration with DSBC 175

In redundant configurations two Processor Modules PM510, two Carrier Modules SC510, and two Bus Extender Masters CI540 are used in the AC 460. One CI540 is connected to the left bus branch, one to the right bus branch. In the I/O subracks two DSBC 175 are used, the left is connected to the left bus branch, the right one is connected to the right bus branch.

The I/O subracks can be configured for the AC 460 using optical bus extenders.

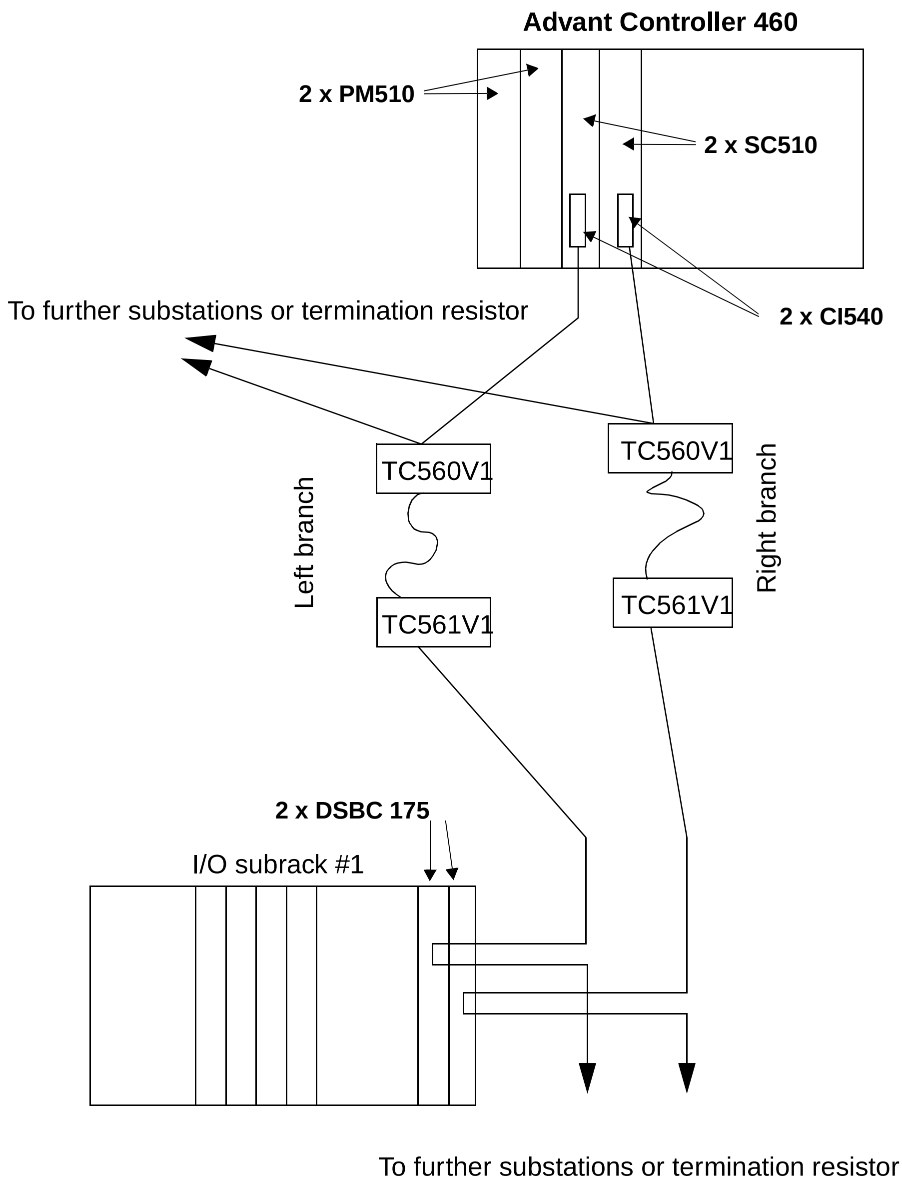


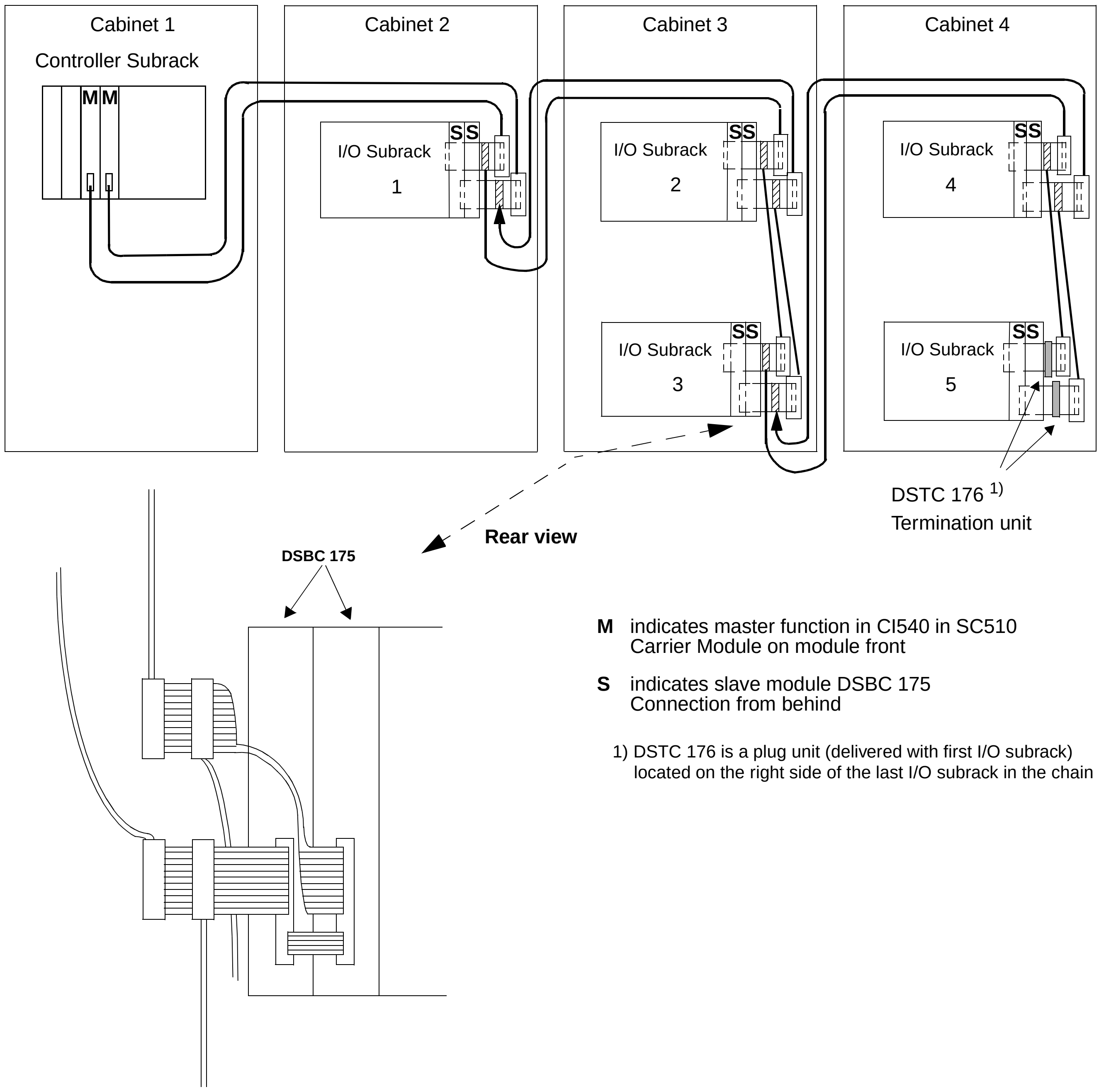
Figure 3-19. Redundant Configuration with Optical Bus Extension

Redundant LAN Operation

The following functions are supported:

- Bus clock signals, generated for the backplane bus on the I/O subrack.
- Supervision of functions such as fans and redundant regulators.

- LED’s on the DSBC 175 front, indicating status of the I/O subrack



M indicates master function in CI540 in SC510 Carrier Module on module front

S indicates slave module DSBC 175 Connection from behind

1) DSTC 176 is a plug unit (delivered with first I/O subrack) located on the right side of the last I/O subrack in the chain

Figure 3-20. Example of How to Connect Redundant CI540´s to Redundant DSBC 175’s in a RE Cabinet

3.2.1.4 Bus Extension with Redundant Bus Extenders

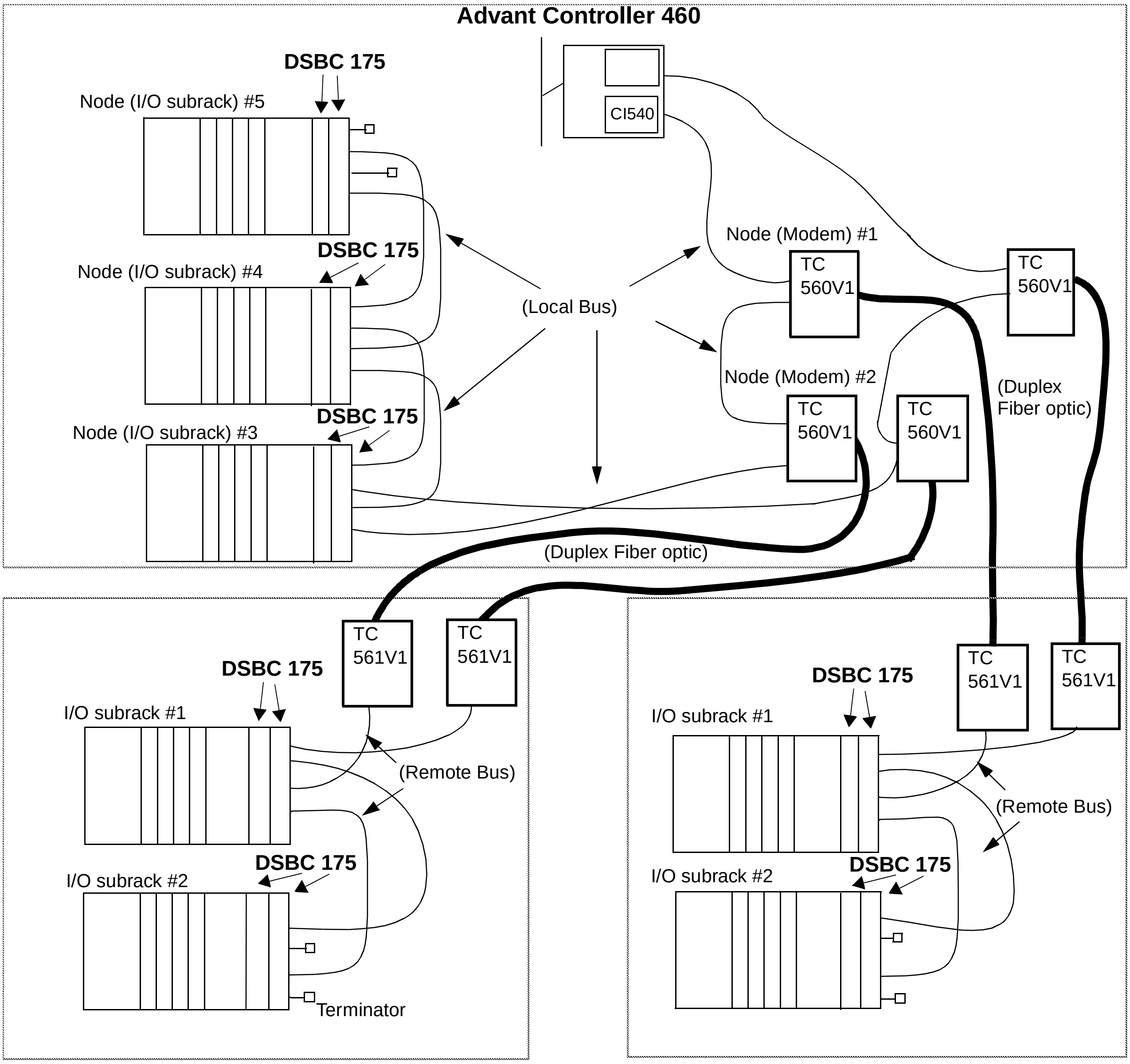


Figure 3-21. Example of Optical Bus Extension with Advant Controller 460 and Redundant Bus Extenders

The preceding figure shows the Advant Controller 460 and I/O Subracks with redundant bus extenders chained together with Bus Extension Cables **and** Optical Bus Extensions.

SPECIAL NOTE: When using single communications, the DSBC 173A Bus Extension Module has been replaced with the DSBC 175 Bus Extension Module.

3.2.1.5 Optical Bus Extension

The optical bus extension is a complement to the normal S100 I/O bus extension used in the Advant Controller 460. You can not use the optical bus extension for Advant Controller 410.

With the optical bus extension, I/O subracks can be placed up to 500 meters (1600 feet) from the central subrack of the controllers.

The optical bus extension is a serial link designed for point-to-point connection (multidrop configuration is not possible) of up to 5 I/O subracks in the far-side. Between the I/O subracks in the far side, the normal bus extension is used.

For more information refer to the S100 I/O Technical Supplement.

3.2.1.6 Object Oriented Connection Units

Object Oriented Connection Units (OOCU) are available for S100 I/O digital inputs and outputs and analog inputs. The OOCUs offer the following features:

- Plug- in connector for each object.
- Object marking facilities.
- Built- in cross connection.
- LED indication for signal status at cable landing.

An “object” can be thought of as a device such as a motor. The OOCU uses one field cable to provide all the digital input and output signals needed to control each object. Each single OOCU can support up to 8 objects. The OOCUs are used in groups of four to support up to 32 objects.

For more information refer to the S100 I/O Technical Supplement.

3.2.1.7 Intrinsic Safety Isolators for AC400 Series Controllers

ABB offers a complete intrinsically safe galvanically isolated process control interface, in conjunction with ELCON Instruments, for analog and digital I/O connected to Advant Controller 400 Series through S100 I/O. Standard prefabricated cables available in different lengths permit termination and marshalling in the main cabinets or in remote cabinets up to 15m (40’) away.

For more information refer to the S100 I/O Technical Supplement.

3.2.2 S800 I/O

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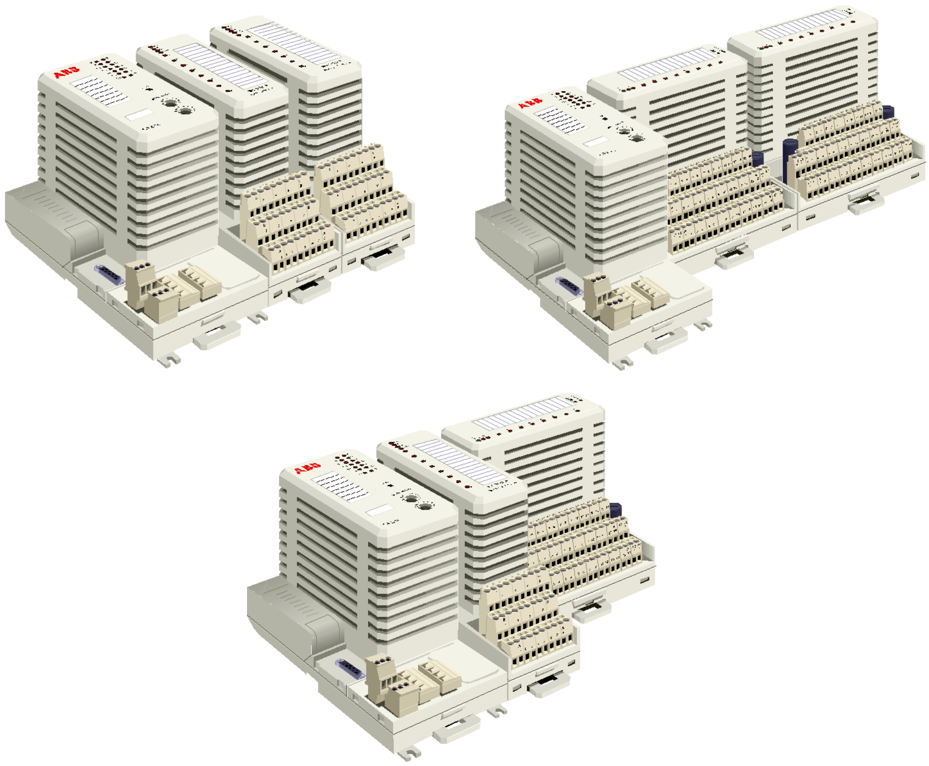


Figure 3-22. S800 I/O Field Communication Interface with an I/O Module on Compact and Extended MTUs

The S800 I/O is a distributed, modular, I/O system which communicates with Advant Controller 400 Series over Advant Fieldbus 100 (AF 100). The S800 I/O provides easy installation of the I/O modules and process cabling. It is highly modularized and flexible so that I/O modules can be combined to suit many applications. The S800 I/O can be mounted in many configurations to fit a wide variety of requirements

The S800 I/O Station is made up of three major components: the Fieldbus Communication Interface (FCI), the Module Termination Unit (MTU), and the I/O Module. The I/O Module plugs onto the MTU. These three components are shown in the following figure:

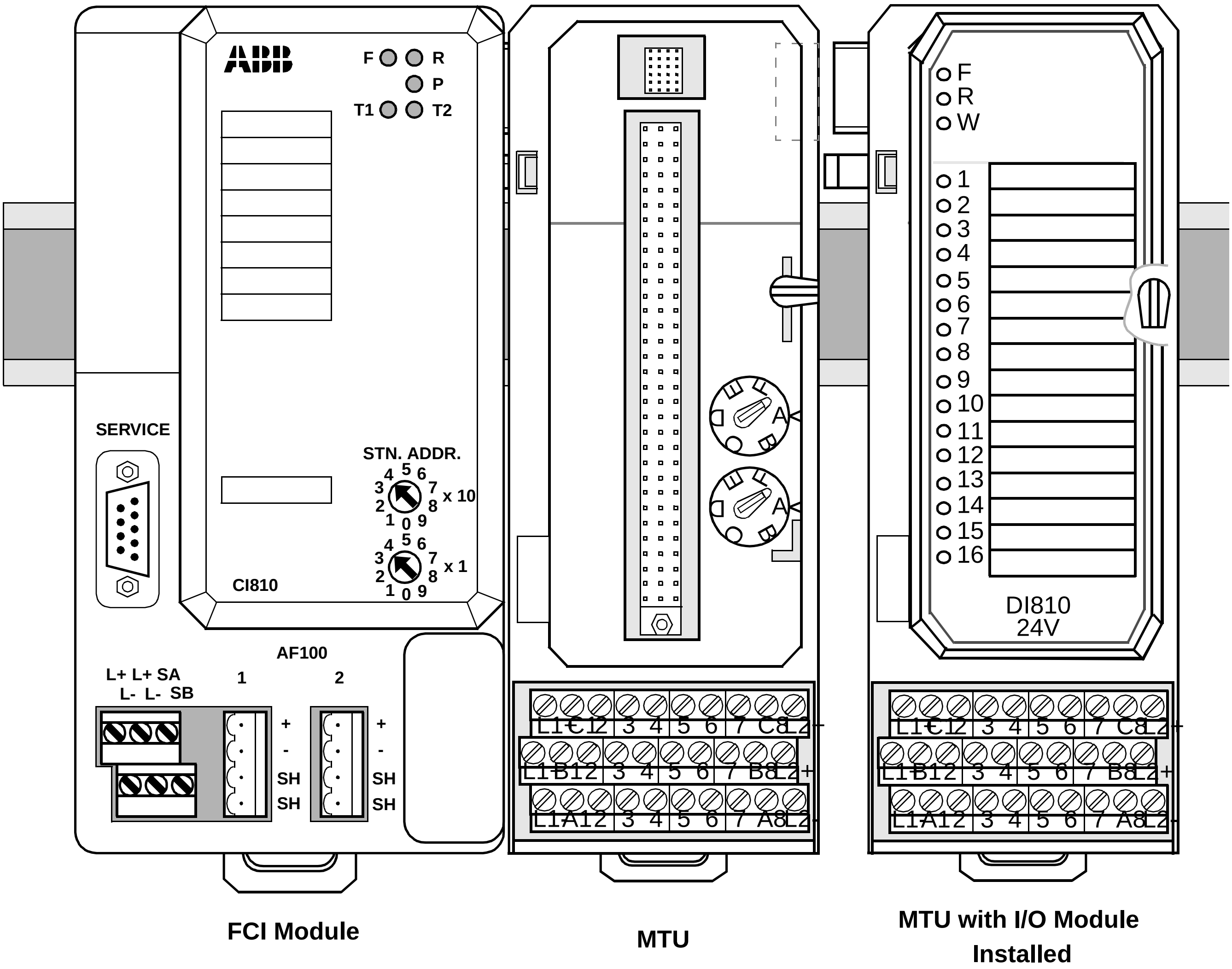


Figure 3-23. I/O Station Components

The following terms and definitions are used as part of the S800 I/O:

Table 3-36. S800 I/O Terminology

Term	Definition
CI520	Advant Controller S800 I/O personality submodule.
AF 100	The Advant Fieldbus 100 is the field communication bus between the CI520 submodule and the S800 FCI modules.
FCI	The Fieldbus Communication Interface (FCI) device contains the interface to the AF 100, Modulebus interface and power regulators. The FCI module can manage 12 I/O devices
I/O module	Is the active, electronic and signal conditioning part of an I/O device.
MTU	The Module Termination Unit is a passive base unit containing process terminals and a part of the Modulebus.
I/O device	A complete I/O device consists of one MTU and one I/O module.
I/O Station	An I/O station consists of one FCI and 1 to 12 I/O devices.
Modulebus	Is an incremental, electrical, bus for interconnection of I/O devices. The maximum length of the Modulebus is 2 meters.
(Modulebus) Extension cable	Is used when extending the Modulebus (within the max. 2 meters).
Opto-repeater	The Opto-repeater device is used when optically expanding an I/O station with more I/O stations.
(Modulebus) Opto-fibre Expansion	The optical interconnection is used for expanding an I/O station or a PLC station with up to seven additional I/O stations (after the second development step).

3.2.2.1 S800 I/O Product Overview

The S800 I/O modules and a Fieldbus Communication Interface module are combined to form an I/O Station. The I/O Station with S800 I/O connects to the AC400 Series controller via the Advant Fieldbus 100. The equipment that is used as part of the I/O Station with S800 I/O is presented in the table below

Table 3-37. I/O Station with S800 I/O Components

Device Type Designator	Function
CI520	S800 I/I personality submodule, AF100 interface
AI810	8 AI channels (1*8), 0...20mA, 0...10V
AI820	4 AI channels (differential), -20...+20mA, -10...+10V, -5...+5V

Table 3-37. I/O Station with S800 I/O Components (Continued)

Device Type Designator	Function
AI830	8 AI channel for Resistance Measurements (e.g. Pt 100 sensors)
AI835	7+1 AI channels for Thermocouples or mV Inputs
AO810	8 AO channels (1*8), 0...20mA
AO820	4 AO channels (bipolar), -20...+20mA, -10...+10V
CI810	Fieldbus Communication Interface (FCI) for S800 I/O Station
DI810	16 DI channels (2*8), 24V d.c.
DI820	8 DI channels (8*1), 120V a.c.
DI821	8 DI channels, (8*1) 230V a.c.
DO810	16 DO channels (2*8), 24Vd.c.,0.5A
DO820	8 DO channels (8*1), Relay, 250V 3A a.c.
TB805	Cable adaptor out module (electrical ModuleBus)
TB806	Cable adaptor in module (electrical ModuleBus)
TB807	Terminator module for electrical ModuleBus
TB810	ModuleBus Optical Port Module 10 Mbit/s, fiber optic connection on the CI810 for S800 I/O
TB820	ModuleBus Modem, fiber optic ModuleBus interface of an I/O cluster.
TC501V150	Cable terminator for AF 100 twisted pairs, 150 ohms
TC505	Connector: AF 100 Trunk Tap to FCI
TC512	Modem for Advant Fieldbus 100 with twisted pair (twp) output (RS485 --> twp)
TC515	Modem for conversion (twp --> twp) or (twp --> twp)
TK801V003	Cable, ModuleBus Extension, 300 mm (11.8 inches)
TK801V006	Cable, ModuleBus Extension, 600 mm (23.6 inches)
TK801V012	Cable, ModuleBus Extension, 1.2 meters (47.25 inches)
TK811V015	Cable, Optical ModuleBus Extension, 1.5 meters (59 inches)
TK811V050	Cable, Optical ModuleBus Extension, 5 meters (16 feet)
TK811V150	Cable, Optical ModuleBus Extension, 15 meters (50 feet)
TU810	Compact MTU, 3*8 + 2*2 terminals, 50V.

Table 3-37. I/O Station with S800 I/O Components (Continued)

Device Type Designator	Function
TU830	Extended MTU, 3*16 + 2*4 terminals, 50V
TU835	Extended MTU, 2*4 groups + 2*2 power terminals, 50V, individually fused per channel
TU836	Extended MTU, 2*4 groups + 2*2 power terminals, 250V, individually fused per channel
TU811	Compact MTU, 2*8 terminals, 250V
TU831	Extended MTU, 2*8 terminals, 250V
SD811	Power supply, 120/230V ac to 24V dc @ 2.5A
SD812	Power supply, 120/230V ac to 24V dc @ 5.0A
RE810	Wall Cabinet, IP65, 800 x 1000 x 300mm (31.5 x 39.4 x 11.8)

.

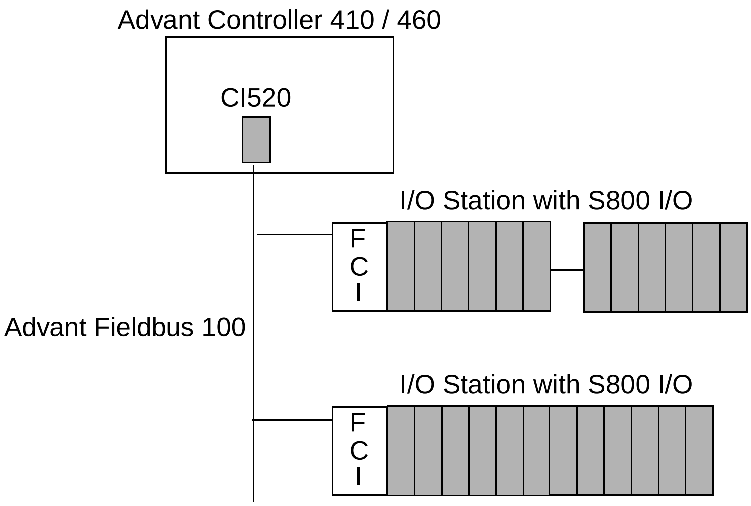


Figure 3-24. S800 I/O Overview

S800 I/O Station

An I/O station with S800 I/O consists of one FCI and up to 12 I/O modules. The Fieldbus Communication Interface (FCI) connects to the Advant Fieldbus 100 (AF100) and supports the I/O modules. The FCI module is the bus-master on the Modulebus which is used to communicate with the I/O modules.

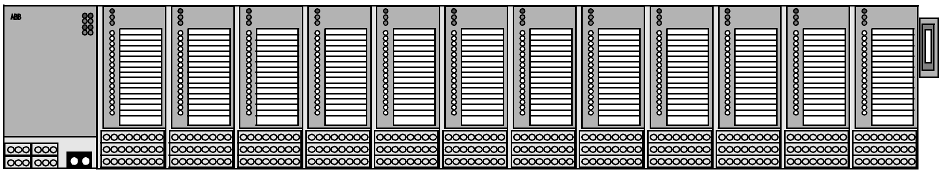


Figure 3-25. S800 I/O Station with 12 I/O Devices

An I/O station can have a maximum of 192 digital channels or a maximum of 96 analog channels. Each I/O module is installed on a Module Termination Unit (MTU). The first MTU with its I/O module connects to the FCI. Each of the remaining MTUs connect to the previous MTU creating a Modulebus. The Modulebus requires a terminator to be installed in the last MTU of the I/O station.

The I/O station can be divided in groups using a TK801 Modulebus extension cable between the groups. The TK801 extension cables are available in three lengths; 0.3m (1’), 0.6m (2’), and 1.2m (4’). A TB805 Modulebus Outlet (male), and a TB806 Modulebus Inlet (female) must be used at each end of the extension cable in order to plug it into the I/O Device or FCI module. The last I/O Device on the modulebus must be terminated using the TB807 Modulebus Terminator.

The station may be broken up because of space limitations or to keep signal types together. The maximum Modulebus length of one I/O station including the FCI, modulebus terminator, and extension cables is 2 meters.

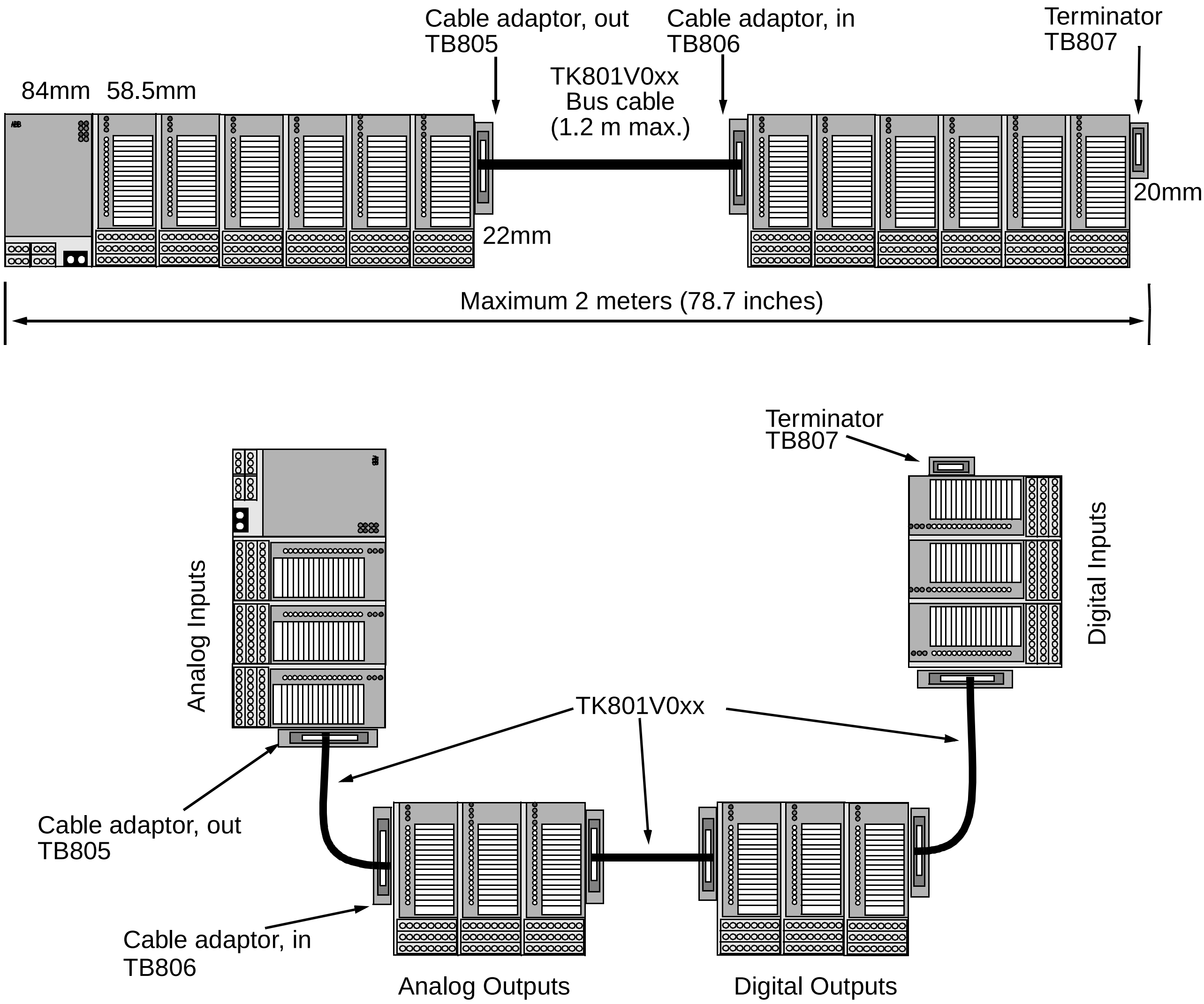


Figure 3-26. Modulebus Length. Configuration using Extension Cables.

3.2.2.2 CI810 Fieldbus Communication Interface

The CI810 Fieldbus Communication Interface (FCI) module is a configurable communication interface which performs operations such as signal processing, gathering of various supervision information, OSP handling and configuration of re-inserted I/O modules. The OSP (Output Set as Predetermined) is a feature which allows an output module to hold its value or go to a predetermined value in the event of a communication or watch-dog timer failure.

The FCI has two AF 100 interfaces which allows the use of redundant cable media. Up to 32 stations can be configured on one AF 100 using twisted pair cable. The FCI has two rotary switches that select its address on the fieldbus in the range of 01 - 79.

An I/O Station consists of the FCI module and the I/O modules. The FCI is the bus-master on the S800 I/O Modulebus and communicates with the S800 I/O modules. It is a pure “slave station” on the AF 100 which is controlled by the Advant Controller 400 Series.

I/O Station modules are mounted on DIN rails and are connected by the Modulebus. This principle allows horizontal and vertical mounting of the stations. The DIN rail also acts as the grounding bus for all modules attached to it.

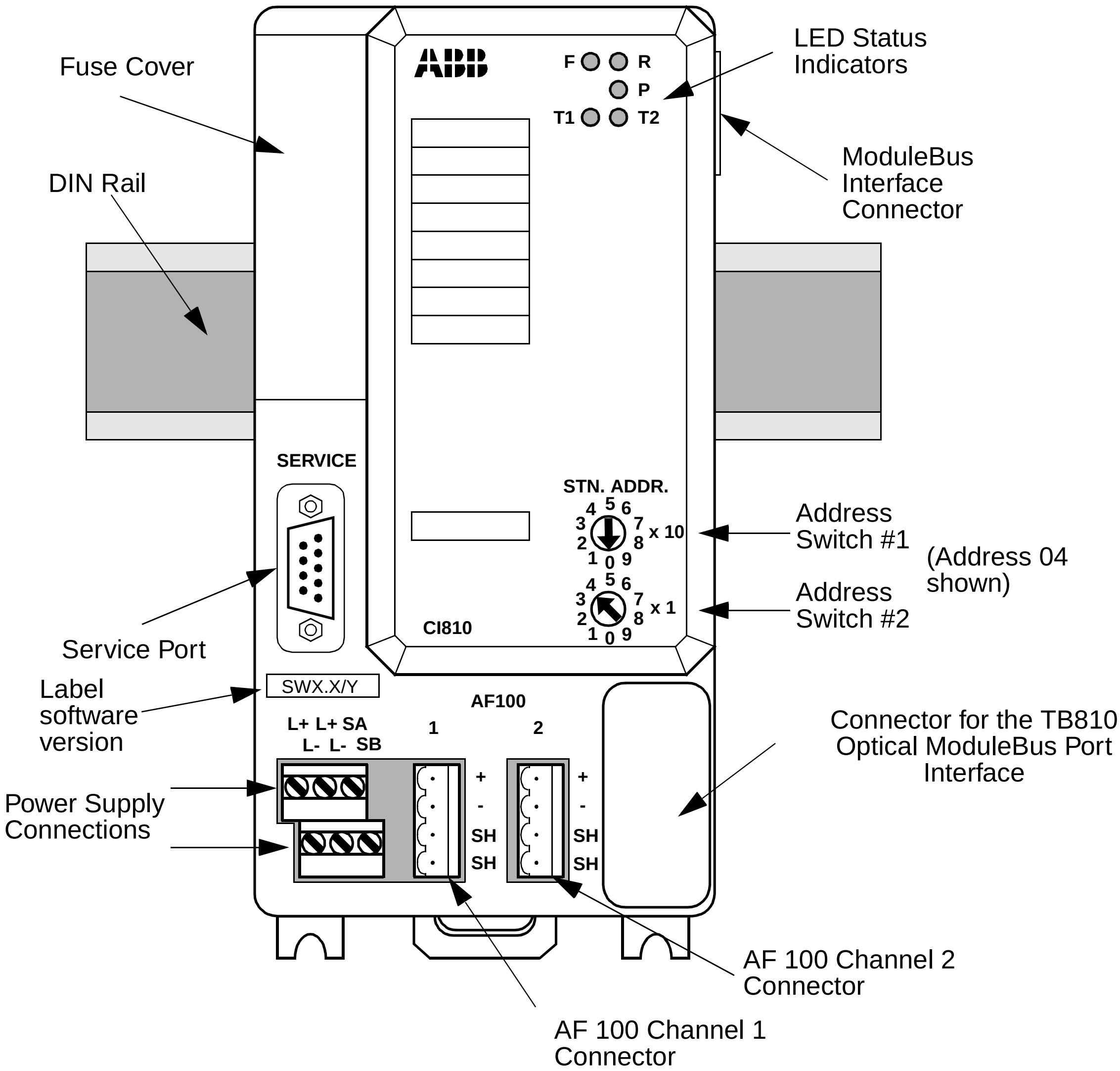


Figure 3-27. CI810 FCI Module

The FCI communicates with both the Advant Controller and the I/O modules. The FCI handles the I/O-modules operations such as read and write data, read status and configuration of modules and channels.

The FCI provides 24 V dc (from the source) and an isolated 5 V dc power to the I/O modules (12 maximum) by way of the Modulebus connections. The power source (single or redundant 24 V dc) can be connected to the power terminals (L+ & L-) of the FCI. A replaceable fuse for the 24 V supply to the I/O modules is located under the fuse cover.

The size, type and direction of data to be transferred on the AF 100 bus depends on and is determined by the I/O module type. The S800 I/O modules can be configured to send dynamic data to the AF 100 with cycle times in the interval of 1 to 4096 ms.

3.2.2.3 Advant Fieldbus 100 (AF 100)

The Advant Fieldbus 100 (AF 100) is the interface from the S800 I/O Station to the Advant Controller 400 Series. The AF 100 connects to the CI520 submodule located in the Advant Controller. Two ports are provided to support dual media between the CI520 and the FCI module. The CI520 submodule is the bus-master for the AF100. The AF 100 is a proprietary serial fieldbus running at 1.5M baud.

The AF 100 can be configured using twisted pair cable. The signal from the CI520 submodule can not be directly connected to the AF 100 without first going through a TC512 modem.The FCI directly accepts twisted pair cable. Maximum cable length is 750m (2450’) for twisted pair.

For the main trunk cable, a twisted pair cable type (IBM Type 1) similar to Belden number 9182 is recommended and for the local tap cable a double twisted pair (2-pairs) cable (IBM Type 6A) similar to Belden number 1215A should be used.

The AF 100 can support, on each twisted pair cable segment, a maximum of 32 stations. The recommended minimum twisted pair cable length between stations is 4 meters; shorter lengths can cause communication problems.

The AF 100 can support, on each twisted pair cable segment, a maximum of 32 stations. The recommended minimum twisted pair cable length between stations is 4 meters; shorter lengths can cause communication problems.

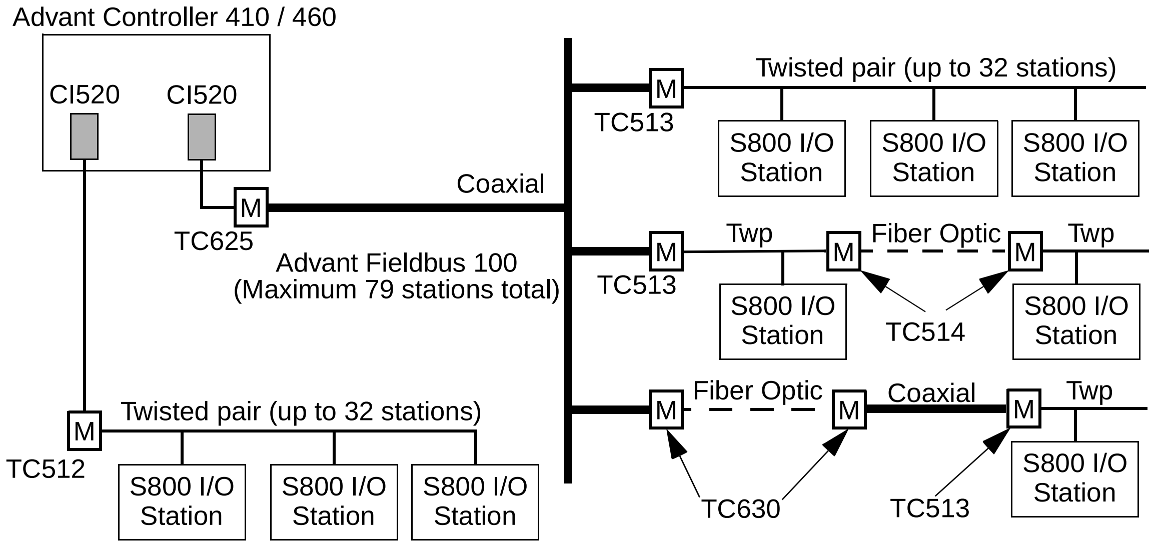


Figure 3-28. AF 100 Cabling Example

AF100 Connections to the I/O Station

The AF 100 cable segment that connects to the FCI of an I/O station must be shielded twisted pair. This twisted pair segment is coming from either a TC512 or a TC516 modem. It can be up to 750m (2450’) long and support up to 32 I/O stations. Connection to each FCI is made through an AF 100 Trunk Tap (TC505) as shown in the following figure. The TC505 allows connection from FCI to FCI and can be DIN rail mounted.

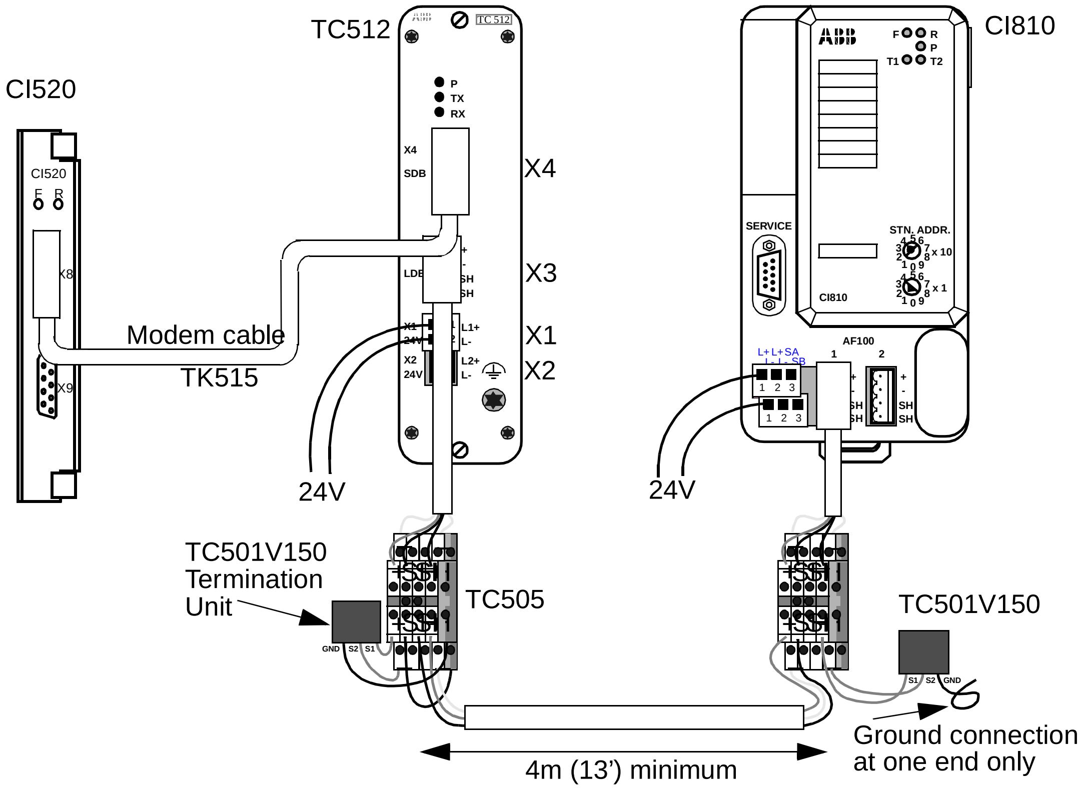


Figure 3-29. AF 100 Twisted Pair Cabling for I/O Station

A 150 ohm terminator (TC501) is required at the beginning and end of each AF 100 twisted pair segment. The FCI has two AF 100 interfaces which allows the use of redundant cable media. This requires a second set of cabling hardware identical to that previously described.

The Advant Fieldbus 100 User's Guide provides detailed information on AF 100 configuration.

AF100 Cable Specifications

Twisted pair cable, up to 750 m (2500 ft.) per segment, Communication media according to IEC 1158-2 fieldbus standard. Example of twisted pair cable used:

- Trunk cable: Belden - 9182 (Commercial 89182 (Plenum)), 1 pair, Stranded conductorIBM type 1, 2 pair, Solid conductor
- Tap cable: Belden - 1215A, 2 pair, Stranded conductor (electrically IBM type 6A)
- Connectors: For example, Phoenix Combicon MSTB 2.5/4-ST-5,08

3.2.2.4 Redundant S800 I/O FCI Modules

The TB815 Interconnection Unit is used with redundant CI820 FCIs to provide an interface to the ModuleBus (electrical and optical) and service port connections. All signals between the redundant FCIs such as AF 100 signals and control signals are routed through the TB815 and it also provides the termination of the electrical ModuleBus.

The TB815 has a connector for the optional TB810 Optical ModuleBus Port extension.

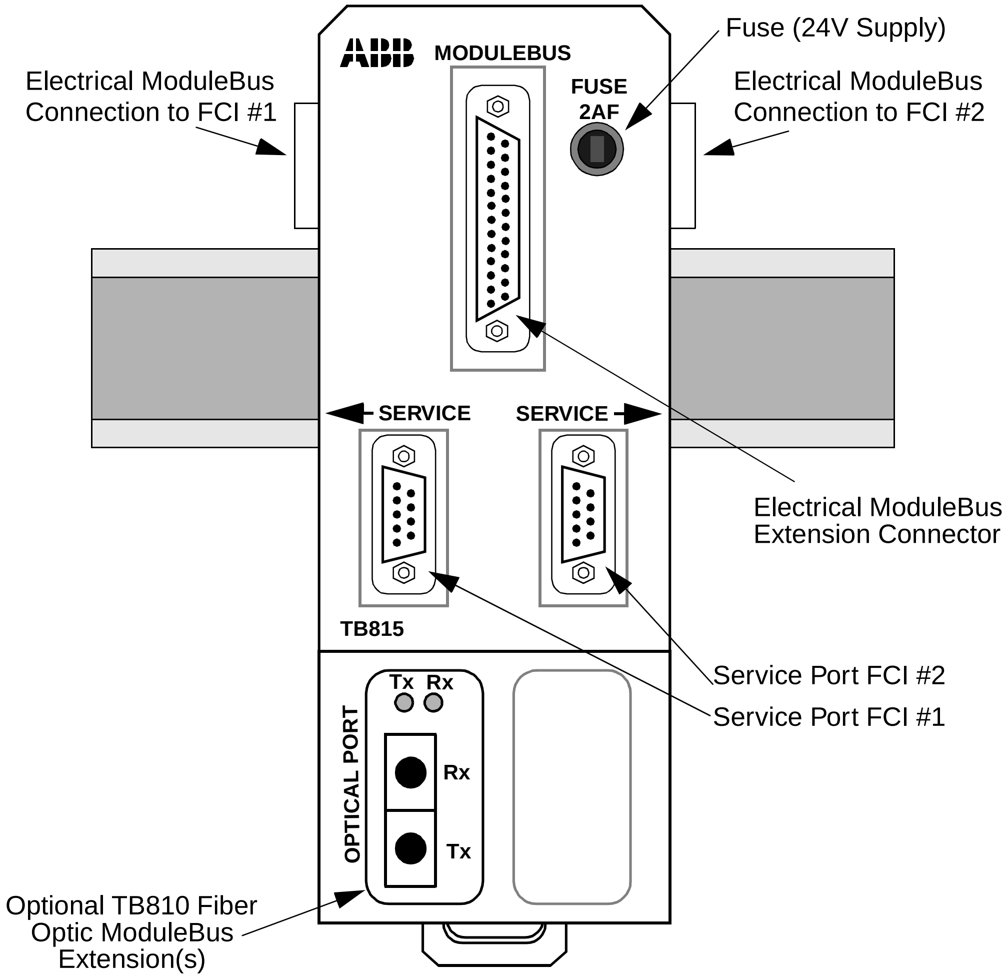


Figure 3-30. TB815 Interconnection Unit Layout

An I/O Station with redundant FCIs requires two CI820 FCIs and a TB815 Interconnection Unit. They are connected to the I/O modules of the base cluster by an electrical ModuleBus extension cable. From the TB815 ModuleBus connector, a TK801V0xx cable is connected to the first MTU via a TB806 Cable Adapter-in module.

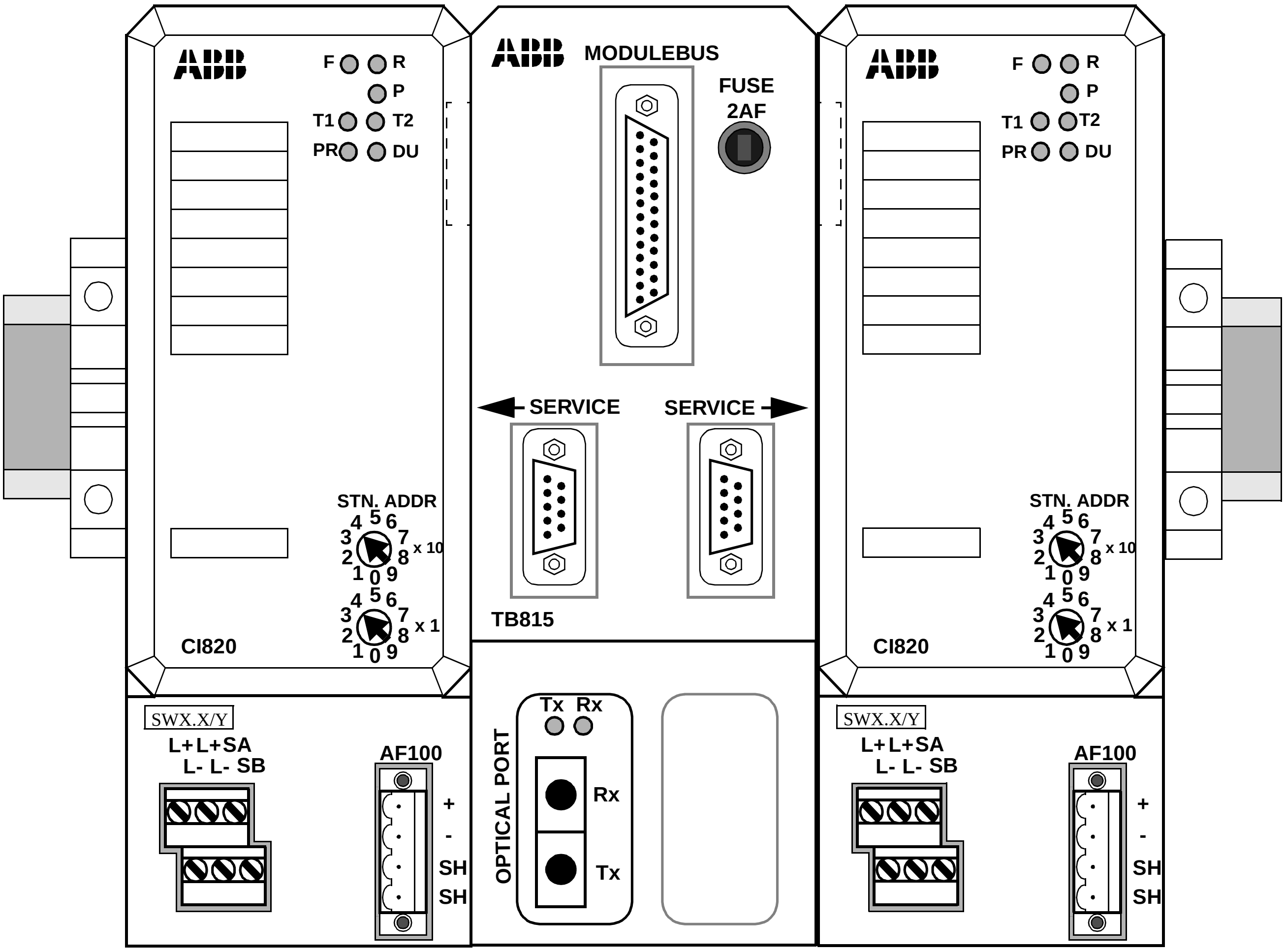


Figure 3-31. Redundant CI820 FCIs and TB815 Interconnection Unit Layout

The redundant FCIs can either be mounted on a separate DIN rail or the same one as the I/O modules. Room must be allowed to the left and right of the FCIs for disconnection from the TB815 for removal.

The total length of the ModuleBus extension, from the TB815, and ModuleBus segments of the I/O modules must not exceed 2.5 meters (8.2 feet).

Optical ModuleBus Extension can be connected to the TB815 via the TB810 ModuleBus Optical Port unit for connection of 1 to 7 additional clusters.

ModuleBus Extension (Electrical)

When the next MTU is located away from the previous MTU, or from the TB815 Interconnection Unit, then a TK801V0xx ModuleBus Extension cable must be used. The previous MTU will require a TB805 Cable Adapter-out to be plugged into the ModuleBus-out connector. The TK801V0xx cable is then connected to the TB805 adapter. The next MTU will have a TB806 Cable Adapter-in plugged into the ModuleBus-in connector and then connected to the other end of the ModuleBus Extension cable.

The TB805 and the TB806 adapters mount on the DIN-rail. Each has a latch that locks it to the rail. There is also a grounding spring that connects it to the DIN-rail. The latch can be released with a screw driver and the adaptor moved toward or away (for removal) from the MTU.

The ModuleBus Extension cable comes in three standard lengths:

- TK801V003 - 300 mm (1 ft.)
- TK801V006 - 600 mm (2 ft.)
- TK801V012 - 1.2 meters (4 ft.)

ModuleBus length must not exceed 2.5 meters (8.2 feet) from FCI, TB815 Interconnection Unit, or ModuleBus Modem to the last MTU including extension cables.

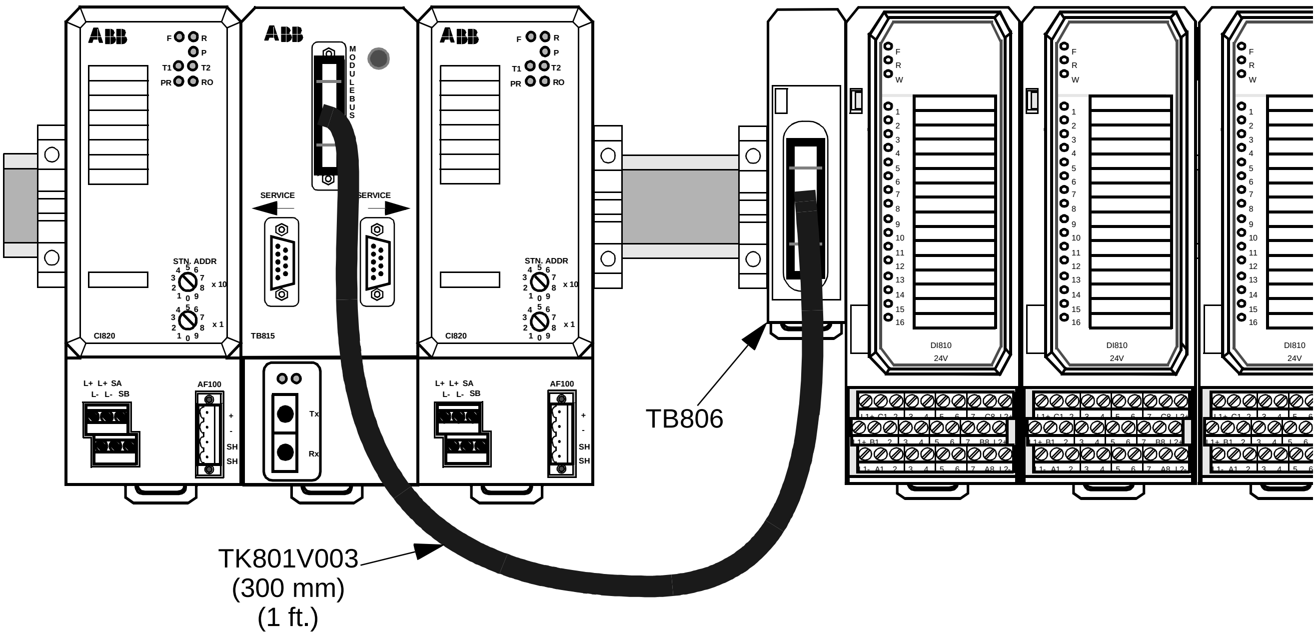


Figure 3-32. Connection of Redundant FCIs to I/O Modules

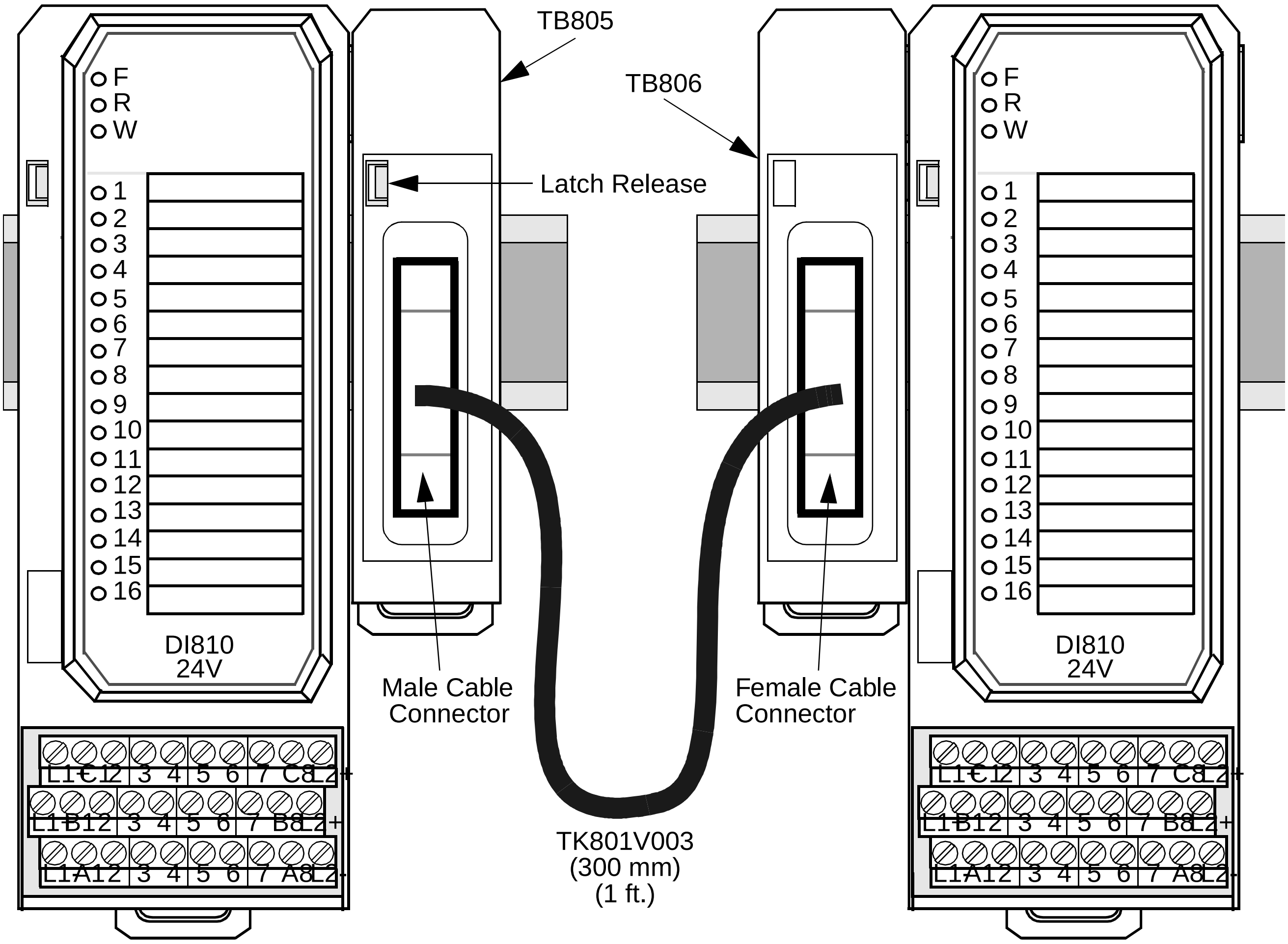


Figure 3-33. ModuleBus Extension Cable Connections

The following Figure shows the connections for dual media to an I/O Station with redundant FCIs.

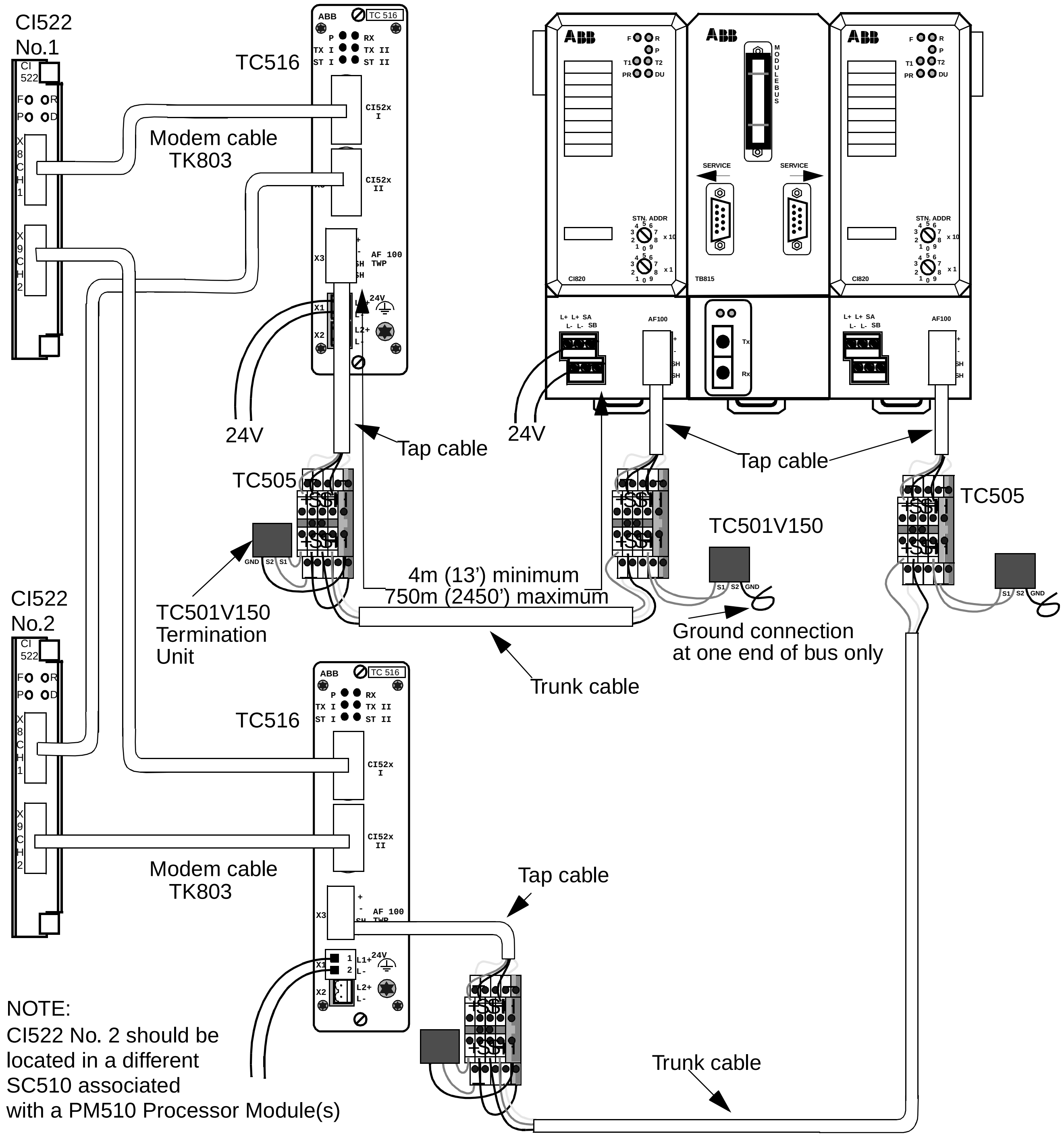


Figure 3-34. Dual Twisted Pair AF 100 Media to Redundant FCIs

Optical ModuleBus Extensions or I/O Clusters can be connected to the TB815 Interconnection Module as shown in the following Figure.

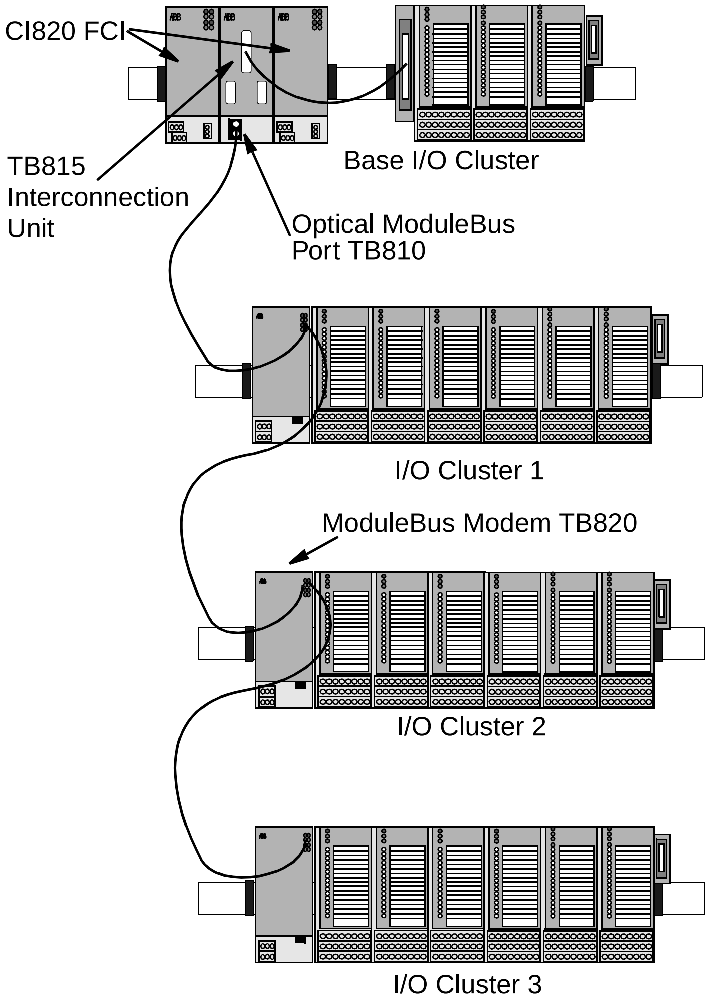


Figure 3-35. Optical ModuleBus Extension

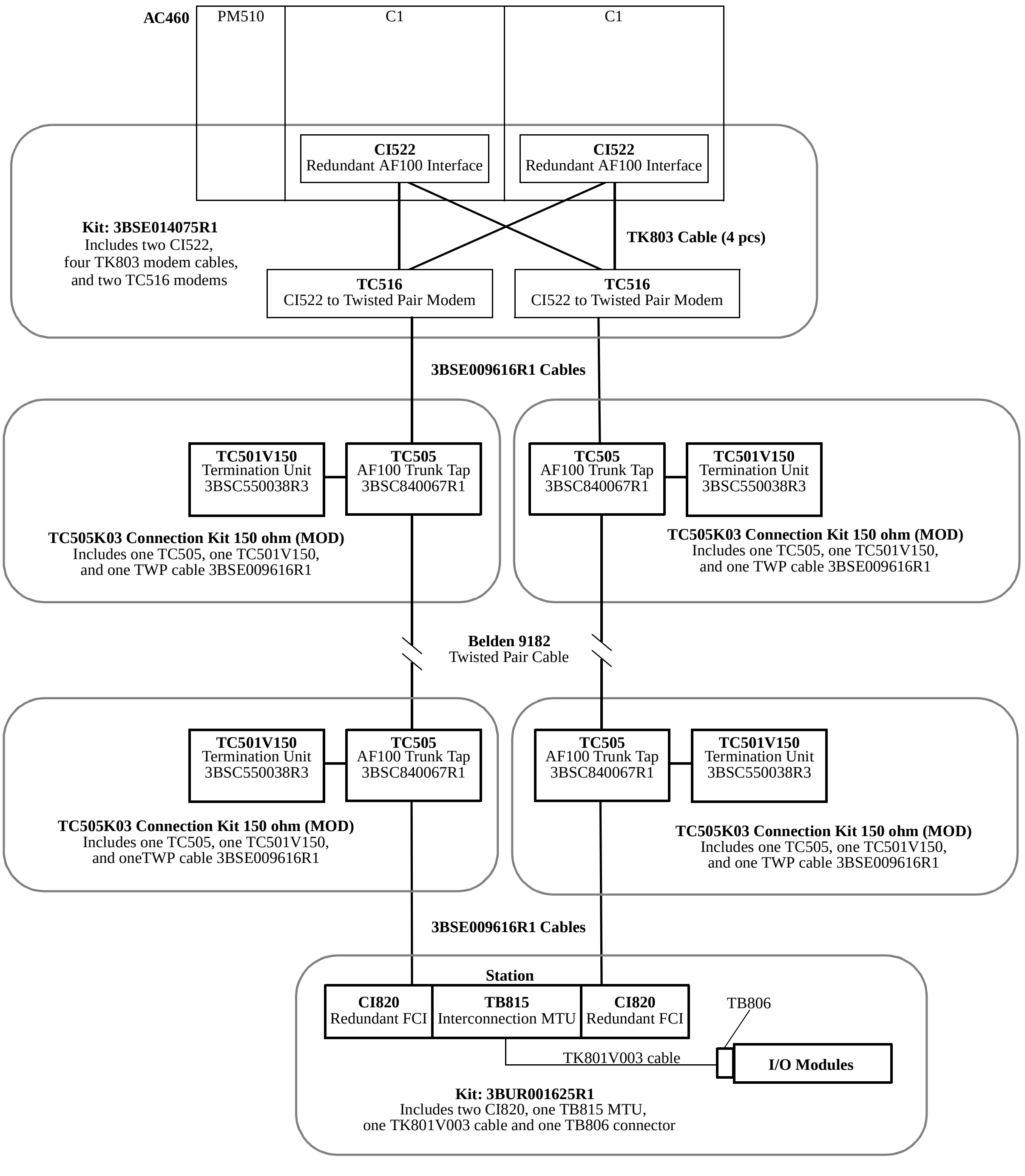


Figure 3-36. S800 Redundant Communications Connection Kits

3.2.2.5 TB810 Optical ModuleBus Port

The TB810 Optical ModuleBus Port is used with the FCI (CI810) to provide an interface for the Optical ModuleBus expansion. The TB810 has two connectors for fiber optic connections and a connection to the communication interface module. The following Figure shows the TB810 installed in the FCI.

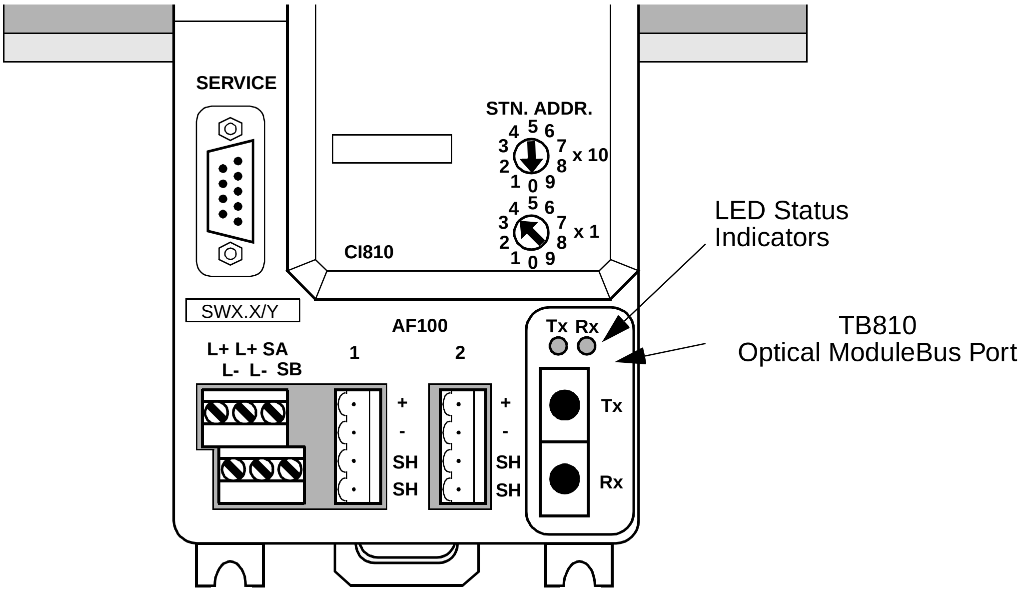


Figure 3-37. TB810 Optical ModuleBus Port Installed in CI810 FCI

3.2.2.6 TB820 ModuleBus Modem

The TB820 ModuleBus Modem is a fiber optic interface to the ModuleBus. The ModuleBus Modem has an electrical and an optical interface which are logically the same bus. A maximum of 12 I/O modules can be connected to the electrical ModuleBus and up to seven clusters can be connected to the fiber optic ModuleBus. The fiber optic interface is intended for local distribution of I/O clusters and where more than 12 I/O modules are required in an I/O Station. The optical Modulebus allows connection of an additional 12 I/O modules, for a total of up to 24 I/O Modules per S800 I/O Station.

The TB820 ModuleBus Modem has a rotary switch that selects its cluster number, 1 to 7, on the optical ModuleBus. The following Figure shows the layout of the TB820 ModuleBus Modem.

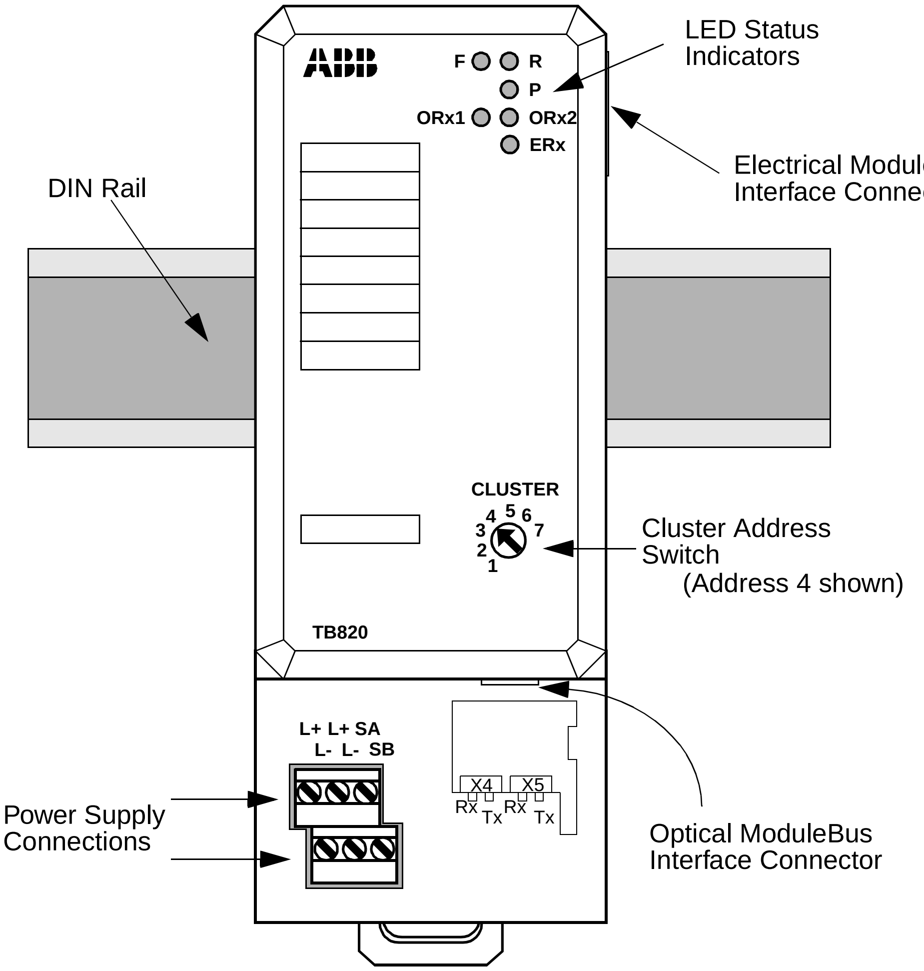


Figure 3-38. TB820 ModuleBus Modem

The ModuleBus Modem communicates with the FCI (via the TB810) and the I/O modules. The FCI handles the I/O-modules operations such as read and write data, read status and configuration of modules and channels.

The TB820 ModuleBus Modem provides 24 V dc (from the source) and an isolated, short circuit proof 5 V dc power to the cluster's I/O modules by way of the electrical ModuleBus connection. One power source (single or redundant 24 V dc) can be connected to the power terminals (L+ & L-).

3.2.2.7 Optical ModuleBus Connections

The TB820 has a connection to the optical ModuleBus by the optical ports on its front. The connector style, either simplex or duplex, all provide snap-in action when mated to the X4/X5 ports. Simplex connectors are color coded to facilitate identification of transmitter (Tx) or receiver (Rx) connections. Duplex connectors are keyed so that proper orientation is ensured during insertion.

The following Figure shows a duplex, simplex and mixed configuration of the optical ModuleBus. Duplex (two-way) is normally the best communication design, but may not apply to all requirements. Duplex design allows additional TB820s to be added down-stream on-line.

Simplex (one-way) connections provide a ring configuration from the FCI to the first TB820, to the next TB820 and etc. and then back to the FCI. Simplex designs will require that the “home-run” cable from the last TB820 back to the FCI, or another TB820, be limited to the 15 meter (49 ft.) plastic fiber or 200 meter (667 ft.) HCS fiber cable length. The 15m (49 ft.) cable length or 200 meter (667 ft.) maximum applies from FCI to TB820, to TB820, etc. and back to the FCI.

Also, duplex and simplex configurations can be mixed in the same optical ModuleBus if required.

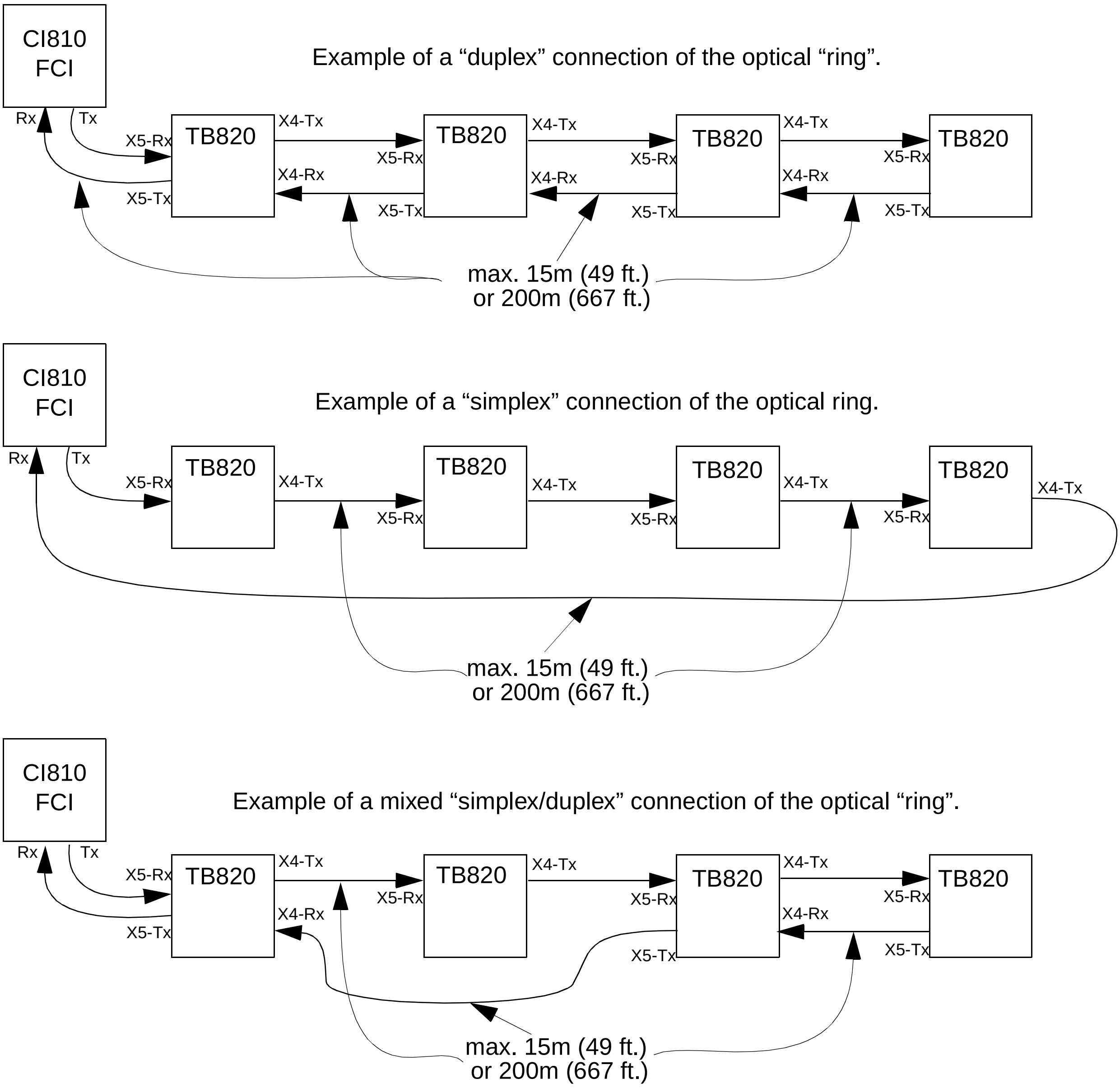


Figure 3-39. Optical ModuleBus Designs

In a “duplex connection” and in a “mixed connection” a cable break or loss of a TB820 will only affect the clusters down-stream of the break. In a “simplex connection” a cable break or loss of a TB820 will affect all I/O expansion clusters on the ModuleBus.

3.2.2.8 S800 I/O Station Isolation and Grounding

S800 I/O provides isolation between all major communication and power buses as illustrated in the following figure.

Isolation and protection includes:

- AF 100 to FCI and modulebus
- I/O module to modulebus
- I/O module to I/O module
- Channel to channel or group
- Power supplies to modules
- Overload and overcurrent on I/O channels

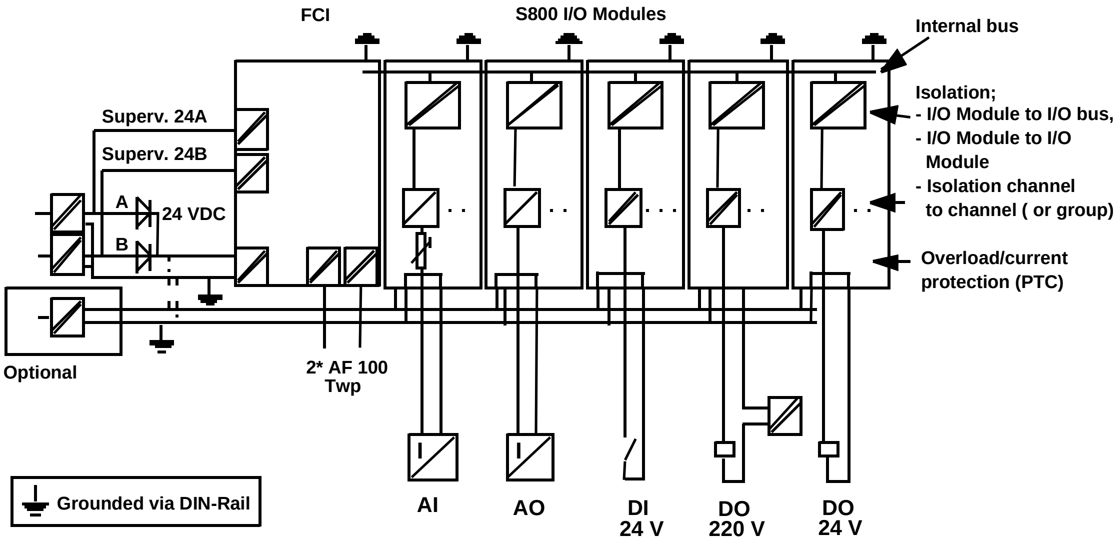


Figure 3-40. Isolation and Grounding

3.2.2.9 Module Termination Unit (MTU)

The Module Termination Units (MTU) are passive base units containing the process wiring terminals and a section of the Modulebus. There are four MTUs used by the S800 I/O modules:

- TU810 Compact MTU for 50 volt applications
- TU811 Compact MTU for 250 volt applications
- TU830 Extended MTU for 50 volt applications
- TU831 Extended MTU for 250 volt applications
- TU835 Extended MTU, individually fused per channel for 50 volt applications
- TU836 Extended MTU, individually fused per channel for 250 volt applications

An MTU can house one I/O module and contains bus connectors on each side for extension of the Modulebus. The MTU interconnects between the FCI and the I/O modules either directly or by way of a Modulebus adaptor cable. The MTU mounts on a standard DIN rail and has a mechanical latch that locks it to the rail.

The MTUs are available in two versions (Compact and Extended). The Compact MTU version typically provides for a compact installation of the I/O modules using 1 wire connections. The Extended MTU version provides for a more complete installation on the MTU, including 3 wire connection, fuses and field circuit power distribution.

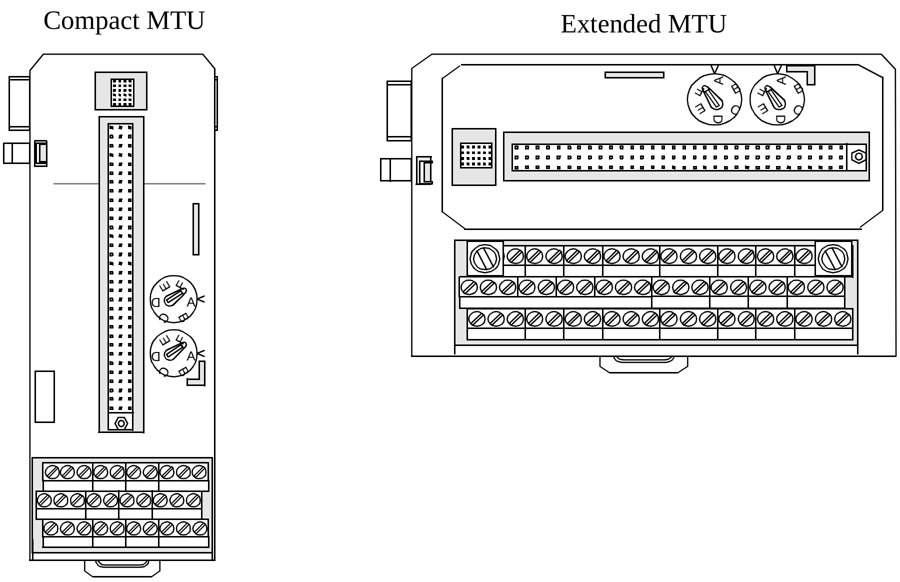


Figure 3-41. Compact and Extended MTU

Two mechanical keys are used to set-up each MTU for a particular group or type of I/O module. The mechanical keys protect the I/O modules from being inserted on the wrong MTU and thereby being damaged by excessive voltage or current. There are 36 different configurations that can be set to match an I/O module type. There is also a mechanical locking tab that locks the I/O module into position on the MTU. This module lock is connected to a switch that keeps the I/O module in its initialization state until it is locked into position.

TU810 Compact MTU for 50 Volt Applications

The TU810 is a 16 channel compact module termination unit. It provides field terminations to the I/O module and connection to the Modulebus of the communication interface (FCI). The TU810 has three rows of terminals for field signals and process power connections. The TU810 distributes the Modulebus to the I/O module and to the next MTU. The correct Modulebus address of this MTU is automatically configured when inserted into the previous MTU.

The TU810 is used with the following S800 I/O modules:

- AI810 Analog Input Module
- AI820 Analog Input Module
- AI830 Analog Input, RTD Module
- AI835 Analog Input, Thermocouple Module
- AO810 Analog Output Module
- AO820 Analog Output Module
- DI810 Digital Input Module
- DO810 Digital Output Module

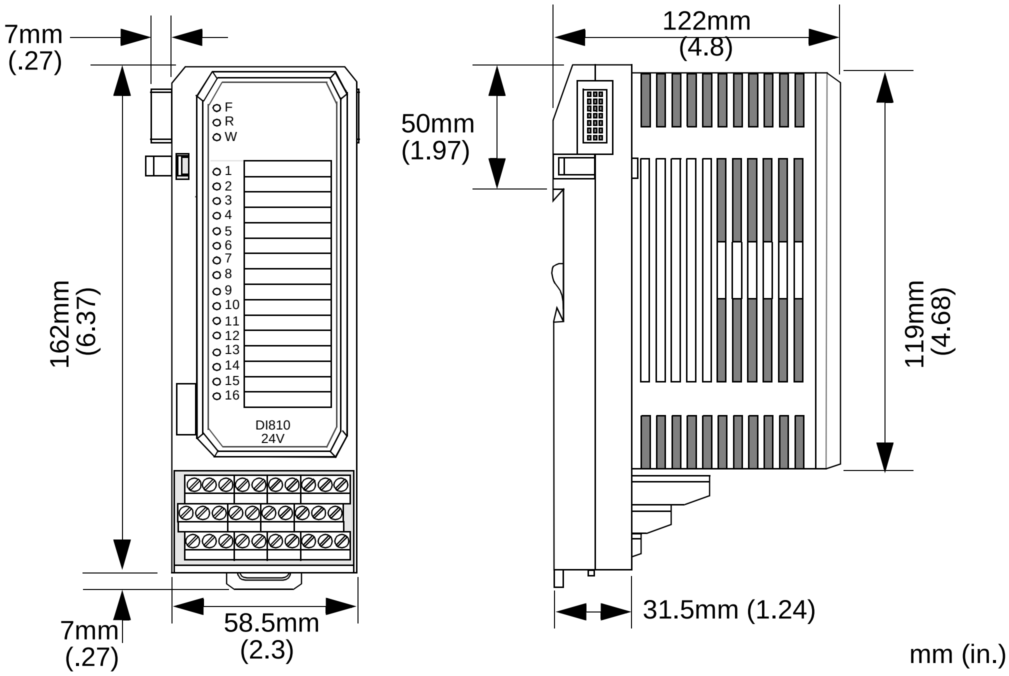


Figure 3-42. Compact MTU with I/O Module

TU811 Compact MTU for 250 Volt Applications

The TU811 is a 8 channel compact module termination unit. It provides field terminations to the I/O module and connection to the Modulebus of the communication interface (FCI). The TU811 has three rows of terminals for field signals and process power connection. The TU811 distributes the Modulebus to the I/O module and to the next MTU. The correct Modulebus address of this MTU is automatically configured when inserted into the previous MTU.

The TU811 is used with the following S800 I/O modules:

- DI820 Digital Input Module

- DI821 Digital Input Module
- DO820 Digital Output Module

TU830 Extended MTU for 50 Volt Applications

The TU830 is a 16 channel extended module termination unit. It provides field terminations to the I/O module and connection to the Modulebus of the communication interface (FCI). The TU830 has three rows of terminals for field signals and process power connection. The TU830 distributes the Modulebus to the I/O module and to the next MTU. The correct Modulebus address of this MTU is automatically configured when inserted into the previous MTU.

The TU830 is used with the following S800 I/O modules:

- AI810 Analog Input Module
- AI820 Analog Input Module
- AI830 Analog Input, RTD Module
- AI835 Analog Input, Thermocouple Module
- AO810 Analog Output Module
- AO820 Analog Output Module
- DI810 Digital Input Module
- DO810 Digital Output Module

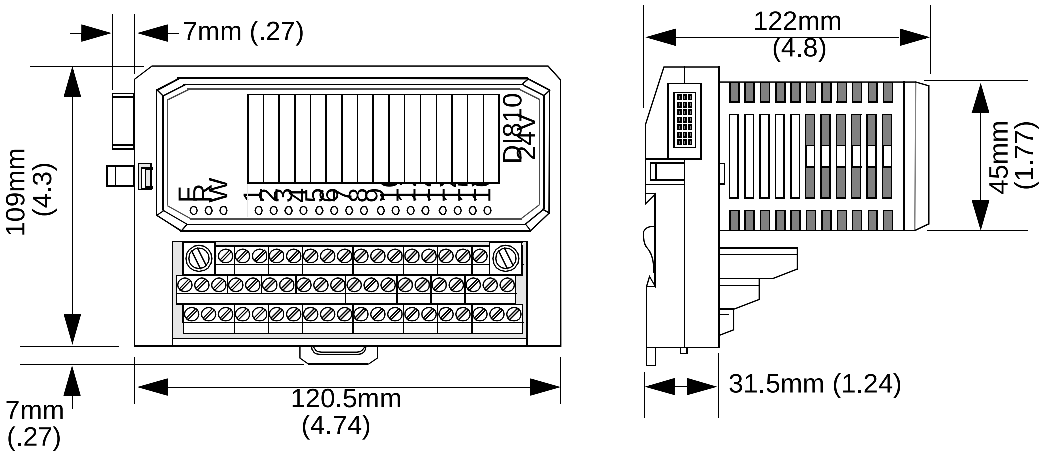


Figure 3-43. Extended MTU with I/O Module

TU831 Extended MTU for 250 Volt Applications

The TU831 is a 8 channel extended module termination unit. It provides field terminations to the I/O module and connection to the Modulebus of the communication interface (FCI). The TU831 has three rows of terminals for field signals and process power connection. The TU831 distributes the Modulebus to the I/O module and to the next MTU. The correct Modulebus address of this MTU is automatically configured when inserted into the previous MTU.

The TU831 is used with the following S800 I/O modules:

- DI820 Digital Input Module
- DI821 Digital Input Module
- DO820 Digital Output Module

TU835 Extended MTU, Individually Fused per Channel for 50 Volt Applications

The TU835 is an 8 channel extended module termination unit. It provides field terminations to the I/O module and connection to the ModuleBus of the communication interface (FCI or ModuleBus Modem). The TU835 has two rows of terminals for field signals and process power connection. Each channel has one fused (3A max.) transmitter power terminal and one signal connection. Process voltage can be connected to 2 individually isolated groups. The TU835 distributes the ModuleBus to the I/O module and to the next MTU. The correct ModuleBus address of this MTU is automatically configured when inserted into the previous MTU.

The TU835 is used with the following S800 I/O module:

- AI810 Analog Input Module

TU836 Extended MTU, Individually Fused per Channel for 250 Volt Applications

The TU836 is an 8 channel extended module termination unit. It provides field terminations to the I/O module and connection to the ModuleBus of the communication interface (FCI or ModuleBus Modem). The TU836 has two rows of terminals for field signals and process power connection. Each channel has one fused (3A max.) power outlet terminal and one signal return connection. Process voltage can be connected to 2 individually isolated groups. The TU836 distributes the ModuleBus to the I/O module and to the next MTU. The correct ModuleBus address of this MTU is automatically configured when inserted into the previous MTU.

The TU836 is used with the following S800 I/O module:

- DO820 Digital Output Module

NOTE

The standard fuse holder that comes with the TU836 can be changed to an indicating fuse holder. This indicating fuse holder can be ordered from Phoenix:

- 15-30 VDC type, order 3118119
- 110-250 VAC type, order 3118106

3.2.2.10 S800 I/O Modules

The I/O modules have open ventilated plastic enclosures. On the front of each I/O module there are three LEDs (FAULT, RUN and WARNING) indicating the module status. One additional LED (OSP) is included on output modules.

I/O modules may be replaced in a fully operational I/O station. Mechanical keying on modules and MTUs protect I/O modules from being inserted in positions where they could be damaged by excessive voltage or current. An electronic type designation ID in each module keeps the I/O module from being taken into operation by the FCI if a module's ID doesn't match the configured module type definition in the data base.

DI810 Digital Input Module

The DI810 Digital Input Module has 16 channels for 24 volt dc digital inputs. The inputs are divided into two isolated groups of eight channels with a voltage supervision input for each group. Each input channel provides current limiting, EMC protection, input state LED indicator and optical isolation from the Modulebus

DO810 Digital Output Module

The DO810 Digital Output Module has 16 channels for 24 volt dc digital outputs. The outputs are divided into two isolated groups of eight channels with a voltage supervision input for each group. Each output channel provides protection against short circuits to ground, over-voltage, over-temperature, EMC protection, output state LED indicator and optical isolation from the Modulebus. State of outputs can be set to a predetermined (OSP) value if an error is detected.

DI820 Digital Input Module

The DI820 Digital Input Module has 8 channels for 120 volt ac digital inputs. The inputs are individually isolated. Channel 1 can be used as voltage supervisor for channels 2 - 4, and channel 8 can be used for channels 5 - 7. If voltage supervision is disabled, channels 1 and 8 can be used as normal inputs. Each input channel provides current limiting, EMC protection, input state LED indicator, noise filter and optical isolation from the Modulebus.

DO820 Digital Output Module

The DO820 Digital Output Module has 8 channels for 230 volt ac/dc relay outputs. The outputs are individually isolated. Each output channel provides a relay contact (NO), EMC protection, output state LED indicator and optical isolation from the Modulebus. State of outputs can be set to a predetermined (OSP) value if an error is detected.

DI821 Digital Input Module

The DI821 Digital Input Module has 8 channels for 230 volt ac digital inputs. The inputs are individually isolated. Channel 1 can be used as voltage supervisor for channels 2 - 4, and channel 8 can be used for channels 5 - 7. If voltage supervision is disabled, channels 1 and 8 can be used as normal inputs. Each input channel provides current limiting, EMC protection, input state LED indicator, noise filter and optical isolation from the ModuleBus.

AI810 Analog Input Module

The AI810 Analog Input Module has 8 current and voltage inputs. The inputs are independent for each channel, in that either voltage or current can be measured.

The current input is able to handle a short circuit to the transmitter supply without damage. Current limiting is performed with a PTC resistor.

AI820 Differential Analog Input Module

The AI820 Differential Analog Input Module has 4 differential, bipolar current/voltage inputs. This module is suitable for applications requiring high common mode rejection ratings, and/or bipolar voltage or current inputs. Nominal input ranges are: -20...+20mA, 0(4)...+20mA, -10...+10V, 0(2)...+10V, -5...+5V and 0(1)...+5V.

The current input is able to handle a short circuit to the transmitter supply without damage. The current input is also compatible with HART protocol.

AI830 Analog Input, RTD Module

The AI830 Analog Input, RTD Module has 8 RTD (Pt100, Cu10, Ni100 and Ni120 and resistor) inputs. The inputs allow 3-wire connection to RTDs. Inputs are monitored for open-circuit, short-circuit, reference channel and internal supply.

AI835 Analog Input, Thermocouple/mV Module

The AI835 Analog Input, Thermocouple/mV Module has 8 differential inputs for TC/mV measurements. One channel (channel 8) can be configured for “Cold Junction” (ambient) temperature measurement, thus serving as the CJ-channel for the other channels on the module. All 8 channels can be used if no CJ-temperature measurement is needed. The inputs can be connected to a variety of thermocouples with the following characteristics: B, C, E, J, K, N, R, S and T.

AO810 Analog Output Module

The AO810 Analog Output Module has 8 current outputs. State of outputs can be set to a predetermined (OSP) value if an error is detected.

AO820 Bipolar Analog Output Module

The AO820 Bipolar Analog Output Module has 4 bipolar current or voltage outputs. The choice of either current or voltage output is configurable per channel. Outputs are individually galvanically isolated. State of outputs can be set to a predetermined (OSP) value if a communications error is detected.

NOTE

A more detailed description of S800 I/O functions including FCI and I/O module specifications, field wiring connections, configuration guidelines including bus loading calculations, power and cooling loads, etc. may be found in the Advant OCS - S800 I/O Technical Supplement 3BUS094096R0101.

3.2.2.11 Power Supplies

The S800 I/O station can be powered by a single or redundant supply voltage of 24 V dc. Two power supplies with 120/230 VAC inputs and 24 VDC outputs are available to supply the I/O station and its field circuits. The SD811 Power Supply provides 2.5A at 24Vdc and the SD812 Power Supply provides 5A at 24Vdc.

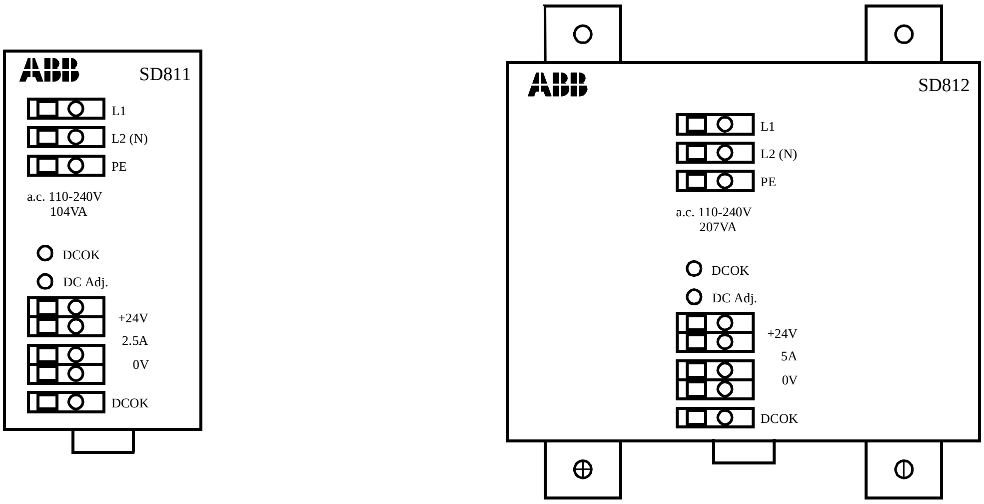


Figure 3-44. S800 I/O Power Supplies

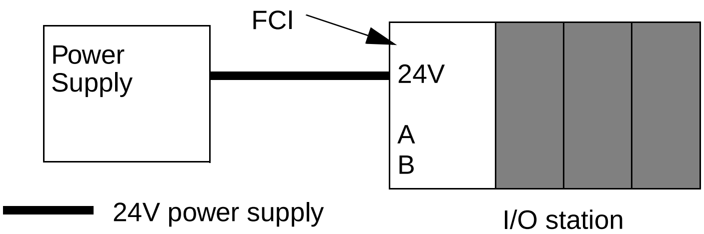


Figure 3-45. Installation Using a Single Power Supply

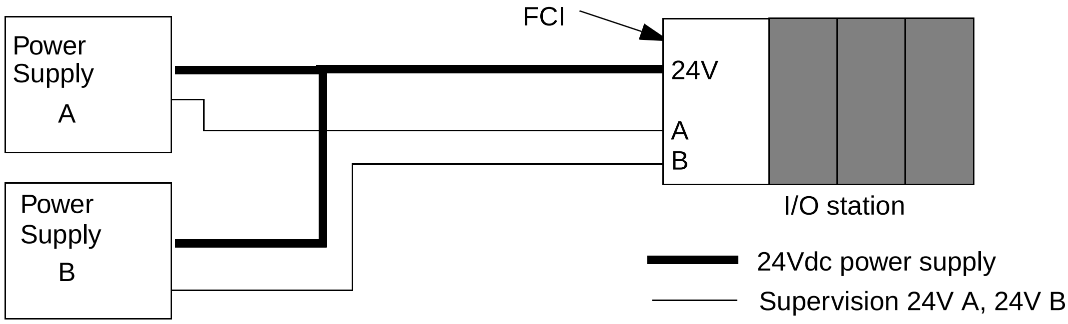


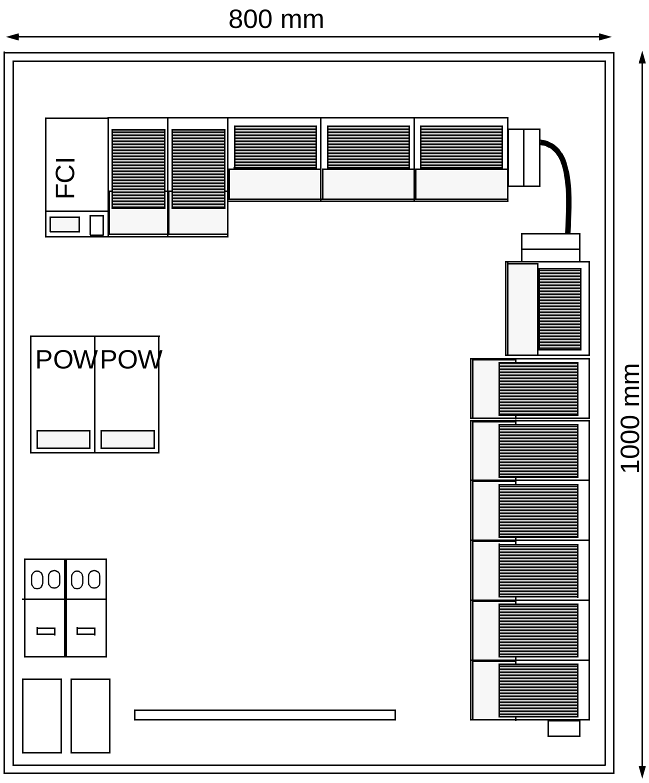
Figure 3-46. Installation Using Redundant Power Supplies

Redundant power supplies are simply connected in parallel and have self contained diode protection. The FCI module is able to supervise the redundant voltage supply. The supervision function is individually configurable for power supervision of each I/O station.

3.2.2.12 RE810 Enclosure and Mounting

The RE810 Enclosure is available for housing the I/O Station(s) and power supplies, with space for marshalling terminals. The following figure shows a typical layout for an I/O Station housed in the RE810 enclosure.

Figure 3-47. Enclosure with12 I/O Modules and Redundant Power Supplies



Mounting

The I/O station can be mounted horizontally and/or vertically or in combinations as shown in the following figures. Different MTUs (Compact or Extended version) can be used depending on available space and preferred way of installing the field wiring (external marshalling/power distribution or direct on Extended MTUs using 3 terminals and power distribution arrangements). Compact and extended MTUs can be mixed on the same Modulebus and mounting rail.

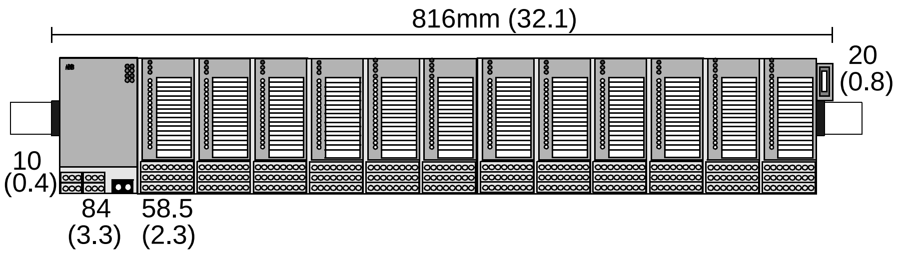


Figure 3-48. Horizontal Mounting of S800 I/O MTUs (Compact)

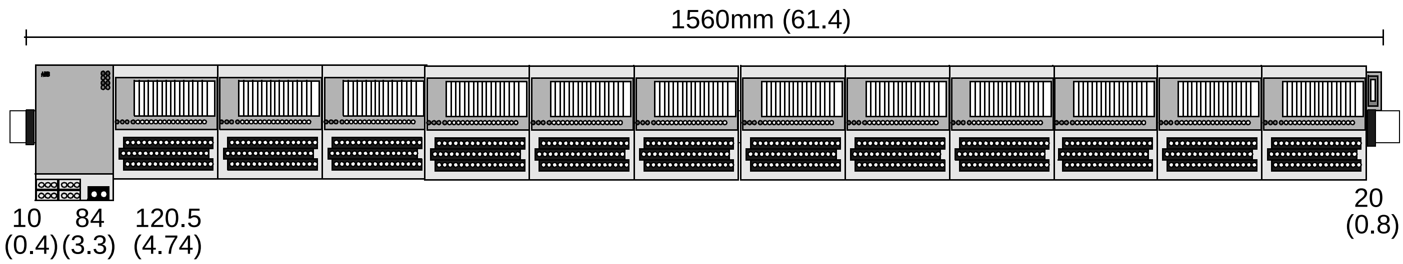


Figure 3-49. Horizontal Mounting of S800 I/O MTUs (Extended)

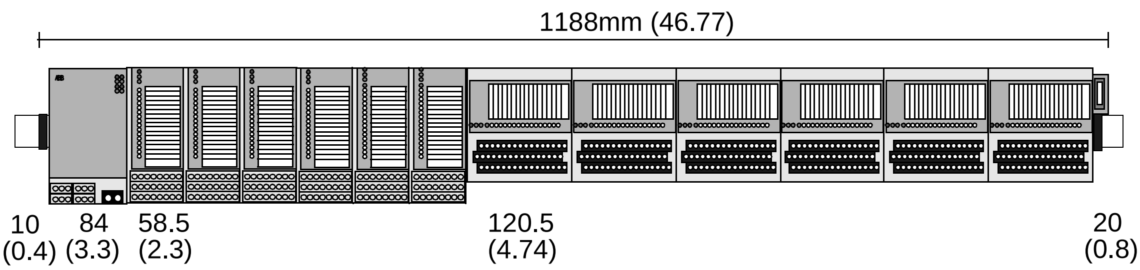
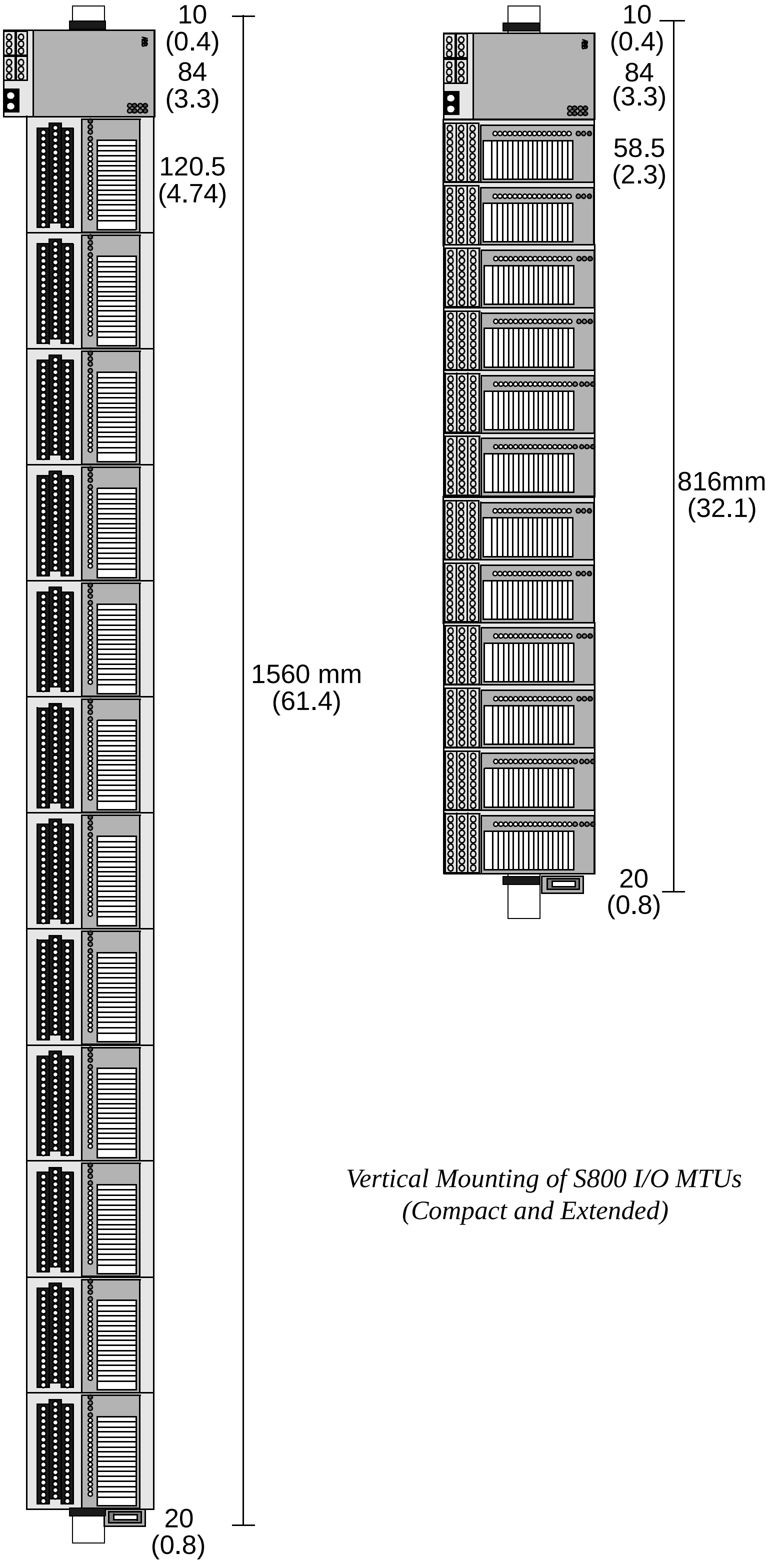


Figure 3-50. Combination Mounting of S800 I/O MTUs (Compact and Extended)



Vertical Mounting of S800 I/O MTUs
(Compact and Extended)

3.2.3 TRIO

TRIO™ (Taylor Remote I/O) is a cost effective I/O approach that collect a large number of I/O points located remotely on the plant floor or in the field. The heart of the system is a variety of multi-channel analog and discrete I/O blocks that can be located close to the point of control. These blocks communicate with the system through Field Buses with as many as 30 blocks being connected to a bus.

3.2.3.1 Devices on the Field Bus

A field bus carries serial communications among the devices of the TRIO I/O system. The maximum number of field buses per each Processor Module is shown in the table below.

Table 3-38. Field Buses

Subsystem	Redundant	Non Redundant
Advant Controller 410	1	2
Advant Controller 460 Module	2	4

A Field Bus is brought into the system via a Controller Field Bus Interface Module. Field buses can consist of a single cable or they can be redundant in which case the bus consists of two cable as shown in the following two figures. The Advant Controller can be at either end of the bus or they can be in a central location. Up to 30 TRIO blocks can be connected to the bus, hand held monitors can also be attached to the bus at either the Field Bus Interface Module, at the I/O blocks, or as an option, at special HHM connectors on the bus.

AC410 / AC460 Connection

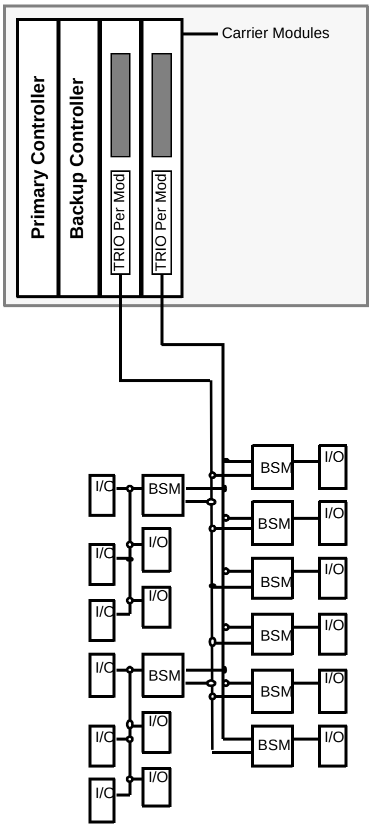


Figure 3-52. Dual Field Bus Connections

Redundant Buses

A redundant bus can eliminate downtime caused by cable breaks during normal operation. A cluster consisting of 1 to 8 blocks can interface to both buses through a Bus Switching Block (BSM). The first block in the cluster must be a block to which the BSM can be physically and electrically attached. If communication on one Bus fails, the BSM switches the blocks in the cluster to the alternate Bus. Bus switching can also be performed automatically by the MOD 300 software or manually by the operator through the Remote I/O Overview Display.

3.2.3.2 Blocks

TRIO blocks are self-contained, configurable I/O blocks used to interface field devices to the communications bus. Unlike conventional I/O blocks, TRIO blocks can be individually installed on machines, in junction boxes, or grouped in racks or panels. A TRIO block is made of cast aluminum, and weighs approximately 4 pounds (1.8 Kg). It measures approximately 9” x 4”x3”. Each block has its own communications capability and microprocessor, and provides from 6 to

32 circuits for connecting input and output devices. The user can place blocks on the bus in any combination or sequence. The user can use analog and discrete blocks on the same bus.

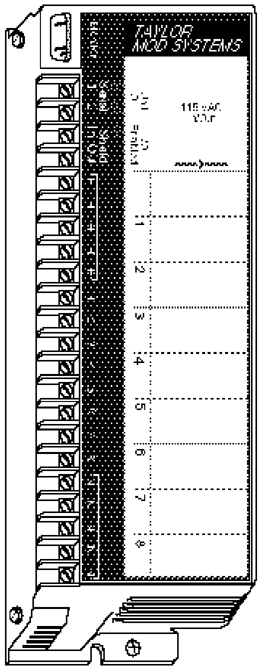


Figure 3-53. A TRIO Block

Because each bus can count up to 30 TRIO blocks, the total number of I/O circuits on a bus depends on the number and types used. The maximum number of analog points per bus is 180, the maximum digital points per bus is 960.

Table 3-39. TRIO Blocks

Model	Channels	Range
6230B	4 In, 2 Out	High Level Analog Block
6231B	4 In, 2 Out	Current Source Analog Block
6232B	6 In	Thermocouple Block
6233B	6 In	RTD Block
6235B	6 In	Current Source Analog Input Block (AC400 only)
6236B	6 Out	Current Source Analog Output Block (AC400 only)
6240B	16	24/48 V dc, 2A Digital I/O Block
6241B	32	5/12/24 V dc, 0.5A Digital I/O Block

Table 3-39. TRIO Blocks

Model	Channels	Range
6245B	8	115 V ac Digital I/O Block
6246B	8	115 V ac/125 V dc Isolated Digital I/O Block
6247B	16	115 V ac Digital Input Block
6248B	16	Relay Output Block

6230B Analog I/O Block

The 6230B Analog I/O Block supports the following voltage inputs:

0 to 10V dc

-10V dc to +10V dc

-5V dc to +5 V dc

0 to 5V dc

1 to 5V dc

The block supports the following current inputs:

4 - 20 mA two wire transmitter, (transmitter requires external power supply)

Current Outputs

Internal power is enough to send 4 to 20 mA through a 0 to 300 ohm load. An external 24 to 48 V power supply is needed for larger loads (up to 2 K ohms at 48V).

The block supports the following current inputs:

4 - 20 mA two wire transmitter, (transmitter requires external power supply)

Current Outputs

Internal power is enough to send 4 to 20 mA through a 0 to 300 ohm load. An external 24 to 48 V power supply is needed for larger loads (up to 2 K ohms at 48V).

Voltage Outputs

Voltage outputs require a load > 2 k ¾.

Output ranges supported are the same as the input ranges.

6231B Current Sourcing Analog I/O Block

The 6231B Current Sourcing Analog I/O Block supports four 4 - 20 mA inputs. Two wire transmitters do not need separate power supplies, although a transmitter with its own supply can be accommodated. Each input is isolated from the other inputs and the outputs. The outputs have a common return.

The block supports two 4 - 20 ma output into a 0 to 850 ¾ load

6232B Thermocouple Block

One 6232B Thermocouple Block has six channels organized in three groups of circuits with 2 circuits to a group. Each group is isolated from the others. It supports thermocouple inputs which can be chosen from the following types:

J, K, T, E, B, R, S, N

The range of inputs is -25.00 mV to +150.00 mV.

Each channel can have cold junction compensation performed using an offset value selected from one of three possible sources:

- Local - offset comes from an on-board cold junction sensor.
- Remote - offset comes from a millivolt input to the two channel group that contains the channels.
- Fixed - offset is a number entered during the software configuration

A 6232B Thermocouple Block can also accept millivolt inputs in the range of -25.00mV to +150.00mV.

Table 3-40. Support Thermocouple Types and Ranges

Type	Minimum °C	Maximum °C
J	-210.0	1200.0
K	-270.0	1370.0
T	-270.0	400.0
E	-270.0	1000.0
B	20.0	1820.0
R	-50.0	1770.0
S	-50.0	1770.0
N*	0.0	1300.0

*The supported N type thermocouples are the #14 AWG Nicrosil vs. Nisil variety.

6233B RTD Input Block

The 6233B RTD Input Block has 6 inputs organized in three groups of circuits with 2 circuits to a group. Each group is isolated from the others. The 6233B RTD Input Block supports the following RTD types:

Platinum DIN 43760

Nickel DIN 43760

Copper

6235B Current Sourcing Analog Input Block

The 6235B Current Sourcing Analog Input Block is available only for AC400 Series Controllers to interface devices that provide 4-20 mA analog signals. Two versions of the Current Source Input Blocks are available: the 115 VAC/125 VDC block and the 24/48 VDC block. Both blocks are functionally identical except for the power supply.

A Current Source Input Block has six 4-20 mA current inputs. Each input has a 24 volt current loop power supply, capable of providing 25 mA, and is isolated from all other circuits within the block. The BSM circuitry is electrically common to Input 1, but is isolated from the other inputs.

The input channels use voltage to frequency converters and counters to translate analog currents to a digital value. All circuits on the block support independent selection of linear scaling values. These values can be used to convert the internal values into engineering units suitable for the application. Block diagnostics include; low and high alarm reporting, over-range and under-range detection, open wire detection, and internal fault reporting.

6236B Current Sourcing Analog Output Block

The 6236B Current Sourcing Analog Output Block has six output circuits and is available only for AC400 Series Controllers to interface to devices that accept 4-20 mA analog signals. Outputs 5 and 6 can also be used for voltage applications. Two versions of the Current Source Input Blocks are available: the 115VAC/125VDC block and the 24/48 VDC block. Both blocks are functionally identical except for the power supply.

Each output provides power and control of a 4-20 mA current loop. This power is isolated from the rest of the block. The outputs and BSM circuitry are electrically common. Output accuracy is 0.15% at 25^{o} C. Output resolution is 6uA.

The output channels use a dual 12-bit digital to analog converter, and can independently control currents from 0 mA to 24 mA. Configurable features of these blocks include; output hold last state or default, circuit scaling to engineering unit values, output feedback checking and feedback time, and Processor Module redundancy. Fault reporting can be enabled or disabled circuit-by-circuit. Block diagnostic checks include; over-range and under-range detection, and output feedback.

Discrete I/O Blocks

The discrete TRIO blocks communicate with the MOD 300 through integer values that represent channel states, i.e., a channel is 1 (ON) or 0 (OFF).

6240B 16 Circuit dc Source and Sink I/O Blocks

The TRIO 16 Circuit Source/Sink Input/Output Block is a configurable DC Input/Output block that interfaces discrete DC sensors and actuators to the control system. The block has 16 discrete circuits, each configured to be an input, tristate input, or output.

This block is compatible with a wide range of input and output devices including both 2-wire and 3-wire solid state sensors. The maximum output current rating for each circuit is 2 amps, making the block suitable for medium sized loads. I/O device power is tapped off the block power supply voltage.

The TRIO 16 Circuit Source/Sink Input/Output Block is available in 24 or 24/48 VDC versions. Functionally identical, the 24/48 volt block can operate from and interface to devices up to 48 VDC.

6241B 32 Circuit dc Source and Sink I/O Blocks

The TRIO 32 Circuit Source/Sink Input/Output Block is a configurable DC Input/Output block that interfaces the control system to devices that provide or accept a binary signal. The block has 32 discrete circuits, each configured to be an input, output, or output with feedback. The block is compatible with a wide range of input and output devices such as switches, relays, and lamps.

The TRIO 32 Circuit Source/Sink Input/Output Block is available in both a 24/48 VDC Source block which provides field current to output devices, and a 5/12/24 VDC Sink block which receives current from field output devices. Both versions operate at a nominal 12 to 24 VDC. The Sink version is TTL compatible when powered at 5 VDC. The maximum output current rating is 0.5 amps, making this block suitable for control of low level loads or for TTL logic interfacing.

6245B 115V ac 8 Circuit Grouped Block, Low Leakage I/O Block

The TRIO 8 Circuit 115 VAC Grouped Input/Output Blocks provide an interface to discrete input sensors and actuators. A Low-Leakage version of the block is available which is designed to operate small loads without having to add resistance to the load. Each of these blocks has one group of eight circuits that is rated to operate at 115 VAC. I/O power is internally isolated from the serial bus and the case ground.

6246B 115V ac / 125V dc Isolated I/O Block

The TRIO 8 Circuit 115 VAC/125 VDC Isolated Input/Output Block is an intelligent configurable block that provides an interface to discrete AC and DC sensors and actuators. Each of the eight circuits can be configured as an input, an output or a tristate input.

The I/O circuits are isolated in four groups of two circuits, each rated to operate at a nominal 115 VAC or 125 VDC. Each pair of circuits can have its own power source, isolated from other I/O circuits and/or the block power source. I/O circuits must be either all AC or all DC.

The block has terminals for a separate power supply for the internal electronics. The block power supply can be independently either AC or DC. The block need not be powered by the same manner as the circuits.

Isolation between either I/O group and ground or between I/O groups., is rated to withstand 250 volts AC or DC continuous. The transient rating is 2000 volts peak for 10 seconds.

6247B 115V ac 16 Circuit Input Block

The TRIO 16 Circuit 115 VAC Input Block is used to interface to 115 VAC discrete input devices. The block has 16 discrete input circuits in groups of two banks of eight circuits each.

Typical inputs are contact closures from switches, pushbuttons, or limit switches. I/O device power comes from the block power supply voltage.

Open Wire and Shorted Wire diagnostics may be optionally enabled by installing external resistors near the input switch.

6248B Relay Output Block

The TRIO 16 Circuit Relay Output Block has 16 relay output circuits in four groups of four circuits each. Each group of circuits shares a common input terminal. the outputs are compatible with a wide range of field devices operating in the range of 5 to 250 VAC or 5 to 220 VDC.

There are two types of Relay Output blocks, one with normally open relays and one with normally closed relays. A logical “1” state causes either block to energize the corresponding relay coil and a “0” causes the coil to de-energize. This has the opposite effect on the state of the output on the two block versions. LEDs on each output represent the state of the relay coil.

The block has no internal fuses. External 2 amp fuses in series with the load are recommended. The type of relay used allows the block to be mounted in any physical orientation.

6234B High Speed Counter

The High Speed Counter Block accumulates digital inputs and performs high speed processing to trigger outputs within 1 msec of when a target count is achieved. The block can also calculate rate information by dividing the total counts over a selectable time base from 1 msec to 65535 msec.

Applications for the High Speed Counter include precise control of the amount of material added in a batch application. The counter can accumulate pulses from a flow meter until a predetermined amount of material has been added, then turn off the flow within 1 msec. It can also be used to set a two rate flow, using a high speed for a predetermined amount and then switching to a lower rate as the amount of ingredient gets close to the target value.

Each unit has 12 inputs and 4 outputs. The inputs include the signals to be counted, preload value (reset), and strobe. The block also has a +5 V dc output and an oscillator output for performing calibrations.

The High Speed counter block can be configured in two primary ways, Type A and Type B. In the Type A configuration the block has four 16-bit counters, and in the Type B configuration it can have two 24-bit counters. Two Type A counters can be cascaded to create a single 32-bit counter.

The block has four outputs that can be programmed to turn on or off when the accumulated count reaches appropriate values. The blocks outputs can be used to drive indicating lights, solenoid relays and other devices. Each output has a response delay of 1 ms maximum and has built-in protection against power surges caused by wiring errors.

3.2.3.3 Hand-Held Monitor

The Hand-Held Monitor (HHM) is a portable interface device used to set up and monitor the operation of TRIO blocks and the Field Bus. The HHM plugs directly into any block, Field Bus Interface Module, or connector on the bus. The HHM can be permanently mounted to create an operator workstation and a mounting kit is provided with each HHM for this purpose. A keyswitch allows the HHM to be set up for a wide range of applications such as monitoring, or configuration.

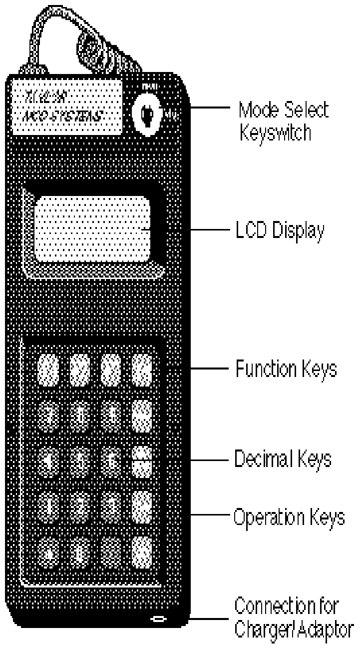


Figure 3-54. Hand Held Monitor

3.2.3.4 TRIO Termination Rack 6188Y

The TRIO Termination Rack is a half depth rack used for mounting TRIO blocks and associated equipment.

Hardware Description:

Half depth rack with rails and mounting hardware for 15 TRIO blocks. One door is included. Three Power On/Off switches per TRIO mounting row are optional.

Dimensions:

Without Doors or Panels:

Height- 77in (1956mm)

Width- 30in (762mm)

Depth- 15in (381mm)

With Doors or Panels:

Height- 77in (1956mm)

Width- 32in (813mm)

Depth- 16in (406mm)

Guidelines/Limits:

The maximum number of TRIO blocks per rack is 15. A Bulk Power Supply is required for 24VDC blocks or 24VDC field inputs/outputs. If power is included, a maximum of 4 rows is permitted. TRIO block types and arrangements are specified on separate worksheets.

3.2.3.5 TRIO Capacities

Practical limits must be considered when the data below is applied:

- Space in the cabinet.
- Processor Module load
- Integrity aspects
- Availability aspects

Table 3-41. Technical Data of Field Bus to TRIO

Data	Value
Number of busses per Processor Module	4
Number of TRIO Blocks (non-redundant bus)	30 per bus
Number of TRIO Blocks (redundant bus)	max 30
Length of field bus	max 1066.8 m (3500 ft.)

3.2.3.6 CE Marking

All TRIO Blocks are CE Marked at delivery except for the following:

- 6246B 8 Circuit Isolated Input/Output Block
- 6200D Hand Held Monitor

3.3 6000B/6200B Controller Migration Information

3.3.1 6000B/6200B Controller Migration Using S800 I/O

The 6000B/6200B Controller to S800 I/O migration provides a simple means to replace an existing 6000B Controller subsystem with the Advant Controller 400 Series and S800 I/O. The migration process allows your existing field connections and termination panels to remain in place and undisturbed.

This migration procedure makes it possible to plug the controller end of your existing 6002C Controller I/O cable into the mating end of a prefabricated I/O cable which plugs directly into the Module Termination Unit (MTU) of the S800 I/O Station.

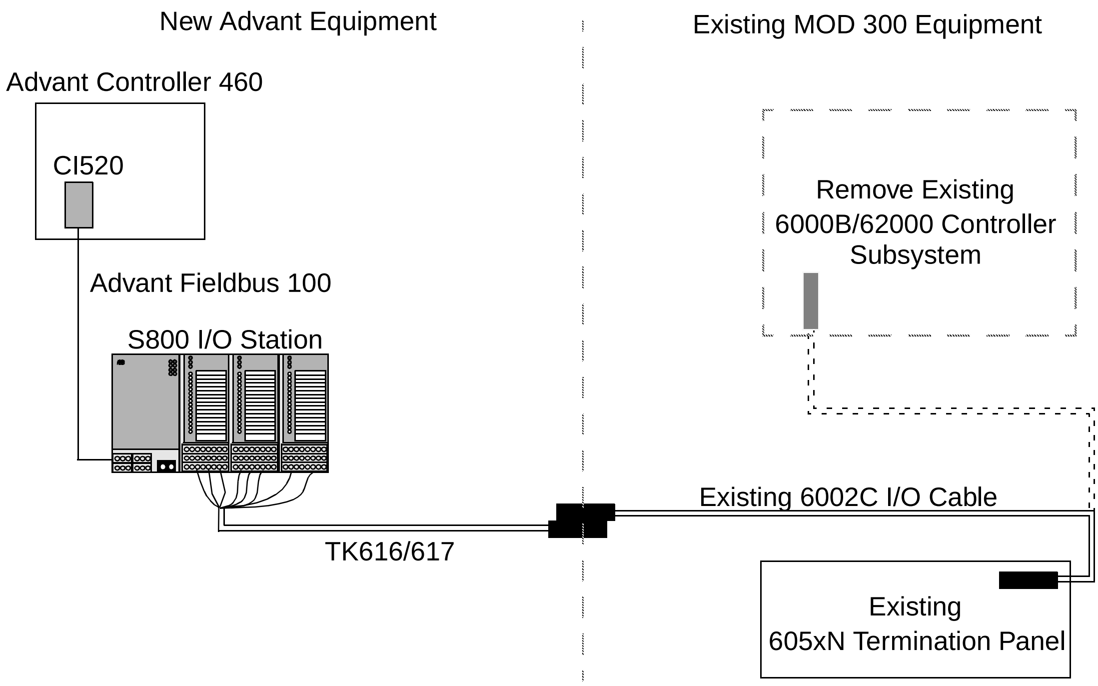


Figure 3-55. 6000B Controller Migration Overview

The S800 I/O Station is made up of three major components: the Fieldbus Communication Interface (FCI), the Module Termination Unit (MTU), and the I/O Module. The I/O Module plugs onto the MTU, which is illustrated in the following Figure. The S800 I/O Station then connects to the AC400 Series controller via the Advant Fieldbus 100.

3.3.1.1 S800 I/O Modules

The migration uses four types of S800 I/O Modules for signal conditioning:

- AI810 - 8 channel Analog Input Module

- AO810 - 8 channel Analog Output Module
- DI814 - 16 channel Digital Input Module
- DO814 - 16 channel Digital Output Module

All of the above I/O modules are used with the TU814 MTU.

AI810 Analog Input Module

The AI810 Analog Input Module has 8 inputs. The inputs are independent for each channel, in that either voltage or current can be measured.The current input is able to handle a short circuit to the transmitter supply without damage. Current limiting is performed with a PTC resistor. The voltage inputs are used with this migration to the 6050N Analog Termination Panel. Two AI810 modules are required for each 6050N Analog Termination Panel.

AO810 Analog Output Module

The AO810 Analog Output Module has 8 current outputs. State of outputs can be set to a predetermined (OSP) value if an error is detected. One AO810 module is required for each 6050N Analog Termination Panel.

DI814 Digital Input Module

The DI814 Digital Input Module has 16 channels for 24 volt DC digital inputs. The inputs are divided into two isolated groups of eight channels with a voltage supervision input for each group. Up to a total of two DO814s may be required for each 6051N Digital Termination Panel. Up to four DI814/DO814 I/O modules can be required to connect to two 6051N Digital Termination Panels depending on the mix of inputs and outputs.

DO814 Digital Output Module

The DO814 Digital Output Module has 16 channels for 24 volt DC digital outputs. The outputs are divided into two isolated groups of eight channels with a voltage supervision input for each group. Up to a total of two DI814s may be required for each 60051N Digital Termination Panel. Up to four DI814/DO814 I/O modules can be required to connect to two 6051N Digital Termination Panels depending on the mix of inputs and outputs.

TU814 Module Termination Unit

The TU814 Module Termination Unit (MTU) is a passive base unit containing the process wiring terminal connector and a section of the S800 I/O ModuleBus. The I/O modules plug and lock into the MTU. The TU814 model MTU is used for all S800 I/O Module types associated with your migration.

3.3.1.2 I/O Cables and Connection

Connections to the S800 I/O modules are made via two styles of prefabricated cables. Both the TK616 Analog Cable and the TK617 Digital Cable have a large connector at one end to mate with your existing 6002C I/O cable, and smaller connectors at the other end which connect to the S800 I/O MTU(s). The cables are available in 3 to 30 meters lengths, in increments of 3 meters.

The TK816 Digital Cable Kit is used with each TK617 Digital Cable to connect to a TU814 MTU.

The TK817 Single Block Cable Kit can be used to connect a non-MOD 300 termination panel to the TU814 MTU.

TK616 Analog Cable

The TK616 cable is used for analog I/O signals and comes pre-wired with six connectors at the MTU end (two which connect to the AO810 Analog Output Module, and four of which connect to the AI810 Analog Input Modules). The TK616 cable comes with extra contacts for power connections to the TU814 MTU.

TK617 Digital Cable

The TK617 cable is used for digital I/O signals and comes loose wired at the MTU end with contacts crimped to the wires. The TK816 Digital Cable Kit supplies the terminal blocks, labels, and keying plugs to connect the TK617 to a TU814 MTU. This allows the cable to be custom configured to your existing digital input and output arrangement for connection to the respective S800 I/O digital input or output modules. Once the contacts are correctly placed in the connectors, the cable can be easily removed and reinserted without future wiring errors. This assembly function can be performed before the cables are delivered to the site. The TK617 cable comes with extra contacts for power connections to the TU814 MTU

TK814 Extension Cable

The TK814 is a cable with connectors at both ends to extend the TK616 and TK617 cables.

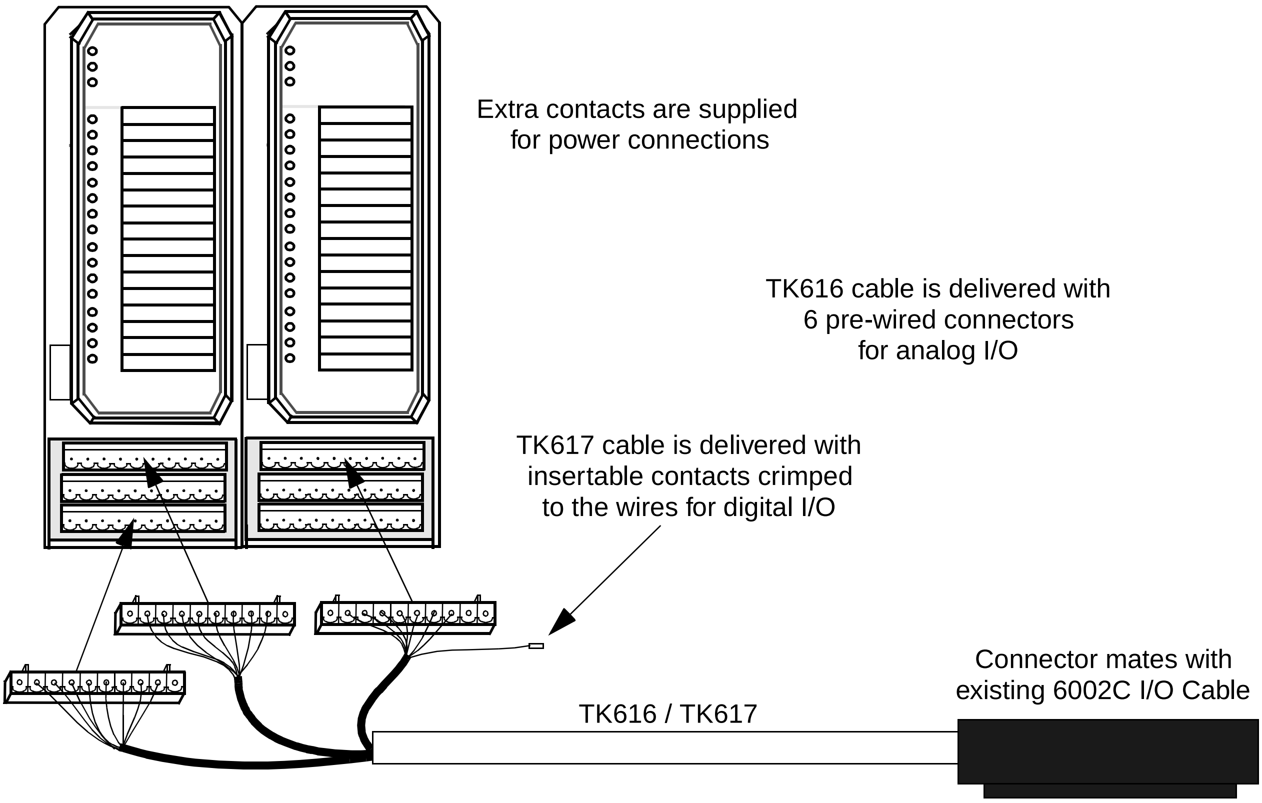


Figure 3-56. TK616 / TK617 Cable Connections

3.3.1.3 Analog I/O Replacement

Your existing 6050N Analog Termination Panels provide 16 analog inputs and 8 analog outputs. Therefore, you will need two AI810 Analog Input Modules, one A0810 Analog Output Module, three TU814 MTUs and one TK616 Analog Cable for each existing 6050N Analog Termination Panel.

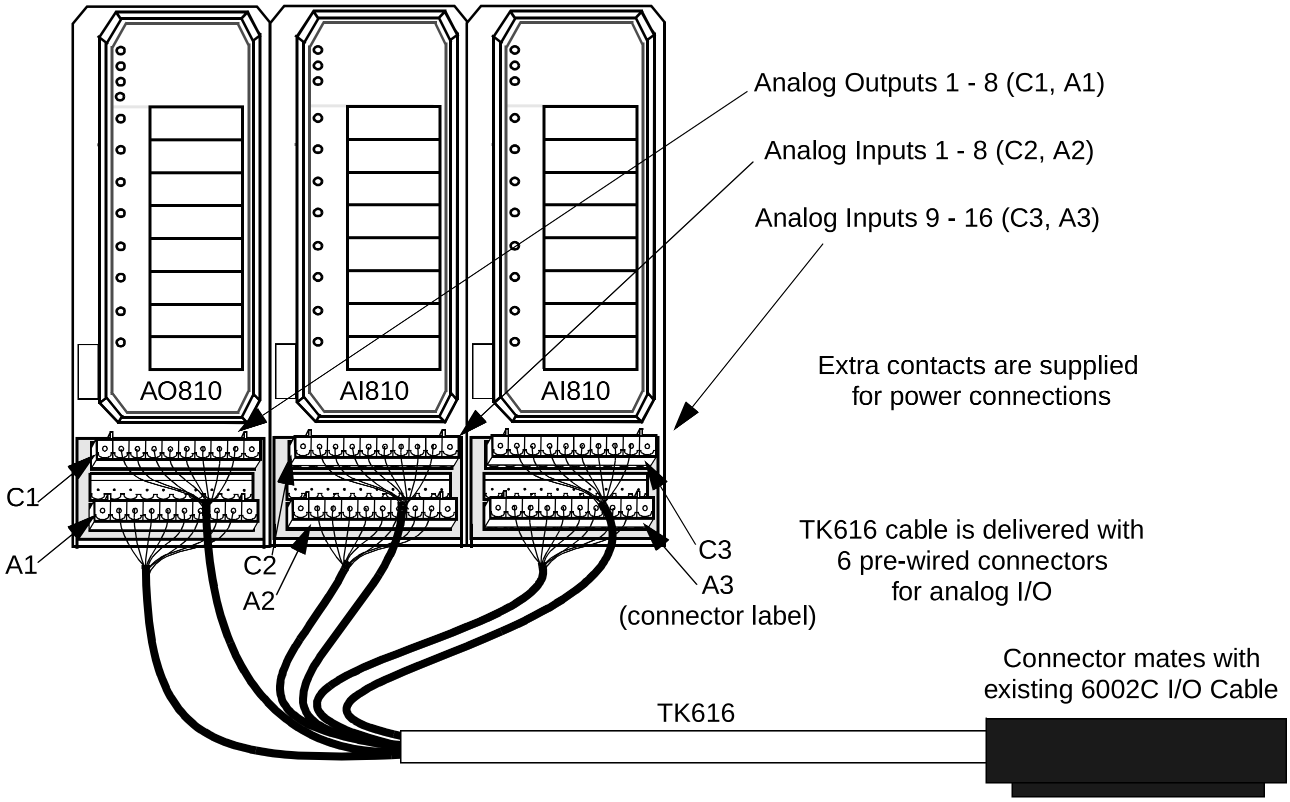


Figure 3-57. Typical Analog I/O Connection Configuration

3.3.1.4 Digital I/O Replacement

Each existing 6051N Digital Termination Panel provides 24 channels which can be configured to be inputs or outputs depending on the I/O module arrangement/mix. Therefore, you may have to use any one of the following combinations:

- two DI814 S800 I/O Digital Input Modules with two TU814 MTUs,
  - Example: 24 digital inputs
- two DO814 S800 I/O Digital Output Modules with two TU814 MTUs,
  - Example: 24 digital outputs
- one DI814 and one DO814 with two TU814 MTUs,
  - Example: 12 digital inputs and 12 digital outputs
- two DI814s and one DO814 with three TU814 MTUs,
  - Example: 18 digital inputs and 6 digital outputs

- one DI814 and two DO814s with three TU814 MTUs.
  - Example: 6 digital inputs and 18 digital outputs

Also needed are: one TK617 Digital I/O Cable and one TK816 Digital Cable Kit for each existing 6051N Digital Termination Panel.

Applications with two 6051N Digital Termination Panels connected to three S800 I/O modules with the correct mix of DIs and DOs may need only one TK816 Digital Cable Kit.

- three DI814s with three TU814 MTUs, two TK617 Digital I/O cables, and one TK816 Digital Cable Kit.
  - Example: 48 digital inputs divided among two 6051N Digital Termination Panels.
- three DO814s with three TU814 MTUs, two TK617 Digital I/O cables, and one TK816 Digital Cable Kit.
  - Example: 48 digital outputs divided among two 6051N Digital Termination Panels.
- two DI814s and one DO814 with three TU814 MTUs, two TK617 Digital I/O cables, and one TK816 Digital Cable Kit.
  - Example: 32 digital inputs and 16 digital outputs divided among two 6051N Digital Termination Panels.
- one DI814 and two DO814s with three TU814 MTUs, two TK617 Digital I/O cables, and one TK816 Digital Cable Kit.
  - Example: 16 digital inputs and 32 digital outputs divided among two 6051N Digital Termination Panels.

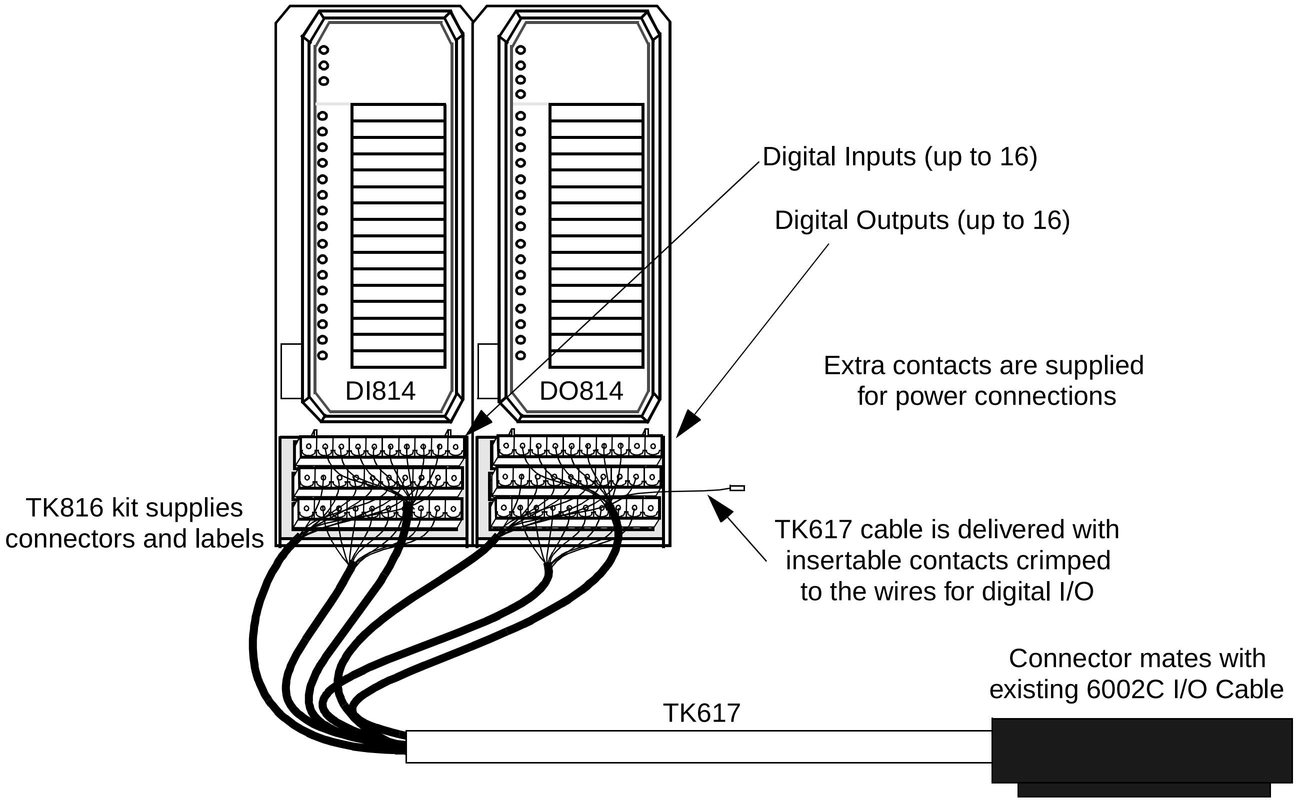


Figure 3-58. Typical Digital I/O Connection Configuration

3.3.1.5 Configuration and Installation

ABB process specialists make it easy for you by analyzing your process and furnishing controller migration recommendations which fit your personal needs. You can install your own migration equipment, or request the amount of installation and database configuration support you need.

Contact your local ABB sales or service representative for more information on installation and support services or any issue regarding 6000B Controller migration.Advant OCS®

3.3.2 6000B/6200B Controller Migration Using S100 I/O

The 6000B/6200B Controller to S100 I/O migration provides a simple means to replace an existing 6000B/6200B Controller subsystem with the Advant Controller 400 Series and S100 I/O. The migration process allows existing field connections and termination panels to remain in place and undisturbed.

This migration procedure makes it possible to plug the controller end of an existing 6002C Controller I/O cable into the mating connector of a conversion panel. The conversion panel then connects to the S100 I/O via cables which go to the S100 I/O Subrack modules.

The panels have the look and feel of the S100 connection units. They are basically comprised of a set of connectors which allow the pre-existing cables from both the 6000B/6200B Controller termination panels and the S100 I/O to be terminated. Circuitry on the conversion panels routes signals from the 6000B/6200B Controller Termination Panel connections to the designated S100 I/O connections.

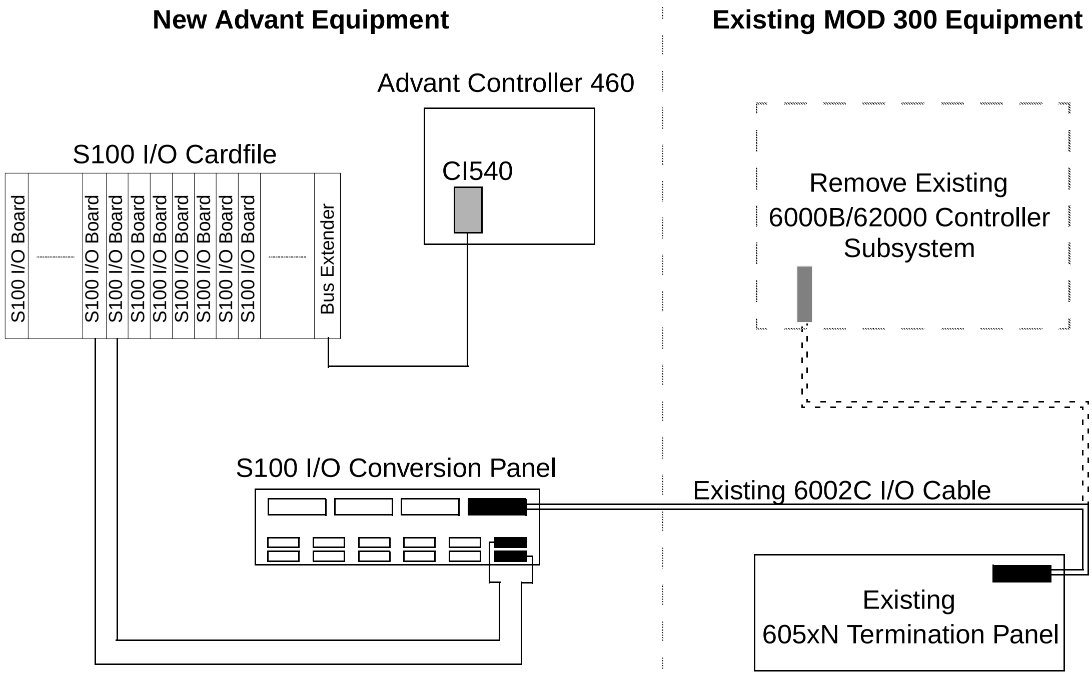


Figure 3-59. 6000B/6200B Controller to S100 I/O Migration Overview

3.3.2.1 Conversion Panels TA510, TA511 and TX513

The three conversion panels, the TA510, TA511 and TX513, have the following properties and features:

- Facilitates easy upgrades of MOD 300 Direct I/O installations to Advant OCS S100 I/O installations.
- No new cables are required, existing cables can be used in all cases.

- Adaptation of S100 I/O modules to MOD 300 termination panels in the most efficient way possible.
- Components added and layout made for compatibility with ABB's safety and EMC compliance directives.

3.3.2.2 TA510 High Level Analog Input/Output Conversion Panel

The TA510 will allow the adaptation of the analog termination panels (6050N) to the S100 analog I/O modules (DSAI133 and DSAX110). Figure 3-60 shows the connections of the TA510 Analog Conversion Panel to 4 pairs of DSAX110 boards (total 8), one pair of DSAI133 boards (2), and to four 6050N Analog Termination Panels.

- High-level analog signals terminated at 6050N Analog Termination Panels are routed to S100 Analog modules of type DSAI133 and DSAX110.
- One conversion panel supports the routing of four 6050N Analog Termination Panels to five sets of redundant S100 modules (Four DSAX110 pairs and one DSAI133 pair).

TA510 Signal Return Issues

For analog outputs, the system ground acts as a return reference for both 6000B/6200B Controller and S100 systems.

However, for analog inputs in the 6000B/6200B Controller systems, separate returns for each input are provided so that floating differential inputs may be accommodated. This is not the case for the S100 system - the returns for the analog inputs are grouped into two groups on each module (two groups of 8 on the DSAX110's, and two groups of 16 on the DSAI133's). There is no way around this.

Jumpers are available for grounding the individual returns, or allowing the group to float (there are 6 groups available). The grouped returns may be connected to system ground via individual suitcase style jumpers. These are the groupings of the analog returns, given in terms of the points on the 6050N Termination Panels.

In general, the six jumpers should be set to the "GND" position. They should only be in the "OPEN" position if the group of analog inputs is to be used as a set of floating inputs.

If floating inputs are required for analog inputs, this adaptation to S100 is difficult because the input returns are grouped according to groups of 8 or 16. These groupings are maintained on the TA510.

The main reason for requiring floating inputs is for field-grounded barriers - the allowance of floating inputs can overcome the errors or ground loops introduced from differences in field and instrument ground points. If this is the case for an installation, it may be possible to take advantage of the grouping on the TA510. If there are a set of barriers which are physically close in the field, it may be possible to keep all the returns of these barriers within one of the groups. However, if just one return of a group is locally grounded, this will end up locally grounding all the returns of a group.

If a small number of points in the system require floating inputs, it may be advantageous to add isolation amplifiers between the field terminations and the MOD 300 termination panels for the desired points.

TA510 Power Requirements

The TA510 requires a 24 Vdc power source. The unit requires at least one +24V feed, however, redundant feeds are available. It is recommended that the same feeds used for the 6050N termination panels be used for the conversion panel.

NOTE

On the DSAX110, an 8 Volt drop is used by the output stage, so if a high ohmic load is to be driven on one of the channels, the supply should be raised a bit (i.e., an 800 ohm load would require +27.1V to allow a 23mA overdrive).

$$V_{supply\ min} = (Max\_load(\Omega)\ X\ 0.023A) + 8.7$$

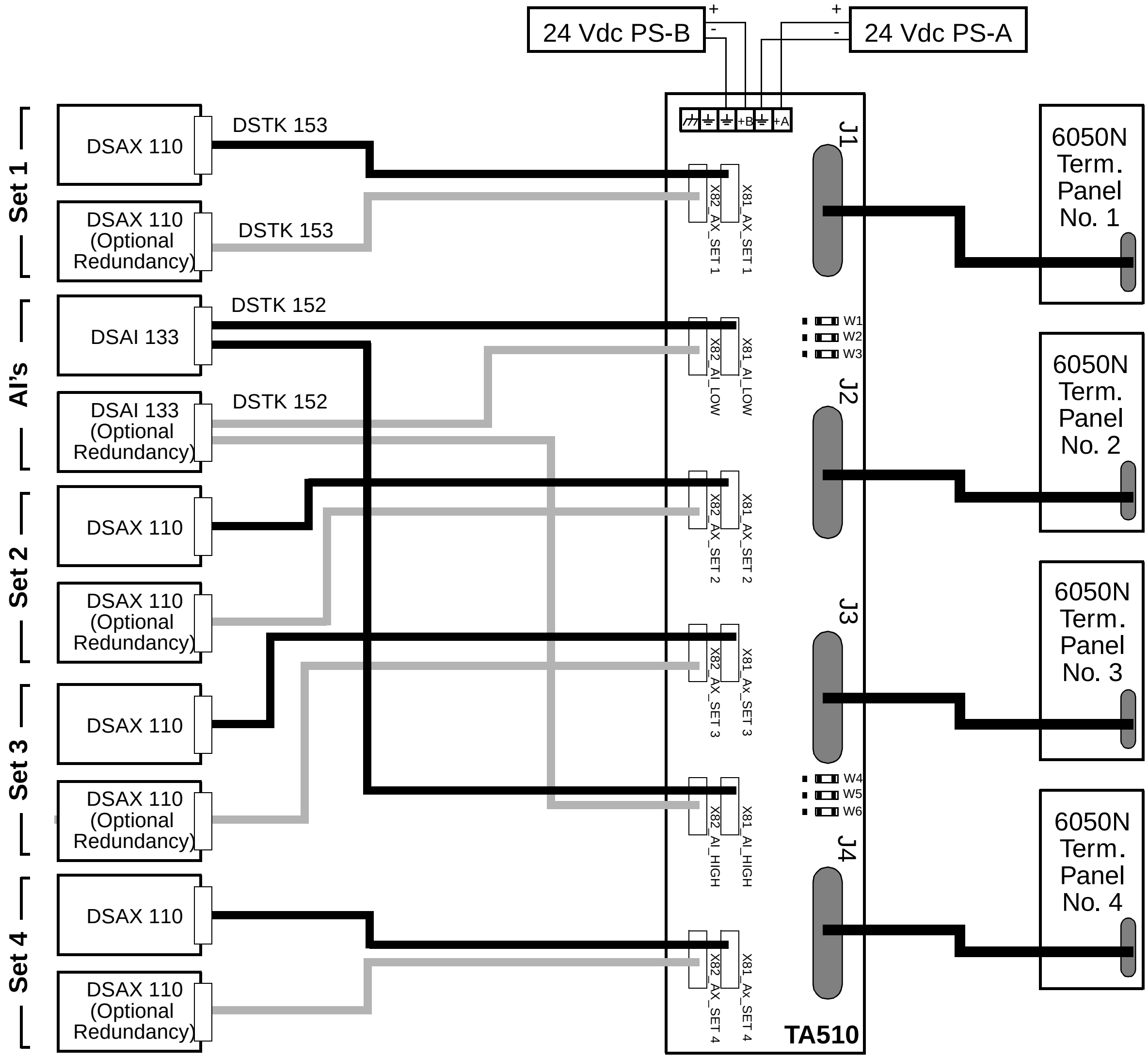


Figure 3-60. TA510 Analog I/O Conversion Panel Connections

3.3.2.3 TA511 Low Level T/C Input Conversion Panel

The TA511 will allow the adaptation of the thermocouple termination panels (6042N) to the S100 Thermocouple measurement module (DSAI155A).

- Feed-through of low-level TC signals from Bulk I/O (Burr-Brown) thermocouple termination unit to S100 module (DSAI155A).
- Conditioning of CJC signal from Bulk I/O unit to be compatible with S100 levels.

15 TC signals on Bulk I/O are routed to 14 TC inputs on DSAI155A, i.e., one channel will not be routed. Figure 3-61 shows the interconnections of the TA511 Thermocouple Input Conversion Panel to a DSAI155A board and to an existing 6042N Termination Panel.

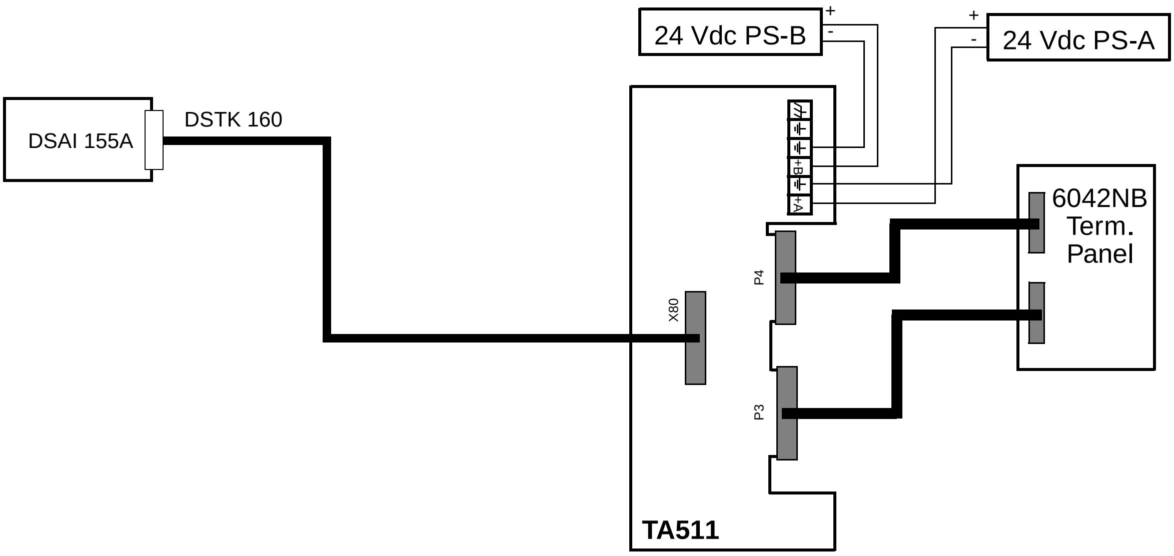


Figure 3-61. TA511 Thermocouple Input Conversion Panel Connections

Thermocouple Channels and Cold Junction Compensation

Since the Bulk I/O TC module allows for 15 TC channels (channels 2-16) to be measured, but the S100 module only allows for 14 channels, only the first 14 channels (channels 2-15) of the Bulk I/O module will be routed to the 14 channels of the DSAI155A. Channel 16 of the Bulk I/O can be re-terminated at an unused input on the panel, or routed to another DSAI155A module.

The CJC signal (channel 1) from the Bulk I/O panel is conditioned to be compatible with the DSAI155A CJC input. The signal from the Bulk I/O panel gives 10mV/^{o}C, and the DSAI155A requires a 100mV/^{o}C signal. An op-amp with a precise gain of 10 is used to make this conversion. EMC protection is added around the circuit. The circuit requires a +24V supply, available as a redundant supply - the negative rail is generated by an inverter circuit for convenience.

TA511 Power Requirements

The TA511 requires a 24 Vdc power source. The unit requires at least one +24V feed, however, redundant feeds are available. It is recommended that the same feeds used for the 6042N termination panels be used for the conversion panel.

Isolation and Shielding Issues

The Bulk I/O TC module has individually isolated input channels, whereas the DSAI155A has differential inputs which are groupwise isolated. This should not normally be a problem unless the total common mode voltage between channels is higher than 15 Volts.

There is a provision for terminating TC shields on the Bulk I/O panel (at the CASE GND connection). However, the cable which jumpers the Bulk I/O panel to the module is not shielded - this should not normally pose a problem as this is usually installed in a protected environment. Use the DSTK160 cable to carry the TC signals from the TA511 to the DSAI155A, and terminate the shield at both ends.

3.3.2.4 TX513 Digital I/O Conversion Panel

The TX513 will allow the adaptation of the digital termination panels (6051N) to the S100 digital I/O module (DSDX180).

- Signals interfacing to digital conditioning modules (of the Opto 22 variety) are routed to S100 Digital module type DSTX180.

One conversion panel supports the routing of four 6051N Digital Termination Panels to three sets of redundant DSTX180 modules.

Figure 3-62 shows the connections of the TX513 Digital Conversion Panel to 3 pairs of DSDX180 boards (total 6), and to four 6051N Digital Termination Panels.

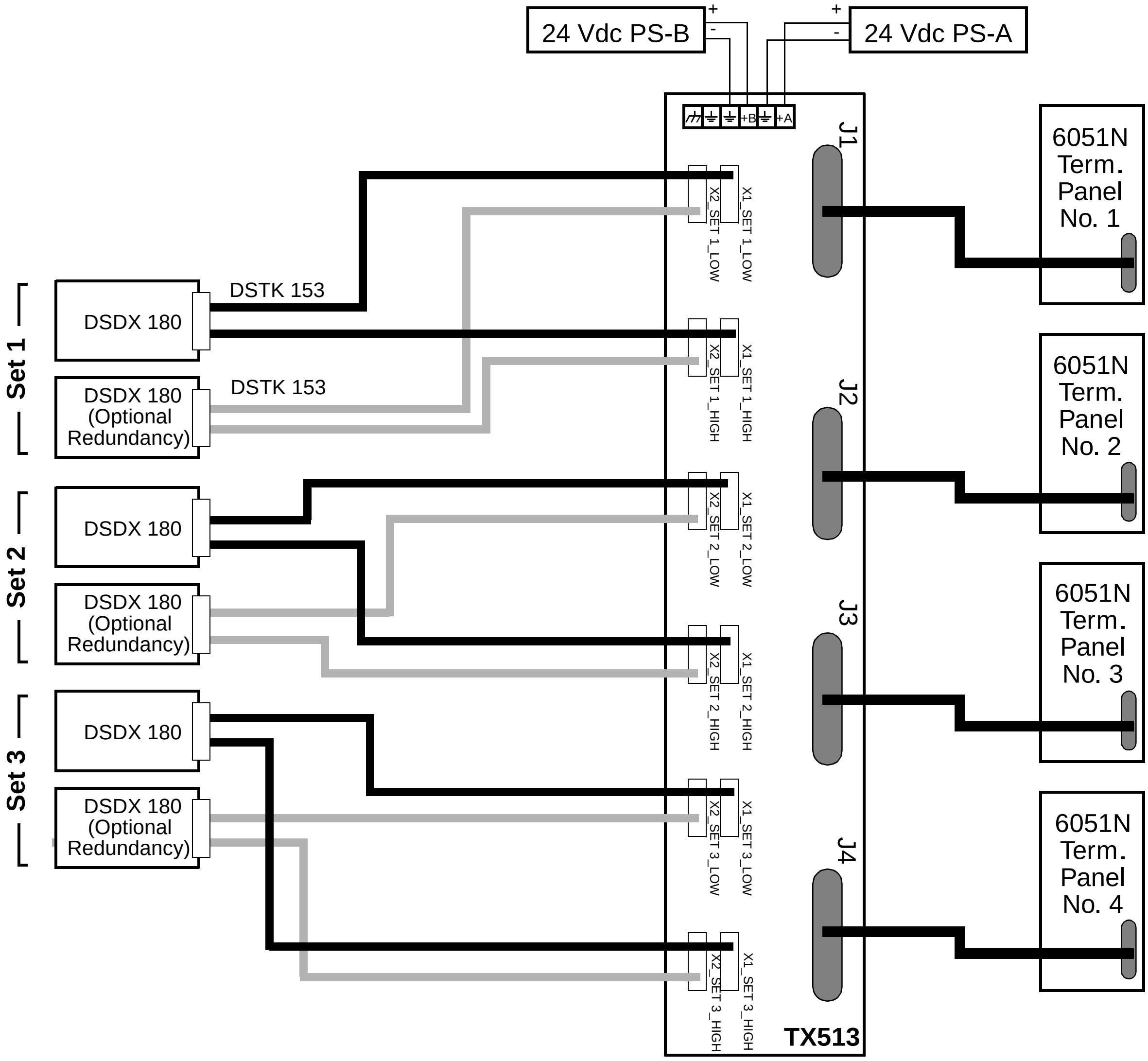


Figure 3-62. TX513 Digital I/O Conversion Panel Connections

TX513 Power Requirements

The TX513 requires a 24 Vdc power source. The unit requires at least one +24V feed, however, redundant feeds are available. It is recommended that the same feeds used for the 6051N termination panels be used for the conversion panel.

Again, it is stressed that the same +24V feed(s) used to supply the MOD 300 termination panels be routed to the TX513. These are used to feed the diagnostic indications on the DSDX180's, to test the availability of redundancy of the +24V supplies. It is anticipated that in most cases the same +24V feed(s) will be used for all the 6051N panels in an installation, or in large enough blocks so that groups of four panels could be converted and the health of the supplies be monitored.

3.3.2.5 S100 I/O Boards

The migration uses four types of standard S100 I/O boards for signal conditioning:

- DSAI133 - 32 channel Analog Input board
- DSAX110 - 16 channel Analog I/O board (8 inputs and 8 outputs)
- DSAI155A - 14 channel Thermocouple Input board
- DSDX180 - 32 channel Digital I/O board (inputs/outputs configurable)

Please refer to the *S100 I/O User's Guide* for detail information on these boards.

DSAI133 Analog Input Board

The DSAI133 Analog Input board measures 32 single ended, unipolar inputs. It can measure either voltage or current, however, the voltage inputs are used with this migration to the 6050N Analog Termination Panel. Two DSAI133 boards (1 redundant pair) connect to the TA510 Analog I/O Conversion Panel using standard I/O interface cables.

DSAX110 Analog I/O Board

The DSAX110 Analog I/O board measures 8 single ended, unipolar inputs and has 8 unipolar current outputs. Eight DSAX110 boards (4 redundant pairs) connect to the TA510 Analog I/O Conversion Panel using standard I/O interface cables.

DSAI155A Thermocouple Input Board

The DSAI155A Thermocouple Input board measures 14 channels plus a separate cold junction compensation input. It supports B, E, J, K, R, S, and T type thermocouples. One DSAI155A board connects to the TA511 Thermocouple I/O Conversion Panel using standard I/O interface cables.

DSDX180 Digital I/O Board

The DSDX180 Digital I/O board has 32 channels that can be individually configured for input or output signals. Each channel consists of an input buffer and an output latch which are software controlled. Six DSDX180 boards (3 redundant pairs) connect to the TX513 Digital I/O Conversion Panel using standard I/O interface cables.

3.3.2.6 Analog I/O Replacement

High-Level Analog Signals

The migration kit is designed to handle the replacement of four 6050N Analog Termination Panels worth of I/O per each TA510 Analog Conversion Panel. An existing 6050N Analog Termination Panels provide 16 analog inputs and 8 analog outputs, therefore, each conversion panel can handle 64 analog inputs and 32 analog outputs.

Eight DSAX110 boards and DSTK153 cables, and two DSAI133 boards and DSTK152 cables are needed for each full TA510 Analog Conversion Panel used. The 6002C I/O cables presently connected to the 6050N Analog Termination Panels may be re-used, or new longer 6002C cables may be purchased if needed.

Thermocouple Signals

The Thermocouple migration provides a one-to-one replacement of the 6042N Bulk I/O Thermocouple Termination Panel, by using the TA511 Conversion Panel. Your existing 6042N Thermocouple Termination Panel provides 15 inputs. The DSAI155A board supports 14 inputs, therefore, the one remaining input, if used, will need to be routed to another DSAI155A board.

One DSAI155A board and DSTK160 cable is needed for each TA511 Thermocouple Conversion Panel used. The 6003C I/O cable presently connected to your 6042N Thermocouple Termination Panel may be re-used, or new longer 6003C cable may be purchased if needed.

3.3.2.7 Digital I/O Replacement

The migration kit is designed to handle the replacement of four 6051N Digital Termination Panels worth of I/O per TX513 Digital Conversion Panel. Each existing 6051N Digital Termination Panel provides 24 channels which can be configured to be inputs or outputs depending on the I/O arrangement, therefore, each conversion panel can handle 96 digital signals (inputs or outputs).

Six DSTX180 boards and DSTK152 cables are needed for each full TX513 Digital Conversion Panel used. The 6002C I/O cables presently connected to the 6051N Digital Termination Panels may be re-used, or new longer 6002C cables may be purchased if needed.

3.3.2.8 Configuration and Installation

ABB process specialists can make it easy for customers by analyzing their process and furnishing controller migration recommendations that fit their requirements. The customer can install the migration equipment, or request the amount of installation and database configuration support needed from ABB.

The customer’s local ABB sales or service representative can be contacted for more information on installation and support services or any issue regarding 6000B/6200B Controller migration.

3.4 Advant Station 500 Series

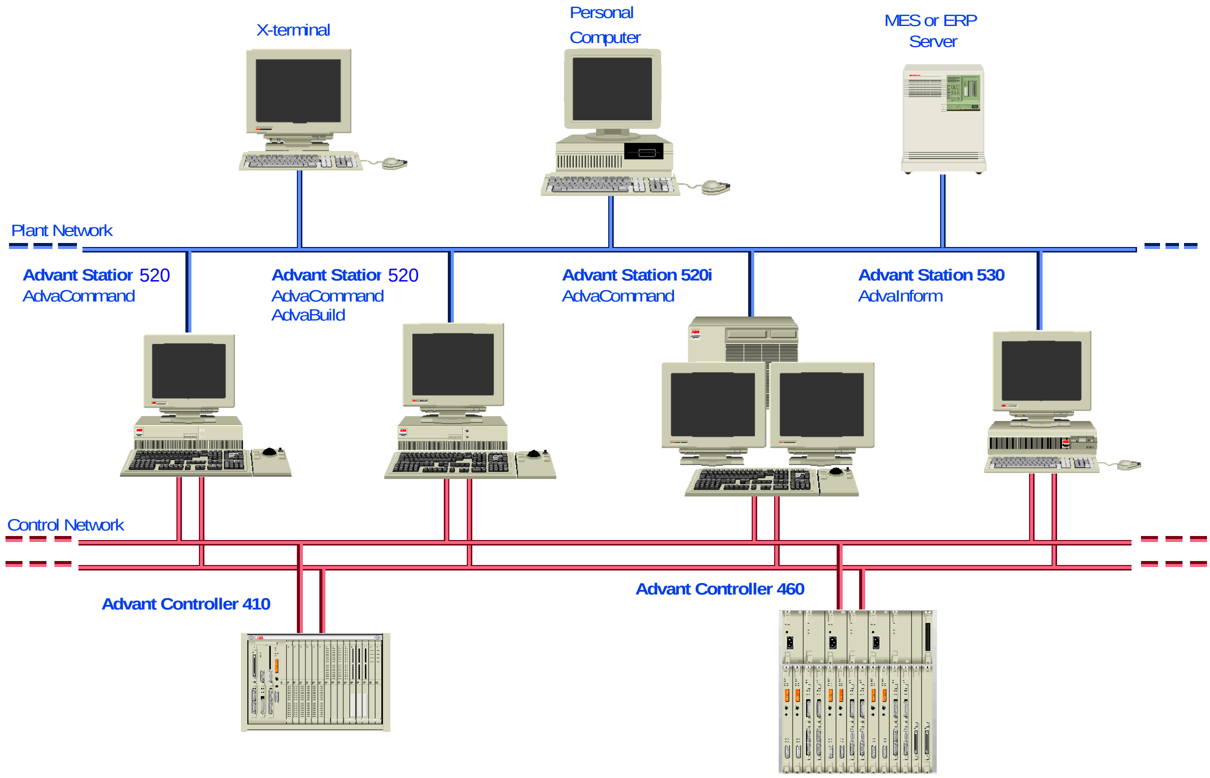


Figure 3-63. System Architecture

General

Advant Station 500 Series workstations are used in conjunction with AC400 Series Controllers. They collect data via the DCN and are used as operator workplaces, information management workplaces or engineering workplaces.

All models in the Advant Station 500 Series are based on HP 9000/700 workstations and are equipped with a real-time accelerator board so they can connect with the DCN.

The Advant Station 500 Series can accept 100-240 V ac power. It is strongly recommended that some means of uninterruptible power supply (UPS) is used. An individual station uninterruptible power supply is available as an option if a plant UPS is not available.

Two versions of the Advant Station 500 Series are available; AS 520 and AS 530.

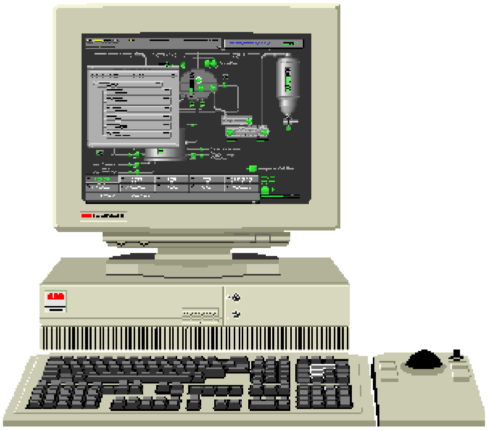


Figure 3-64. Advant Station 520 & 530 Configuration

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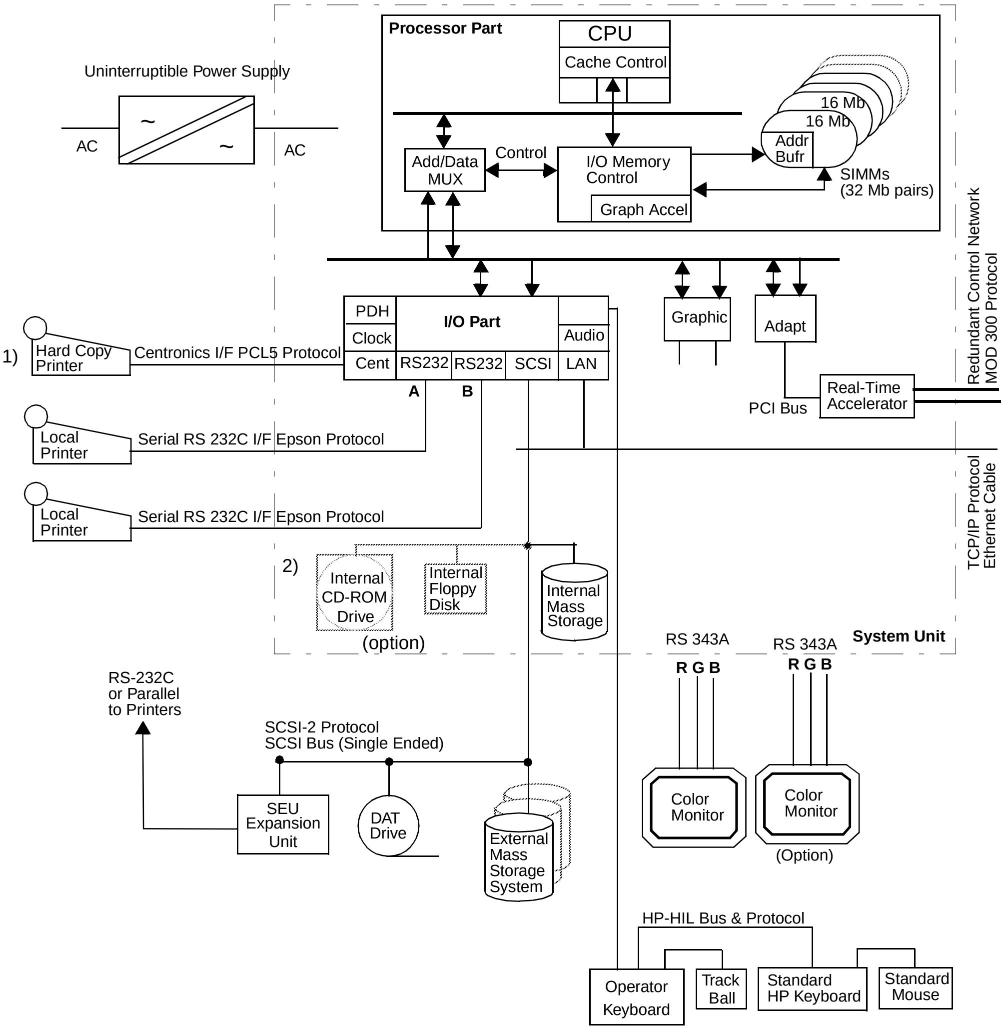
Table 3-42. Advant Station Functional Compatibility

Function	Advant Station
Operator Workplace	AS520
Information Management Workplace	AS520, AS530



1) or Document Postscript Printer
2) The System Unit can house up to two internal hard disks and one floppy disk drive **or** one CD-ROM drive at the same time

Note: All options are not available for all Advant Station products.

Figure 3-65. Simplified Overall System Block Diagram

3.4.1 Advant Station Technical Data

Advant Station 520/B180L

The Advant Station 520 (AS 520) is based on the HP 9000 B180L table top unit. The internal drive and memory are included. One or two monitors can be connected and must be ordered separately. The basic configurations (3) of the AS 520 available are: (see Table 3-43)

Table 3-43. AS 520/B180L Basic Hardware Kit

Item Designation	Description
PCX523K01	B180L System Unit with: 180 Mhz CPU 128 Mbyte RAM 9 Gbyte hard disk drive (UltraSCSI-3) 12X CD-ROM drive PCI backplane One graphic (video) channel PS/2 QWERTY keyboard and mouse Power cords TCP/IP terminator (TX511)
PCX524K01	B180L System Unit with: 180 Mhz CPU 128 Mbyte RAM 9 Gbyte hard disk drive (UltraSCSI-3) 12X CD-ROM drive PCI backplane Two graphic (video) channels PS/2 QWERTY keyboard and mouse Power cords TCP/IP terminator (TX511)
PCX525K01	B180L System Unit with: 180 Mhz CPU 256 Mbyte RAM 9 Gbyte hard disk drive (UltraSCSI-3) 12X CD-ROM drive PCI backplane Two graphic (video) channels PS/2 QWERTY keyboard and mouse Power cords TCP/IP terminator (TX511)

The AS 520 Provides the following interfaces:

- One Enhanced Video Connector (EVC) for one display channel. A conversion cable is included that converts from EVC to 15-pin high-density VGA-style connector.
- Two RS-232 (serial) interfaces for connection of printers and external alarm (9-pin PC compatible)
- One Centronics (parallel) interface for connection of one hard copy or document printer (PC compatible)
- One single-ended SCSI-2 bus output connector for connection of external SCSI-2 devices
- One wide single-ended UltraSCSI-3 16-bit interface
- One IEEE 802.3 Ethernet ThickLAN Interface (AUI connector) and one LAN-TP connector (Unshielded Twisted Pair, UTP). Only one of those outputs can be used at a time. With automatic selection.
- Two GSC/PCI card I/O slots. The Real Time Accelerator (RTA) board is installed in the PCI I/O slot. The optional graphics card for a second display channel is also installed here.
- Two DCN connectors and a USB port when the RTAB is installed

AS520 Technical Data

Table 3-44. AS 520/B180L Technical Data

Property	Data
CPU Performance	
Clock Frequency	180Mhz
SPECint95	9.22
SPECfp95	9.43
Cache memory	256K, 64 bit
Power Requirements	
Voltage	120/230VAC - 50/60Hz (auto-ranging)
Current	5A max @ 120V 3A max @ 230V
Line Frequency	50-60 Hz
Power	300W max
Environmental	
Operating Temperature	+5 to +40^{o}C
Storage Temperature	-40 to +70^{o}C
Humidity	15% to 85% (non-cond)
Physical	
Width	444mm (17.5”)
Height	117mm (4.6”)
Depth	452mm (17.8”)
Weight	18.5kg (41 lbs)

Advant Station 530/B180L

The Advant Station 530/B180L (AS 530) is a high performance workstation that is used for CPU intensive applications. The Advant Station 530/B180 is based on the HP B180L 180MHz table top unit. Internal drive and memory is included along with a 256K byte instruction and 256K byte data cache memory and 1M byte of second level cache. One monitor can be connected and must be ordered separately.

The basic system unit that is available for the Advant Station 530/B180L is (see Table 3-45):

Table 3-45. AS 530/B180L Basic Hardware Kit

Item Designation	Description
PCX520K01	B180L System Unit with: 180 Mhz CPU 256 Mbyte RAM 9 Gbyte hard disk drive (UltraSCSI-3) 1 Mbyte Second Level Cache 12X CD-ROM drive PCI backplane One graphic (video) channel PS/2 QWERTY keyboard and mouse Power cords TCP/IP terminator (TX511)

The AS530 Provides the following interfaces:

- One IEEE 802.3 Ethernet LAN with ThickNET AUI connector
- One IEEE 802.3 Ethernet LAN with twisted pair modular connector
- One parallel Centronics
- Two RS-232C
- One single-ended SCSI II
- One Ultra SCSI III (supports up to 15 devices)
- One video monitor connector
- Two DCN connectors and USB port when the RTAB is installed

AS530 Technical Data

Table 3-46. AS 530/B180 Technical Data

Property	Data
CPU Performance	
Clock Frequency	180Mhz
SPECint95	9.22
SPECfp95	9.43
Cache memory	256K, 64 bit
Power Requirements	
Voltage	120/230VAC - 50/60Hz (auto-ranging)
Current	5A max @ 120V 3A max @ 230V
Line Frequency	50-60 Hz
Power	300W max
Environmental	
Operating Temperature	+5 to +40^{o}C
Storage Temperature	-40 to +70^{o}C
Humidity	15% to 85% (non-cond)
Physical	
Width	444mm (17.5”)
Height	117mm (4.6”)
Depth	452mm (17.8”)
Weight	18.5kg (41 lbs)

Real Time Accelerator Board (RTA)

The Advant Station comes equipped with the PU518K01 Real-Time Accelerator (RTA) with a DCN communication module and USB port.

The RTA board is a slave processor board with its own memory and two communication ports. The RTA board consists of a mother board with a DCN communication module mounted on it. The on-board software is down-loaded to the RTA at start up of the Advant Station.

The RTA is installed inside the System Unit in a PCI slot. The communication connectors are available on the rear bulkhead of the System Unit.

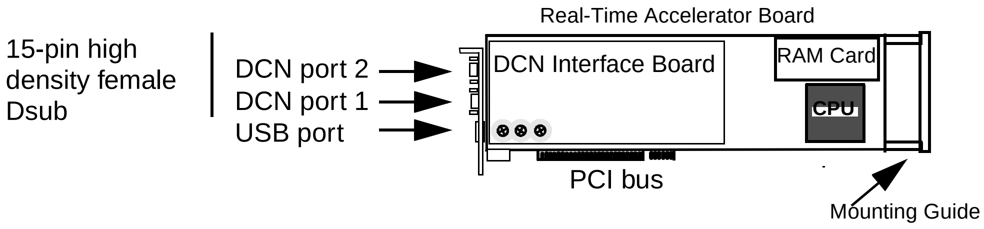


Figure 3-66. Real-Time Accelerator Board PU518K01

Packaging

Two different hardware packages are possible:

- The AS 520 and AS 530 workstation in a standard HP desktop enclosure with standard desktop peripherals.
- The Advant Station 520 and AS 530 in industrial style cabinets. This cabinet is well suited for industrial applications and is protection class IP21.
- The AS 500 Series workstation in an ABB RE540 kneehole table cabinet with standard HP desktop peripherals. This cabinet is well suited for use together with the operator table, and is protection class IP21.

For cabinet dimensions and operator workplace table, see the Cabinetry and Consoles section.

CE Marking

Advant Station 500 Series and associated peripherals have been certified by HP or the manufacturing vendor, and are purchased with CE label with the exception of the following:

- Redundant Disk Arrays MP551

Basic Advant Station Configuration Guidelines

The distance between the workstation and the monitors is limited to 30 m (100 ft.).

The interactive devices, i.e., operator® keyboard, trackball, mouse, etc., are connected via Universal Serial Bus (USB). The distance between the interaction devices and the workstation is limited to 15 m.

Hard-copy printers are connected to Advant Station 500 Series via Centronics parallel ports.

For printer distances over 15 m (50 ft.) modems are required.

The primary memory of Advant Stations can be extended in modules of 32, 64, 128 Mbytes.

Additional internal memory units can be added to the Advant Station operator workplace, engineering workplace, and information management workplace.

Additional external mass memory units can be added to operator workplace, engineering workplaces, and information management workplace.

Redundant Disk Array housing one to four pairs of either 9 or 18 Gbyte drives can be added to the operator workplace and information management workplace.

X-terminals can be connected through the TCP/IP network to both engineering workplaces and information management workplace.

3.4.2 Advant Station 500 Series Hardware

An operator workplace can consist of one or two monitors and a combination of the following interaction devices; a function keyboard, a standard workstation keyboard, a track ball and/or a mouse.

3.4.2.1 Keyboards

The Advant Station 500 Series is available with three different keyboards:

- **Operator Keyboard.** The Operator Keyboard is required to support the AdvaCommand and other software packages in an operator workplace. This keyboard may also be used to support AdvaBuild functions in an engineering workplace. The operator keyboard is available in both mechanical and membrane technologies. The degree of protection, in accordance with IEC 529, is IP51 for the standard Operator Keyboard and IP62 for the membrane version. The membrane keyboard can be flush mounted under a panel with the RX501 Flush mounting kit. The kit includes profiles, clamps and sealing.
- **Page Selector Alarm Panel (PSAP).** The PSAP provides 48 user-configurable push-button stations. These stations represent either a group, area, or unit. Each station includes a push-button, four LEDs, and a text area. The push-button can be configured to either call up a display related to the group or area, or start a TCL sequence on the unit. The LEDs annunciate the occurrence of an alarm in the group, area, or unit represented by the push-button. The text in the text areas are user definable. As a membrane keyboard, the degree of protection, in accordance with IEC 529, for the PSAP is IP62. The membrane keyboard can be flush mounted under a panel with the RX501 Flush mounting kit. The kit includes profiles, clamps and sealing.
- **The standard QWERTY Keyboard.** This keyboard can be used for engineering workplace activities, and can also support some operator functions. This keyboard is not mandatory since all functions can be supported by an Operator keyboard. The QWERTY keyboard is included with the System as standard.

Three languages are supported:

- North-American english
- German
- Swedish.

You can install the Advant Station 500 Workstation keyboards as follows:

- Fixed table top mounting (PSAPs, Operator and QWERTY keyboard)
- Splash proof table top mounting (membrane Operator and PSAPs)

- Flush mounting (membrane Operator and PSAPs with RX501 Flush mounting kit).
- Console cabinetry mounted with a TX505 Keyboard Work Station Interface.

Table 3-47. Mechanical Universal USB Keyboards

Type Designation	Description
IH532ENK01	North American kit including IH532EN mechanical keyboard, 5m (16 ft.) USB cable, 100-240VAC/12VDC converter, and keyboard manual.
IH532DEK01	German kit including IH532DE mechanical keyboard, 5m (16 ft.) USB cable, 100-240VAC/12VDC converter, and keyboard manual.

Table 3-48. Membrane Universal USB Keyboards

Type Designation	Description
IH542ENK01	North American kit including IH542EN membrane keyboard, 5m (16 ft.) USB cable, 100-240VAC / 12VDC converter, and keyboard manual.
IH542DEK01	German kit including IH542DE membrane keyboard, 5m (16 ft.) USB cable, 100-240VAC / 12VDC converter, and keyboard manual.

All keyboards are connected through a Universal Serial Bus (USB) to the System Unit USB port. Each keyboard has one input and three output USB connectors and one connector dedicated for the trackball. The mouse, if used, is connected to the System Unit through the PS/2 connection.

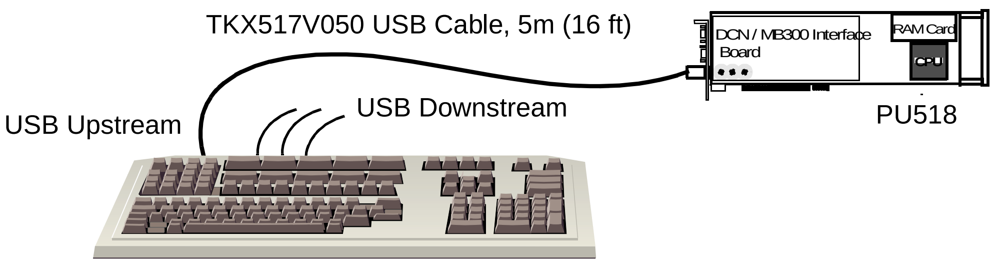


Figure 3-67. USB Keyboard Typical Connection

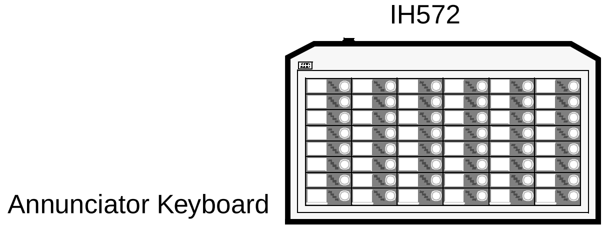


Figure 3-68. USB PSAP Keyboard (IH572)

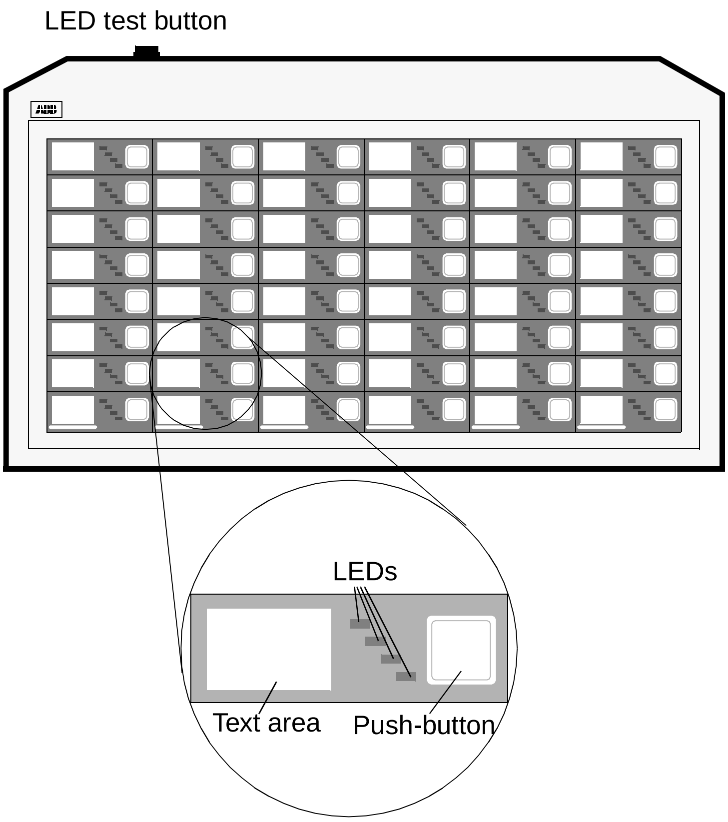


Figure 3-69. IH572 Annunciator, PSAP Keyboard, Membrane

Table 3-49. Membrane Annunciator USB Keyboard (IH572)

Type Designation	Description
IH572K01	USB Annunciator, PSAP, including IH572 membrane keyboard, 5m (16 ft.) USB cable, 100-240VAC / 12VDC converter, and keyboard manual. With 48 push button stations. Each station includes a push-button, four LEDs, and a text area. Protection class acc. to IEC 529: IP62.

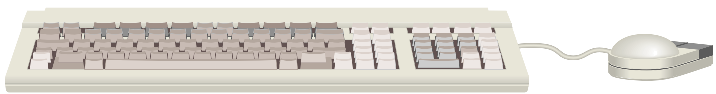


Figure 3-70. IH556, HP Standard QWERTY Keyboard with IH585, HP 3-button Mouse

Table 3-50. USB Keyboard Accessories

Type designation	Description
USB Cable	
TKX517V050	USB cable assembly, 5m (16 ft.). For attachment of USB keyboards on the USB bus. USB type A plug in one end, type B plug in the other.
Keyboard Power Supply	
SD524	AC/DC converter, Input: 100-240VAC / output: 12VDC 3.6A, for powering of IH512/522/532/542/572 USB keyboards. The DC cable, 1.8m (6 ft.), is permanently attached to the converter. The 2-pin DC connector fits directly into the conn. on the keyboard.
Blank Keytop Kits	

Table 3-50. USB Keyboard Accessories (Continued)

Type designation	Description
IH502V01	Bag with 25 pcs blank light beige keycaps. Size LxWxH: 18.3x18.3x9.3mm. For the IH510/511/512 and IH530/531/532 ABB mechanical keyboards
IH502V02	Bag with 10 pcs blank dark beige keycaps. Size LxWxH: 18.3x18.3x9.3mm. For the IH510/511/512 and IH530/531/532 ABB mechanical keyboards

3.4.2.2 Pointing devices

Two pointing devices are available with your Advant Station 500 workstation:

- IH580 4-button trackball
- IH585 HP 3-button mouse.

The trackball is connected to a dedicated connector on the Operator keyboard.The HP 3-button mouse, if used, is connected to the System Unit through the PS/2 connection. The degree of protection, in accordance with IEC 529, is IP40 for the trackball.

The HP 3-button mouse is included with the System as standard.

NOTE

You **cannot** connect a trackball directly to the USB ports.

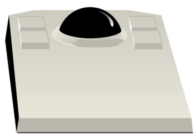


Figure 3-71. IH580 4-Button Trackball

3.4.2.3 Security Key

The MX514 Security Key is a plastic, key-like device designed to enhance password security. The key can be read from or written to with a MX513V01 Security Key Interface Unit. The key itself contains EEPROM read/write memory.

Once programmed the Security Key is easy to operate. Upon insertion into the Security Key Interface Unit, the operator workplace verifies the user information and either autologs you on or continues a security check by requiring a password. The log on and log off information can be routed to the history package and/or a logger. The message sent contains the time, the individual's name and the CRT logged onto.

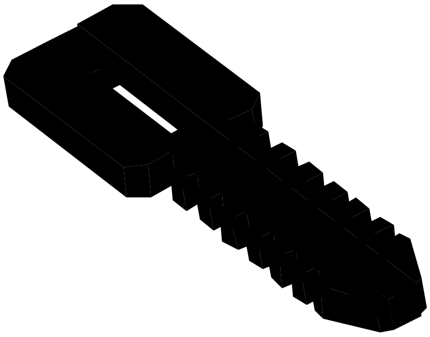


Figure 3-72. An Example of a MX514 Security Key

NOTE

Keys previously programmed for use in MOD 300 CDP subsystems will not be usable without reprogramming.

3.4.2.4 Monitors

Six multisyncronizing color monitors are available for the Advant Station 520/B180L:

- IM521K05 - 20” color monitor, resolution 1280x1024 pixels, frame rate 72 Hz. With BNC input connectors, rack mounting.
- IM521K06 - 20” color monitor, touchscreen, resolution 1280x1024 pixels, frame rate 72 Hz. With BNC input connectors, rack mounting.
- IM538 - 19” color monitor, resolution 1280x1024 pixels, frame rate 60/72 Hz. The monitors come with a cable that has a connector that fits directly into the video output of the System Unit. For table top mounting, southern and northern hemisphere use.
- IM539 - 21” color monitor, resolution 1280x1024 pixels, frame rate 50-90 Hz. With a video cable. Table top mounting. The IM539 monitor has five BNC connectors (R, G, B, V/H and V) and a permanently attached video cable with a 15-pin high density Dsub connector, VGA style, for connection to the System Unit.
- IM540V1 - 21” color monitor, touchscreen, resolution 1280 x 1024 pixels, frame rate 50-90 Hz. With a video cable. Table top mounting. The monitor has five BNC input connectors (RGB, HD, VD), a 15-pin high density VGA-style D-sub connector and a 9-pin D-sub connector for the touchscreen serial connection. It is delivered with a 1.5 m (about 5ft.) video cable with 15-pin high density VGA-style D-sub plug connectors at both ends and a 1.5 m. (about 5 ft.) touchscreen (serial) cable with 9-pin D-sub connectors on both ends.
- IM541 - 17” color monitor, resolution 1280x1024 pixels, frame rate 60/72 Hz. The monitor comes with a permanently attached video cable with a 15-pin high density connector that fits directly into the System Unit. A short conversion cable that converts from the 15-pin Dsub to the System Unit Enhanced Video Connector (EVC) port is

included with the System Unit. For table top mounting and northern hemisphere use.

The differences between monitors for the northern and the southern hemispheres are in tube mask design and adjustment of the deflection.

NOTE

All monitors automatically selects between 120 V and 230 V power voltage.

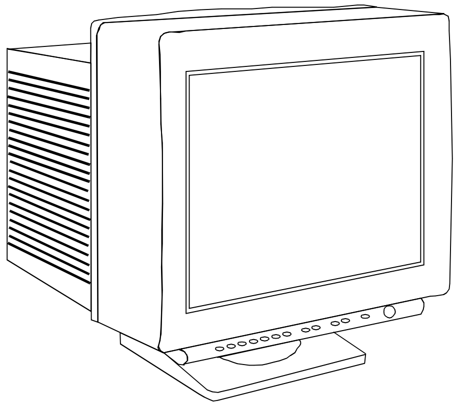


Figure 3-73. 19” IM538 Color Monitor

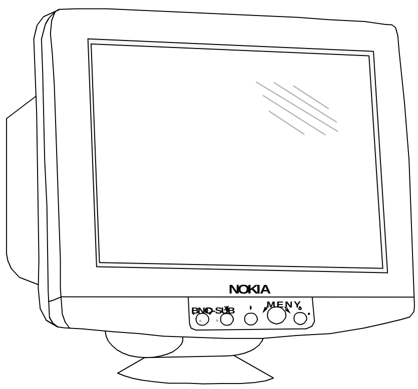


Figure 3-74. 21” IM539 Color Monitor

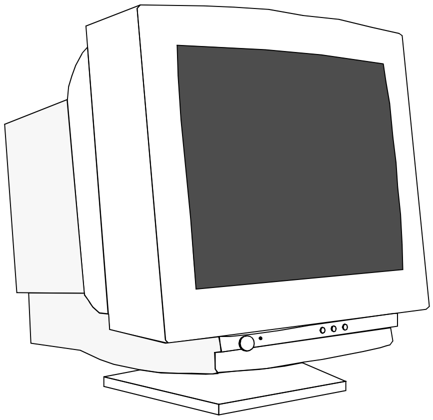


Figure 3-75. 19” IM540 Color Monitor with Touchscreen

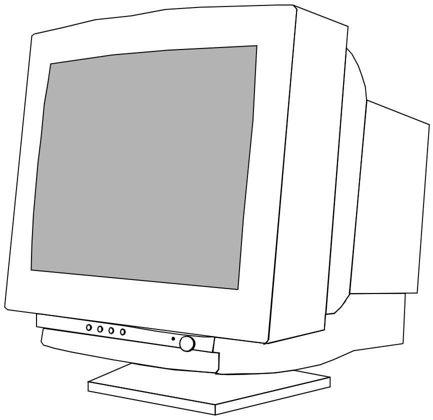


Figure 3-76. 17” IM541 Color Monitor

Table 3-51. Monitor Technical Data

Property	IM521K__ 20” Color Monitor	IM541V1 17” Color Monitor	IM538 19” Color Monitor	IM539 21” Color Monitor	IM540 21” Color Monitor
Frame Rate	72 Hz	75 Hz	60/72/75 Hz	50 - 90 Hz	50 - 90 Hz
Resolution	1280 x 1024	1280 x 1024	1280 x 1024	1280 x 1024	1280 x 1024
Dimension h x w x d mm (inches)	466x508x568 (18.5x20.0x 22)	433 (17) x 410 (16.1) x 385 (15.2)	454 (17.9) x 448 (17.6) x 460 (18.1)	490 (19.3) x 515 (20.3) x 544 (21.4)	490 (19.3) x 493 (19.4) x 490 (19.3)
Net weight	36 kg (79 lbs)	17.3 kg (38.1 lbs)	24 kg (52.8 lbs)	32 kg (71.4 lbs)	31 kg (71.0 lbs)

Table 3-51. Monitor Technical Data

Property	IM521K__ 20” Color Monitor	IM541V1 17” Color Monitor	IM538 19” Color Monitor	IM539 21” Color Monitor	IM540 21” Color Monitor
Current Max.	-----	1A @ 230V 2A @ 110V	1.8A @ 230V 3A @ 110V	2.25A @ 230V 3.5A @ 120V	2.5A @ 230V 3.5A @ 120V
Power consumption (typical)	150W	100 W	150W	160W	160W

3.4.2.5 X-Terminals

One X-terminal, with two different QWERTY keyboards, is available for the Advant Station 500 Series. The X-terminals are connected to the Standard Communication network or the Plant Network. The X-terminal packages consists of a base unit, keyboard and mouse. An HP standard, language dependent, PS/2 QWERTY-style keyboard and mouse are included.

The monitor is optional. The X-terminal packages are based on the HP ENVIZEX II Netstation that includes a 66.7 MHz (133MHz internal) NEC R4300, 12Mbyte RAM, and 2Mbyte video memory. A color monitor can be connected to the video output of the base unit. The monitor must have a screen resolution of 1280x1024 pixels and operate at 72 Hz frame rate.

For network connection the base unit is equipped with one AUI LAN, one Thin LAN and one twisted pair interface.

Up to four X-terminals may be connected to the Advant Station 500 series.

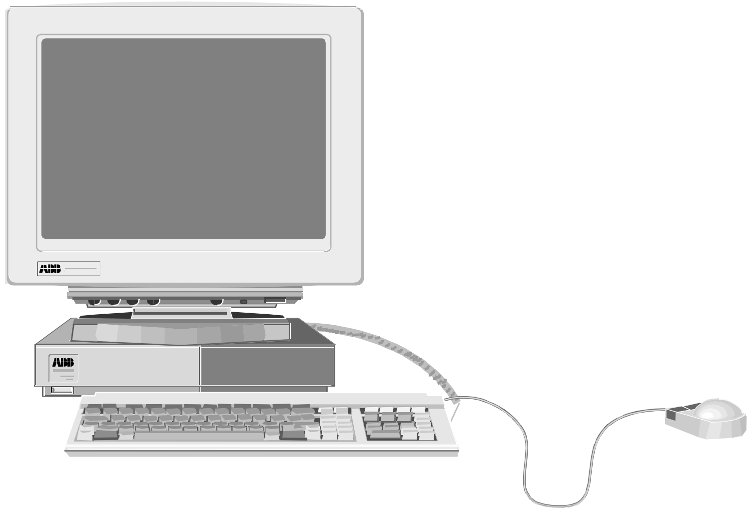


Figure 3-77. X-Terminal with Monitor, Base Unit, Keyboard and Mouse

Table 3-52. Technical Data on X terminal

Property	ID518K01 / ID518K02
Refresh rate	72/75/76 Hz
Resolution	1280 x 1024
Power supply	2.9 A @ 230 V 5.5 A @ 115 V
Power consumption, max.	80W
Dimensions h x w x d mm (inches)	Control unit: 76.2 x 420 x 374 (3.0 x 16.5 x 14.7)
Net weight	29 kg (64.3 lbs)

AdvaCommand with X-Terminals

You can have up to four X-terminals running AdvaCommand software from a single OS or OS/ES. If you run AdvaCommand from the local graphics monitor, a maximum of three X-terminals can be used.

You can have up to four X-terminals running AdvaBuild software from an Engineering Station or an OS/ES.

Operating Characteristics

X-terminals operate independently with unique users, but they use the same environment and alarm database as the host Operator Station.

The authority scheme for AdvaCommand is on an X-terminal session basis versus on an Operator Station basis. For example, if a user is logged onto X-terminal 1 as an operator, and another user is logged into X-terminal 2 as an engineer, the operator on X-terminal 1 does not have the authority of the engineer.

X-terminal alarm authority is different than the general authority scheme. The three alarm messages displayed in the Fetch Alarm Display Area are alarms that all X-terminal users have authority over. Also, the TCL MSG button flashes for unit messages that all X-terminal users control for all units in the environment.

Alarms and messages that the user does not have authority over will blink on graphics and list displays, but they cannot be acknowledged. It is the same way as MOD 300 multibus consoles operate.

All X-terminals must be on the Login page or logged out in order to install an environment.

Two local heads are supported as before, but they count as one X-terminal in calculating system load and hardware requirements.

A total of four simultaneous RDP displays may be active on an X-terminal server. In stand-alone workstation configurations, the limit is four RDP displays per workplace.

X-Terminal Server Workstation

X-terminals are supported with AdvaCommand and AdvaBuild, but are not supported with AdvaInform or Batch 300.

You can have a maximum of 4 X-terminals. The local monitor counts as one X-terminal.

Two local heads are supported, but they count as one X-terminal in calculating system load and hardware requirements.

The following are the minimum requirements for Advant Stations that serve X-terminals:

- AS520/B132L workstation or higher
- RTAB board with 16 MBytes or RAM
- 96 MBytes of workstation RAM, see following Table
- HP Netstation version 8 or 9 X-terminal software.

You must purchase the HP Netstation software as an option to use X-terminals on your station. Instruction for loading the HP Netstation X-terminal software are supplied with the media when the option is purchased.

Table 3-53. Workstation RAM Requirements for X-Terminals

Number of X-Terminals	Amount of RAM (MBytes)(1)
1	96
2	128
3	192
4	256

(1) These are the minimum requirements and may need to be raised for larger environments, a large number of graphics, or increased performance.

- 3 GBytes of disk space. If you have more than 300 graphics, additional disk space may be required.
- Common ethernet sub-network for the Workstations, X-terminals and printers

Additional Configuration Guidelines

The workstation performance and display call-up times, when using X-terminals, should be equal to a standard AdvaCommand workstation. The following conclusions have been established based on test data:

- The following provides additional configuration guidelines for applications using four X-terminals:

Table 3-54. Additional Memory Requirements for Systems Using Four X-terminals

Number of Tags in the Environment	Amount of RAM (MBytes)
Up to 1000	256
1001 - 3000	384
Greater than 3001	512

- Workstations using 64MHz processors are not suitable to control critical functions when multiple X-terminals are used. These workstations are also limited to a maximum of 256 Mbytes of RAM
- The 512 Mbyte configuration gives the user the ability to cache more graphics and perform better under extreme circumstances, such as when many applications are required simultaneously (i.e. trends, dialogs, alarms, display windowing and collages). In general, the 512 Mbyte configuration feels faster. Menus appear quicker, no degradation is noticed when Builders activate, and cursor movements are smoother.

Memory Cache

An optional 1 MByte memory cache chipset is available. It improves the performance of the B132 workstation about 5-10%. It is not available for the other workstations.

Additional X Workstation Requirements

Additional requirements that apply to all workstations include:

– Swap space is set to the values in the following Table:

Table 3-55. Workstation Swap Space Settings

RAM Memory (MBytes)	Swap Space Size (MBytes)
< 96	200
96 - 128	320
128 - 192	480
192 - 256	640
> 256	960

– Universal keyboard with mouse or trackball

– 4mm, 1.2 GB DAT tape drive

– CD-ROM drive (as fast as possible)

X-Terminal Requirements

The X-terminal can be either an HP Envizex II with 20 MBytes of RAM, or a PC. The X-station monitor should be color and have a resolution of 1280 x 1024.

The minimum requirements for a PC are:

- 100MHz Pentium CPU
- 32 MBytes of RAM
- Microsoft Windows 95 with service pack 1, or NT 4.0 with service pack 3 operating system
- WRQ Reflection X X-terminal server software version 6.2.

NOTE

On a PC X-terminal, configure your PC operating system to use only 256 colors.

The following Figure shows the layout of an Advant Station with X-terminals on a plant network.

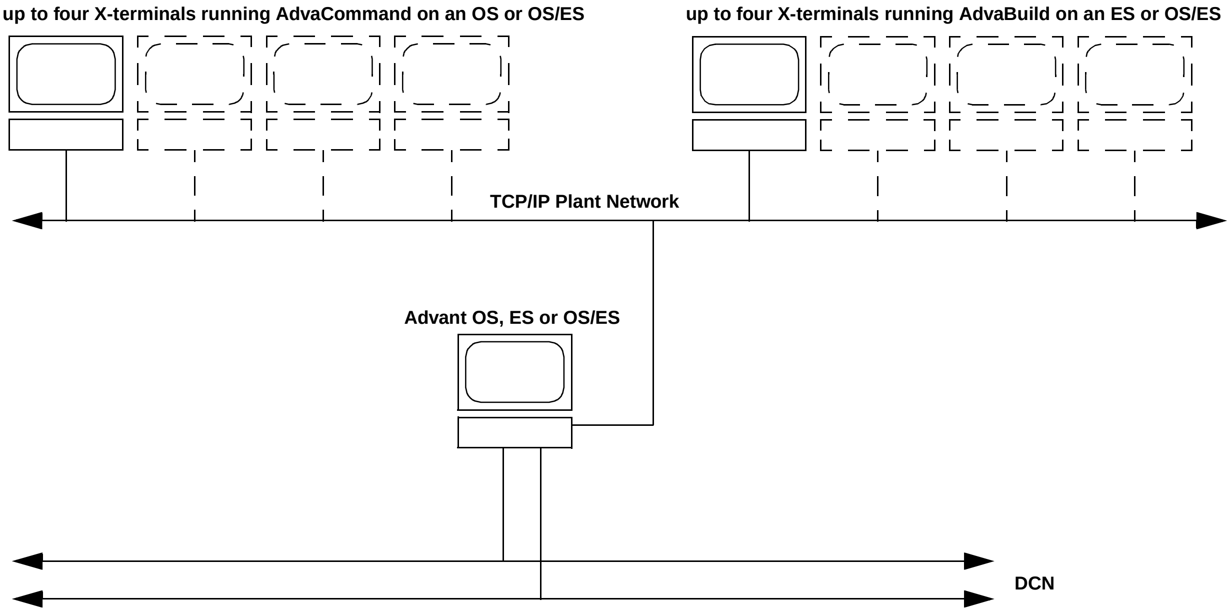


Figure 3-78. Advant Station with X-terminals

X-terminals do not support touchscreens, datakeys, ABB keyboards, or PSAPs.

There are keyboard mappings that X-terminals can use to emulate the ABB keyboard functions.

There is a total of 4 simultaneous RDP displays allowed per server.

The X-terminals must be on a common TCP/IP sub-network. The sub-network can be part of the plant network, or a dedicated network.

3.4.2.6 Printers

The Advant Station 500 Series will support the following printers:

- 6006J712 multicolor alarm/event printer, 115 V
- 6006J312 multicolor alarm/event printer, 230 V
- EP537-1 Matrix printer, narrow A4, black ribbon, alpha-numeric/graphic printer, 120 V
- EP538-1 Matrix printer, narrow A4, black ribbon, alpha-numeric/graphic printer, 230 V
- EP539-1 Matrix printer, wide A3, black ribbon, alpha-numeric/graphic printer, 120 V
- EP540-1 Matrix printer, wide A3, black ribbon, alpha-numeric/graphic printer, 230 V
- EPX510 Color InkJet Printer, paper size A3, PCL5 and Postscript protocols,120/230V
- EP526 Laser Printer, 24 pages per minute, A3 format, PCL5, PCL6, Postscript, 115 V

- EP527 Laser Printer, 24 pages per minute, A3 format, PCL5, PCL6, Postscript, 230 V
- EP528 Laser Printer, 16 pages per minute, A4 format, PCL5, PCL6, Postscript, 115 V
- EP529 Laser Printer, 16 pages per minute, A4 format, PCL5, PCL6, Postscript, 230 V

Alarm & Event and Report Printer

A multicolor printer is used for alarm and event logging, reports, and listings. The printer can print on fanfold paper up to 17-1/2 inches wide. It is configured with a serial RS-232 interface and is connected to one of the RS-232 ports on the System Unit.

Table 3-56. Printers for Alarm, Event and Report

Type Designation	Description
6006J712	Multicolor alarm/event printer for 115 V AC power
6006J312	Multicolor alarm/event printer for 230 V AC power

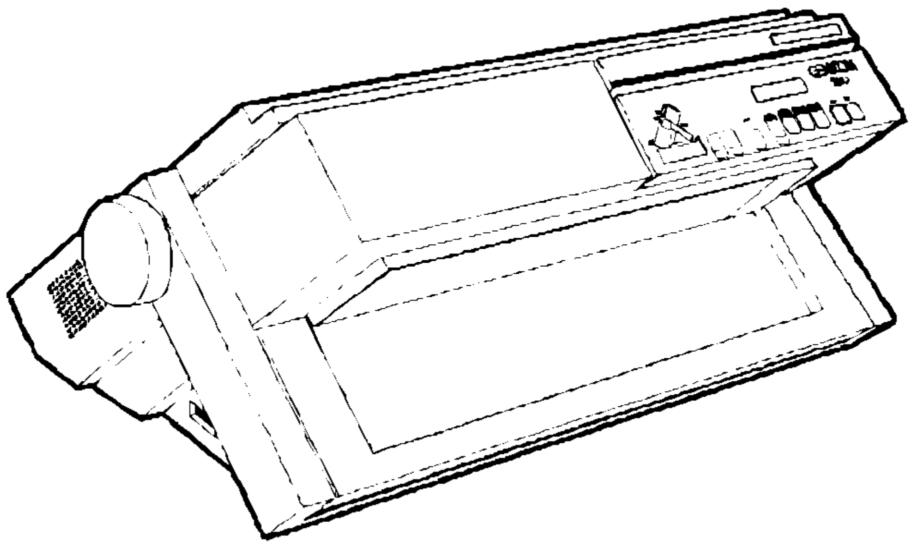


Figure 3-79. Multi-Color Printer 6006J

The Mannesmann Tally T2030/9 (EP537/538), Epson and IBM Proprinter compatible, black and white 9-needle printer head matrix printer is used for alarm and event logging, reports, and listings. The printer can print on fanfold or cut sheet paper size A4 portrait and ANSI-A. It is configured with a serial RS-232 interface and is connected to one of the RS-232 ports on the System Unit.

Table 3-57. Printers for Alarm, Event and Report

Type Designation	Description
EP537-1	Narrow (A4) black and white alpha-numeric/graphic printer, with Epson and IBM Proprinter protocols, for 120 V AC power, with serial cable
EP538-1	Narrow (A4) black and white alpha-numeric/graphic printer, with Epson and IBM Proprinter protocols, for 230 V AC power, with serial cable

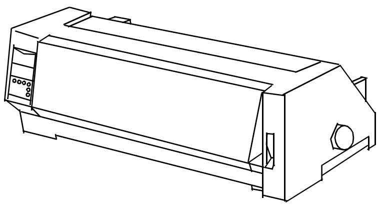


Figure 3-80. EP537/538 Narrow (A4) Black and White Alpha-Numeric Matrix Printer

Wide Report and Graphics Printer

The Mannesmann Tally T2130/24 (EP539/540), is Epson and IBM Proprinter compatible, 24-pin print head matrix printer is used for wide printouts like alarm and event logging, reports, program listings and process control diagrams (not hard copy printouts of the screen).

The printers can print on fanfold and cut sheet paper size A4 portrait as well as A4 landscape and A3. The EP539/540 is configured with a serial RS-232C interface and is connected to one of the RS-232C ports on the System Unit. The EP534 is configured with a serial RS-232C and parallel interfaces and is either connected to one of the RS-232C ports or the parallel port on the System Unit. The printers are delivered with a black only ribbon.

Table 3-58. Wide Alpha-numeric Printers for Alarm, Event and Report

Type Designation	Description
EP539-1	Wide (A3) alpha-numeric/graphic printer, with Epson and IBM Proprinter protocols, for 120 V AC power, with serial cable
EP540-1	Wide (A3) alpha-numeric/graphic printer, with Epson and IBM Proprinter protocols, for 230 V AC power, with serial cable

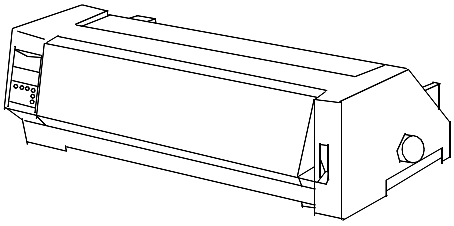


Figure 3-81. EP539/540 Wide (A3) Alpha-Numeric Printers

Table C-59. Data on EP539/540 Wide Black and White Printer

Designation	Description
Printer type	Tally T2130/24
Technology	24-needle impact matrix
Ribbon	Black
Printing width	75-406 mm (3-16 inch)
Printing speed	330 char/sec
Duty cycle	600 pages per day, ppd
Interface	Serial RS-232C, and parallel
Emulations	IBM Proprinter, Epson FX
Acoustic level (ISO 7779)	55 dB(A)
Power Voltage	110/120 V for **EP539** 230/240 V for **EP540**
Power Frequency	50/60 Hz
Power consumption	60 VA (printing) 10 VA (standby)
Net weight	11 kg (24.2 lbs)
Dimensions h x w x d, mm (inch)	206 x 625 x 245 (8.1 x 24.6 x 9.6)

Color Hardcopy Printer

A color inkjet printer is available as an option for color screen copies; the EPX510 that is based on the HP C2685B printer.

The EPX510 printer is an inkjet printer with a dot resolution of 600x600 dpi for black and 300x300 for color printing. It offers PCL5, and Postscript Level 2 protocols. This printer prints on A4/A3 cut sheet media. A total of 12Mbyte RAM is installed. The printout time is about 2 minutes total for color. The printer is equipped with a 10BaseT (Twisted Pair), 10Base2 (BNC), and ECP two-way parallel port. A cable (1.9 m long) is provided so you can connect the printer to the System Unit's parallel port. Always use HP original ink cartridges in your printer. The printer has four different cartridges, one for each color, black, cyan, magenta and yellow. The HP product numbers for the ink cartridges are: black - C4844A, cyan - C4841A, magenta - C4843A, yellow - C4842A

You can use plain paper for printouts on the printers, but for higher quality special paper should be used. You can also print on transparency film.

Table 3-60. Printers for Color Hardcopy (Screen) Printouts

Type Designation	Description
EPX510	Color InkJet Printer, A4/A3, with Postscript Level 2 and PCL5C protocols and 12 Mbyte RAM. ECP two-way parallel port. 10BaseT (Twisted Pair), 10Base2 (BNC), and parallel. Parallel cable incl. No RAM slot available. For 110 - 240 V AC (autoselecting).

Table 3-61. Data on EPX510 Hard Copy Printer

Designation	Description
Printer type	Hewlett Packard DeskJet 2500CM
Technology	Thermal inkjet printing
Print cartridges	1 Black, 1 cyan, 1 magenta, 1 yellow
Resolution	600 x 600 dots per inch, dpi, for black and white 300 x 300 dots per inch, dpi, for color
Media size	A3, A4 and Legal letter
Printing speed	Black and white text: up to 11 pages per minute, ppm Color: up to 3 pages per minute, ppm
Duty cycle	12,000 pages per month
Interface	Two-way parallel (IEEE 1284), Ethernet with 10/100Base-TX (twisted pair) and 10Base-2 (BNC for thin coax). The HP TCP/IP interface card JetDirect J4100A is included.
Emulations	HP PCL5C/E, Adobe Postscript Level 3
Acoustic level (ISO 7779)	Printing <49 dB(A)

Table 3-61. Data on EPX510 Hard Copy Printer (Continued)

Designation	Description
Power Voltage	100-240 V AC (automatic selection)
Power Frequency	50/60 Hz
Power consumption	65 W (max at 100% throughput) 8 W (in the standby state) 2 W (max in Power-Save mode)
Net weight	27 kg (59.5 lbs)
Dimensions h x w x d, mm (inch)	247 (9.7) x 563 (22.1) x 277 (10.9)

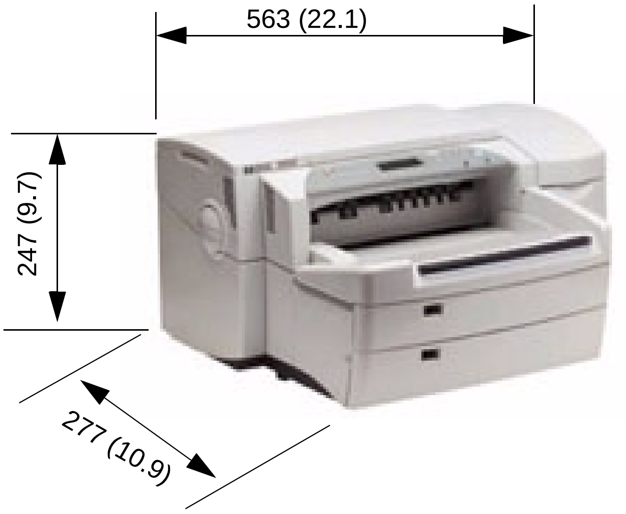


Figure C-82. Dimension of Printer EPX510 in mm (inch)

Document Printer

An HP LaserJet 8000 (EP526/527) printer is used for various black and white document printouts with a dot resolution of 600x600 dpi at 24 pages per minute. It offers PCL5e, PLC6 and Postscript Level 2 protocols. This printer prints on A3 and A4 cut sheet media. It included a duplex printing accessory for printing on both sides of the paper. A total of 16Mbyte RAM is installed.

The printer comes with the Centronics parallel interface. A Centronics cable (1.9 m long) is provided so you can connect the printer to the System Unit parallel port.

You can use the expansion slot for the TCP/IP interface board CIX514. This interface board is configured with 10Base-T (Twisted Pair), 10Base-2 (BNC) and LocalTalk ports.

Depending on the power source, there are two different printers:

Table 3-62. Document Page Printer, EP526/527

Type Designation	Description
EP526K01	Laser Printer, A3 and A4, with Postscript Level 2, PCL5, and PCL6 protocols and 16 Mbyte RAM. Print speed 24 pages per minute. Parallel interface as standard. For 110-115 V AC
EP527K01	Laser Printer, A3 and A4, with Postscript Level 2, PCL5, and PCL6 protocols and 16 Mbyte RAM. Print speed 24 pages per minute. Parallel interface as standard. For 220 - 240 V AC
MBX512	8Mbyte SDRAM DIMM memory for EP526/527/528/529 laser printers. Installed in one of the two free memory slots.
CIX514	Internal print server card, TCP/IP, with 10BaseT (Twisted Pair), 10Base2 (BNC), and LocalTalk (mini-DIN) interfaces. Installed in one Enhanced Input/output, EIO, slots.
EP502	Duplex printing accessory for HP LaserJet 8000 printer. Installed inside the printer.

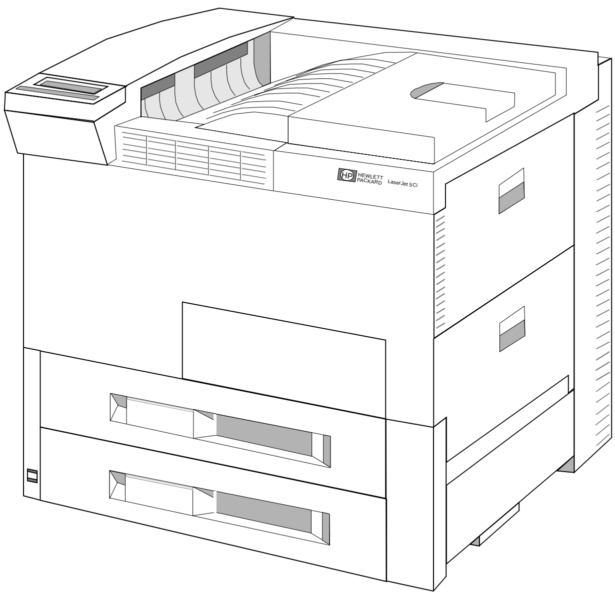


Figure 3-83. EP526/EP527 - HP LaserJet 8000 Laser Printer

An HP LaserJet 4050 (EP528/529) printer is used for various black and white document printouts with a dot resolution of 600x600 dpi at 16 pages per minute. It offers PCL5e, PLC6 and Postscript Level 2 protocols. This printer prints on A4 cut sheet media. It included a duplex printing accessory for printing on both sides of the paper. A total of 4Mbyte RAM is installed.

The printer comes with the Centronics parallel interface. A Centronics cable (1.9 m long) is provided so you can connect the printer to the System Unit parallel port.

You can use the expansion slot for the TCP/IP interface board CIX514. This interface board is configured with 10Base-T (Twisted Pair), 10Base-2 (BNC) and LocalTalk ports.

Table 3-63. Document Page Printer, EP528/529

Type Designation	Description
EP528K01	Laser Printer, A4, with Postscript Level 2, PCL5, and PCL6 protocols and 4 Mbyte RAM. Print speed 16 pages per minute. Parallel interface as standard. For 110-115 V AC
EP529K01	Laser Printer, A4, with Postscript Level 2, PCL5, and PCL6 protocols and 4 Mbyte RAM. Print speed 16 pages per minute. Parallel interface as standard. For 220 - 240 V AC
MBX512	8Mbyte SDRAM DIMM memory for EP526/527/528/529 laser printers. Installed in one of the two free memory slots.
CIX514	Internal print server card, TCP/IP, with 10BaseT (Twisted Pair), 10Base2 (BNC), and LocalTalk (mini-DIN) interfaces. Installed in one of the Enhanced Input/output, EIO, slots.
EP503	Duplex printing accessory for HP LaserJet 4000/4050 printers. Installed inside the printer.

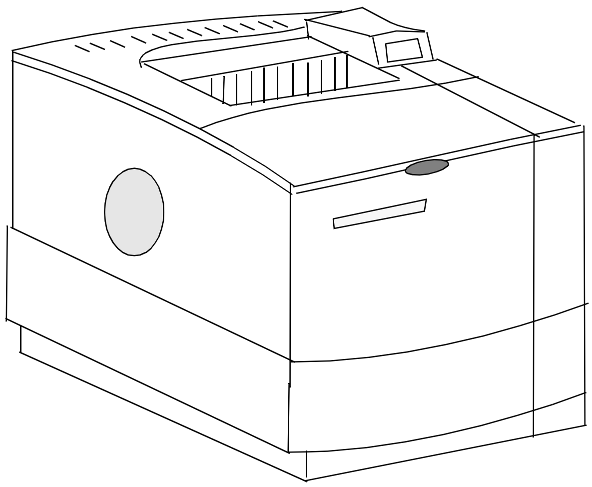


Figure 3-84. EP528/EP529 - HP LaserJet 4050 Laser Printer

Table C-64. Data on EP526/527 Laser Printer

Designation	Description
Printer type	Hewlett Packard LaserJet 8000
Technology	Laser Printer
Print cartridges	1 Black toner
Resolution	600 x 600 dots per inch, dpi
Media size	A3, A4 and Legal letter
Printing speed	24 pages per minute
Duplex printing	Yes, with optional EP502 Duplex printing accessory
Included RAM	16 Mbyte
Duty cycle	Up to 130,000 pages per month
Interface	Standard: Two-way parallel Centronics (IEEE 1284) With optional CIX514 TCP/IP interface installed: Ethernet with 10Base-T (twisted pair), 10Base-2 (BNC for thin coax), LocalTalk (mini-DIN).
Emulations	HP PCL5, PCL6, Adobe Postscript Level 2
Acoustic level (ISO 9296)	Printing <55 dB(A) Standby <36 dB(A)
Power Voltage	**EP526**: 120 V **EP527**: 230 V
Power Frequency	58-62 Hz at 120 V, 48-52 Hz at 230 V
Power consumption	300 W (typical at 100% throughput) 100 W (in standby state) 45 W (in Power-Save mode)
Net weight	45 kg (99 lbs)
Dimensions h x w x d, mm (inch)	540 (21.3) x 540 (21.3) x 520 (20.5)

Table 3-65. Technical data on printer EP528 and EP529

EP 524 and EP525 Laser Printer	
Make	Hewlett-Packard HP LaserJet 5Si
Intended use	- Printout of engineering documentation from Advant Station 500 Series engineering workplaces
Emulations	HPGL/2, HPPCL5 and Postscript

Table 3-65. Technical data on printer EP528 and EP529

EP 524 and EP525 Laser Printer	
Paper format	A4 (210 x 297 mm) and US legal (8 x 13.6 in.)
Max. speed	24 pages/min at A4
Print volume	100,000 pages/month
Duplex printing	double-sided printing included
Interface	Parallel Centronics, Serial RS 232
Power Supply	EP524; 110-115 Vac 9.4 A max. EP 525; 220-249 V ac 4.5 A max.
Power consumption	<135 W idle < 580 W printing
Max. paper stack	2 x 500 sheets
Noise level	max. 33 dBA idle, 43 dBA printing
Dimensions (h x w x d) mm (inches)	540 x 540 x 520 mm (21.3 x 21.3 x 20.5 in.)
Weight	45 kg (99 lbs)

3.4.2.7 Disk Drives

Optional Internal and External Disks

Internal CD-ROM drive

The Advant Station 520/530 is equipped with the MD529V1, internal single-ended SCSI-2 CD-ROM Drive. The MD529V1 is a 12x (1800 kbyte/second data transfer rate), 1.6” high and 5.25” wide drive intended for reading of 120 mm (4.7 inch) Compact Disc media.

It is installed on the 1.6” height slot on the Storage Tray of the System Unit. The drive occupies one address on the SCSI-2 bus.

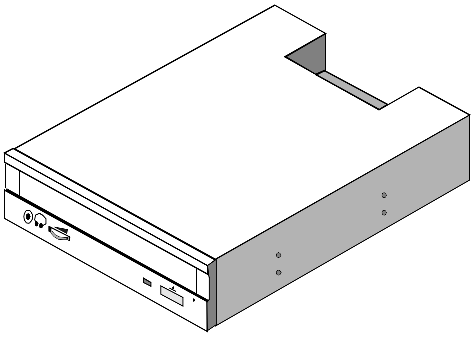


Figure 3-85. MD529/532 - Internal CD-ROM Drive

NOTE: The MD534, a stand-alone version of the above, is also available.

Extra Internal Hard Disk

If required, your Advant Station 500 Series can be equipped with up to two wide single-ended Ultra SCSI internal hard disks. One 3.5" internal hard disks is available, the MDX510 with 9 Gbyte memory (1" high). The disk is installed in one of the two available disk slots. Every disk occupies one address on the UltraSCSI-3 bus.

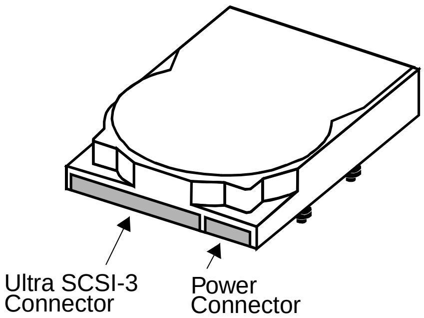


Figure 3-86. MDX512 Internal 9 Gbyte Hard Disks

When the internal CD-ROM drive MD529 is installed, it occupies the 1.6" high disk slot. Then only one 1" high internal hard disk can be installed!

External mass storage system

Your Advant Station 520/B180L may come equipped with an MP550V2 External Mass Storage System for Ultra SCSI-3 devices. The External Mass Storage Systems consist of a cabinet, power supply, and one hard disk. The MP550V2 offers a 9 Gbyte disk.

The MP550V2 External Mass Storage Systems include:

- a cabinet with an AC power supply with automatic selection between 120 V AC and 230 V AC power voltage
- a built in 9 Gbyte hard disk

Redundant Disk Array Unit as External Mass Storage

The Advant Station 520/530 may be equipped with an MP551 Redundant Disk Array (RDA) Unit (see Figure 3-87). The RDA unit comes with its own cabinet and redundant power supplies. The MP551 has a cabinet for table top or 19” rack mounting, and the MP551K01 is a kit for mounting the RDA in a console cabinet. The cabinet has a low density single.ended SCSI-2 input and output connectors. It should be connected to the SCSI-2 device “OUT” connector on the system unit.

The RDA can be an MP551 table top or 19” rack mount unit, or with an MP551K01 mounting kit for an console cabinet.

The MP551 Redundant Disk Array unit includes:

- Cabinet with redundant power supplies and fans.
- Four RAID controllers to external SCSI connectors.
- SCSI 68pin HD termination connector (1).
- Mounting feet for table top use (4).
- 19” rack mounting brackets (2).
- Shielded power cable (NEMA to IEC) to meet CE requirements (2 meters).
- Adapter power cable that plugs into a IEC-320 power distribution unit (1 meter).

Up to four 9.0GByte, or 18.0GByte hard disk sets can be installed in the cabinet, providing up to a total of 72.0GByte redundant mass storage.

Each set of disk drives can be connected to a different Advant Station 500 Series workstation or all four disk drive sets can be cabled to one Advant Station. The total cable length on a SCSI-2 bus is set at 6 meters for a single-ended bus (must include external and internal cables).

NOTE

Each disk drive set installed in this cabinet occupies one address on a 17SCSI-2 interface bus.

A 2.0 m SCSI-2 interface cable (TK588V020) is needed to connect the RDA unit to the single-ended SCSI -2 connector on the system unit. A 152 mm SCSI-2 interface cable (TK501) is needed to jumper the additional hard drive sets if added to the unit.

A SCSI-II 68 pin high density external terminator (TX506) is required for termination of the SCSI bus on the output connector of the RDA unit cabinet.

Please refer to the *Redundant Disk Array MP551 Hardware User's Guide* for more information.

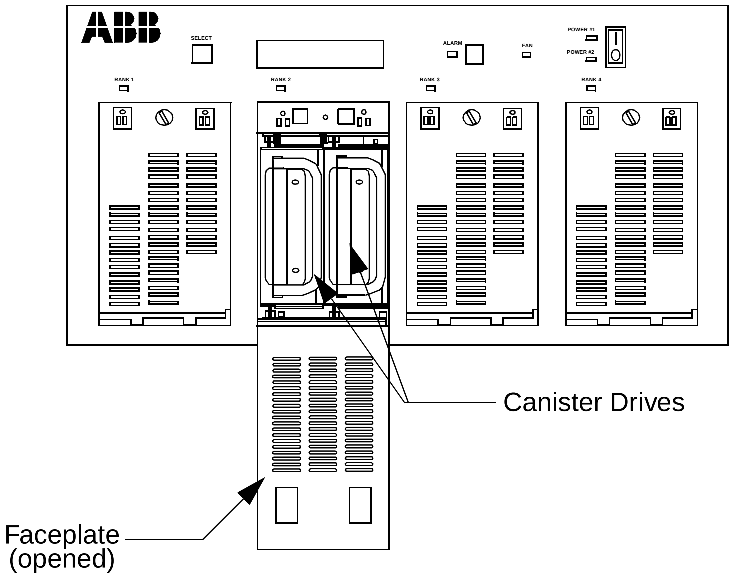


Figure 3-87. MP551 RDA Unit

Removable cassette storage drive (DAT)

Your Advant Station 500 Series can be equipped with a removable DDS cassette storage media drive:

- MT516 - an 8 Gbyte (typically) DAT drive with data compression (4 Gbyte native)
- MT517 - a 24 Gbyte (typically) DAT drive with data compression (12 Gbyte native)

Both drives have there own housing and power supply and are intended for stand-alone use.

The drives have 50-pin high density single-ended SCSI-2 input and output connectors. They are connected to the single-ended SCSI device "OUT" connector on the System Unit.

The tape drives have a 100-240 V AC autoselecting power supply so it fits both 120 V and 230 V power lines.

A DAT drive includes:

- a 0.9 m SCSI-2 interface bus cable for connection of the tape drive to the System Unit 50-pin high density connector
- the TX502 50-pin high density active external terminator for termination of the SCSI-2 bus

on the output connector of the tape drive.

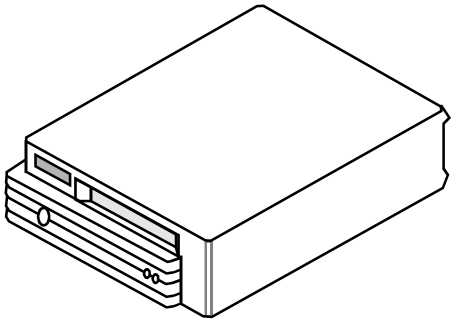


Figure 3-88. MT516/MT517 Standalone 8/4 Gbyte DDS Cassette Drive

Available media are MT501K02, a package of 5 pcs of 90 m DDS (or DDS-1) tapes, MT502K02, a package of 5 pcs of 120 m DDS-2 tapes, and MT503K02, a package of 5 pcs of 120 m DDS-3 tapes. The MT501K02 and MT502K02 tapes can be used by both MT516 and MT517 DAT drives, The MT503K02 tapes can only be used by the MT517 DAT drive.

3.4.2.8 Uninterruptible Power Supply (UPS)

Two Uninterruptible Power Supply units are available for the Advant Station 500 Series:

- SV530 Uninterruptible Power Supply (UPS) 120 V AC, 10 minutes, 900 W, 1000 VA
- SV531 Uninterruptible Power Supply (UPS) 230 V AC, 10 minutes, 900 W, 1000 VA

The UPSs can supply 1250VA but the battery backup time is then only 7 minutes.

The SV530 with 120V output has one IEC-320 power inlet connector (pin) and three US output connectors.

The SV531 with 230V output has one power inlet connector (pin) and three output connectors in accordance with IEC 320.

You can check the power supply status either through a RS-232C communication or monitoring of status outputs on a 25-pos Dsub connector.

If you require the power supply status, the status communication output from the UPS can be connected to the System Unit for RS-232 communication or the external alarm unit DSPC 452 (MP 51) for monitoring of output status.

The UPS is a true on-line-UPS with a built-in battery bank. It conditions the raw mains and supplies continuous, clean one-phase power to the critical systems. While feeding the load the UPS also keeps the internal battery charged all the time. If utility power fails, the UPS will continue to supply clean power without any interruption at the UPS outputs.

If the power failure outlasts the backup time, the UPS will shut down in order to prevent a total discharge of the battery. When the line voltage is restored the UPS will start up again automatically and recharge the battery and supply the load.

The UPS also has an internal bypass switch. At temporary overload, at computer or monitor start-up situations, the UPS automatically switches to internal bypass mode, this way passing the filtered utility power through the UPS to the load.

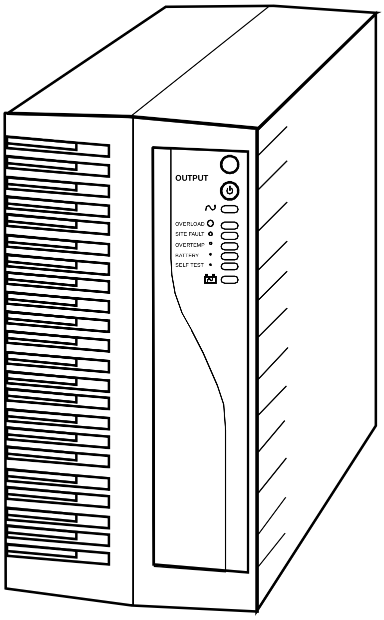


Figure 3-89. SV530 and SV531 Uninterruptible Power Supply (UPS)

3.4.2.9 External Bypass Switch for UPS

Your UPS for the Advant Station 500 Series can be equipped with an optional external bypass unit:

- SX521 External bypass switch to be mounted at the rear of SV530 UPS (120V)
- SX522 External bypass switch to be mounted at the rear of SV531 UPS (230V)

The bypass switch has a maintenance bypass feature that supplies power to your equipment even when the UPS electronics are removed for maintenance or upgrades. The bypass switch should be installed at the back of the UPS. The utility power connector and all load connectors are connected to the bypass switch. The bypass unit is then pressed onto the rear of the UPS passing input power through one connector and receiving UPS power through another.

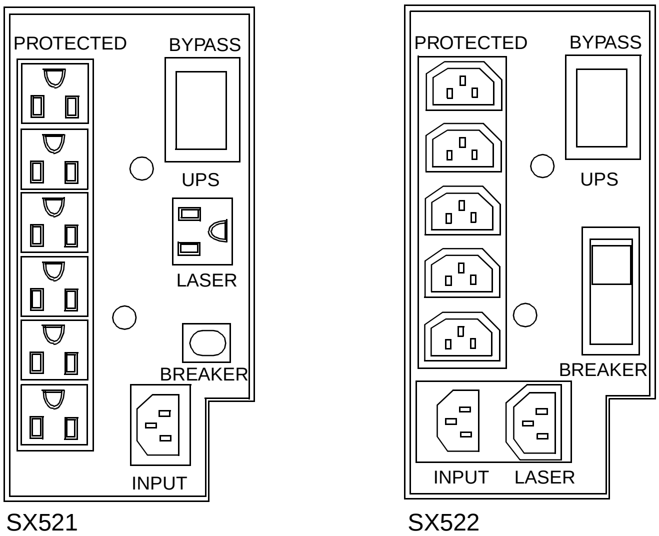


Figure 3-90. SS521 and SX522 External Bypass Switches for SV530/531 UPS

The bypass unit may be used as a power distribution unit. Please observe, that the LASER output current does not go through the UPS unit.

3.4.2.10 Power Distribution

Your Advant Station 500 Series comes equipped with an SX520K01 Power Distribution Unit kit with IEC-320 compatible connectors and power cables. This kit includes a socket strip with seven connectors and six power cord sets. The SX520 socket strip has one pin connector for power input and six socket connectors for power output.

Power distribution to different devices in the Advant Station 520/B132L is made with SX520 power distribution unit. The input connector for the SX520 is also included in the kit but neither the cable to the wall outlet nor the wall connector. The user must supply the input power cable and the wall connector.

The power distribution unit is designed to reduce the impact of country-specific power cords by standardizing on the IEC-320.

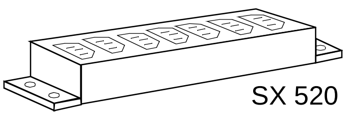


Figure 3-91. SX520 Power Distribution Unit

Console cabinet mounted Advant Station 520/B132L Stations will use the 19" rack mounted SX556 Power Distribution Unit. The SX556 is designed to be used with the SV520 or SV521

UPS for supply of critical and non-critical equipment associated with an Advant Station 520/B132L. The unit comes with eight IEC-320 compatible power cords. The SX556 has four outlets for critical equipment and four outlets for non-critical equipment. The main power is connected to terminals (TB1) under the power connection cover. Power to the UPS (X1) and the non-critical outlets are controlled and protected by a 15 A circuit breaker (CB1). Power from the UPS, to the critical outlets, is controlled and protected by the UPS. The user must supply the input power cable and the wall connector.

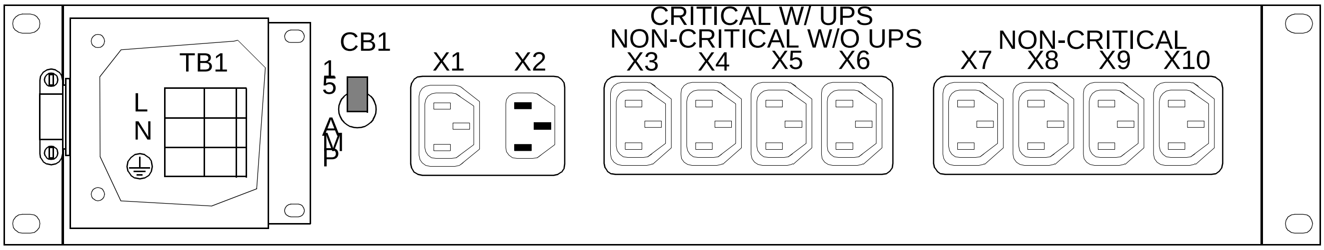


Figure 3-92. SX556 Power Distribution Unit, 19" Rack Mounted

3.5 Networks

3.5.1 Distributed Communications Network (DCN)

DCN cables provide the physical node-to-node path for communications and are available in two primary types of media; twin axial and fiber optic. The type of cable chosen depends upon the application. Two cables per adjacent node are required to form a redundant ring.

Cable

For twin-axial cable, the 3BUR000118Rxxx DCN Cable provides a connection between nodes 10 to 1000 feet (3 to 300 m) apart in buildings or where it can be protected against a severe environment. DCN Extension Cable 3BUR000117Rxxx is a heavy duty cable used for severe environments and is available in lengths of 10 to 4000 feet (3 to 1200 m). The maximum recommended distance between any three nodes connected by twin-axial DCN cable is 1 mile (1.6 km). The DCN Cable Adapter 6006F is used with the DCN Extension Cable when node to node communications is greater than 1000 feet or must be installed in a severe environment.

6057C Fiber Optic Cable is commonly used in applications that require longer transmission distance, for isolation, or if the cable must cross hazardous or high EMI areas. The maximum recommended distance between any three nodes connected by fiber optic DCN cable is 2 miles (3.2 km).

TC530 DCN T-Box

The TC530 Terminal Box is used for connecting Advant Station 500 Series and Advant Controller 400 Series to the Distributed Communications Network (DCN).

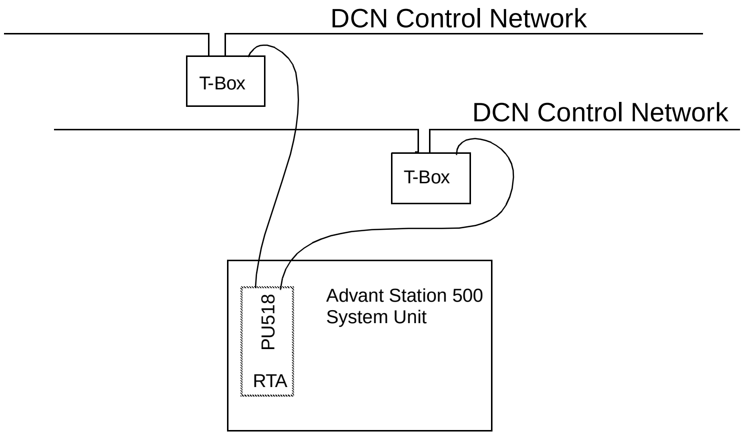


Figure 3-93. T-Box Attachment to the DCN Control Network

TC532 Fiber-Optic T-box

The TC532 Fiber-Optic T-box provides a fiber-optic communication link between Advant Stations and Advant Controllers. The Fiber-optic T-box is normally used for long runs of cable, in environments with high electro-magnetic interference, or when the media needs to run through an intrinsically safe area. The unit provides signal conversion from electrical to optic, and vice versa. The fiber-optic T-box offers the following features:

- DCN galvanic isolation
- Passive fiber optic relay for node bypass, loopback test, and redundancy support
- LED status indicators
- Maintenance port for monitor interconnection
- Functionality invisible to the user
- Can be stand-alone or rack mounted

6059N DCN Fiber-Optic Media Interchange Unit

The 6059N Media Interchange Units allows the conversion of a DCN signal from electrical (twin-axial cable) to optic (fiber optic cable), and vice versa. The unit contains both a fiber optic and an electrical relay which will bypass their respective signals in case of a power loss, dividing the ring into two intact sub-rings. The Media Interchange Unit allows the replacement of any section of the DCN ring using fiber optic technology. This stand-alone unit may be located at any distance from a node within the media distance limitations. It may be powered by AC and/or DC voltages for both flexibility and redundancy purposes.

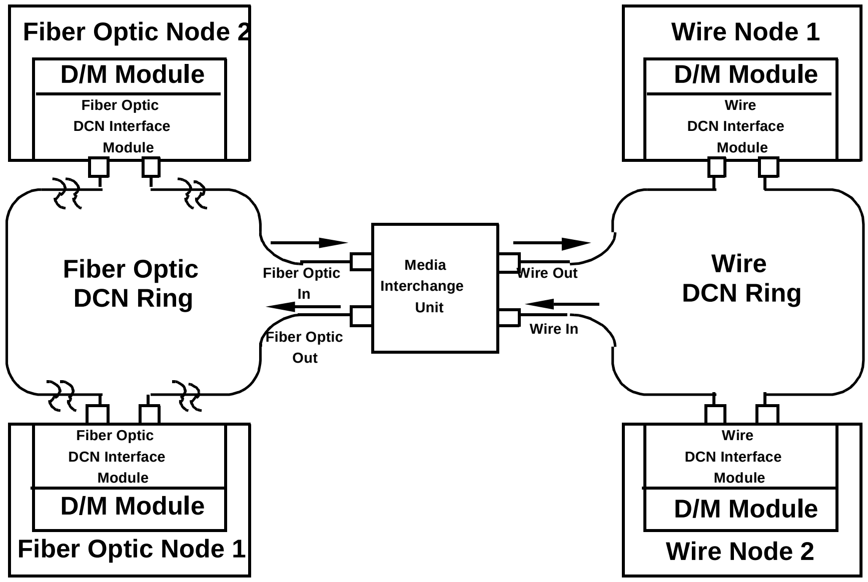


Figure 3-94. 6059N Media Interchange Unit

Physical Characteristics

Table 3-66. Physical Characteristics

	DCN Cable Adapter	Accessory Mounting Plate
Height	6 in. (152 mm)	7 in. (178)
Width	5 in. (127 mm)	19 in. (483 mm)
Depth	2 3/4 in. (70 mm)	
Rail Height		4 units
Weight	2 lb. (0.91 kg)	2 lb. (0.91 kg)
Mounting	Accessory Mounting Plate	Standard, EIA, 19 in. (483 mm)

3.5.2 Plant Network (including TCP/IP)

At the Physical and Data Link Layers the IEEE 802.3/Ethernet Driver is used for Plant Network communications. In order to access other TCP/IP networks, standard IEEE 802.3 communication bridges or routers can be used, thus allowing for wide-area networks (WAN).

IEEE 802.3 defines a baseband, coaxial or fiber optic bus media with a speed of 10 Megabits per seconds, CSMA/CD and IEEE 802.3 support.

Depending on the EMI levels, 10base5 or 10base2 can be used. In “normal” office environments 10base2 can be used. If the station will be connected to ABB MOD 300 Plant Network, 10base5 is used. The choice between 10base2 and 10base5 is done by a switch on the communication board in the Advant Station 520. Up to 30 connections can be made to 10base2 and up to 100 connections to 10base5.

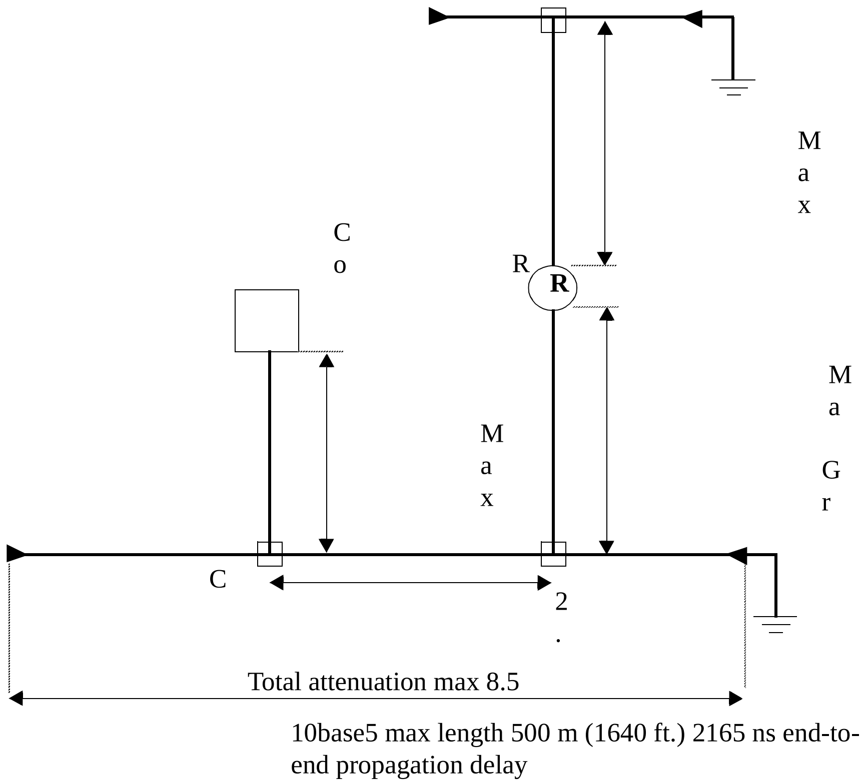


Figure 3-95. Distance and Data for Coax Cables

Internet Addresses

Internet addresses are used extensively by the TCP/IP network. An internet address (often referred to as the IP address) consists of two parts:

- Network address
- Host address

The network address identifies the network. Host address identifies a node within the network. A network address is concatenated with a host address to form the internet address and uniquely identify a node within a network.

3.6 Consoles and Cabinets

Control Desks, and Kneehole Cabinets are available to house Advant OCS equipment. All enclosures are available in a CE Marked version for use in Europe.

A general description of CE Marking for cabinets is provided in the EMC information to follow and in the Product Configuration section. For detailed information on CE Marking please refer to MOD Installation Requirements for Conformance to European Standards - 3BUR000950R0001, and Advant OCS User’s Guide for Compliance with EMC Requirements - 3BSE009178R0001.

3.6.1 Control Desk Furniture

The available packaging options are:

RE550 Operator table with manual adjustment

RE551 Operator table with mechanical parallel control

RE552 Operator table with electrical parallel control

RE553 Extension table, pie 45 degrees

RE554 Monitor mounting bracket

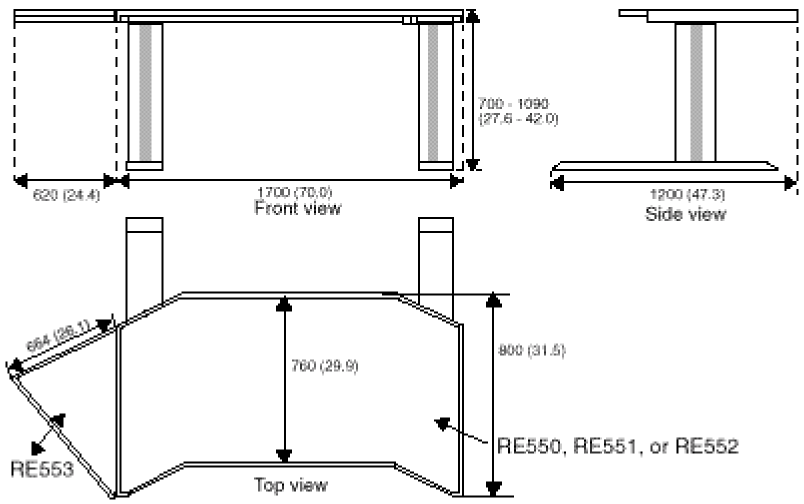


Figure 3-96. Operator Table with Extension Table (measurements in mm and inches

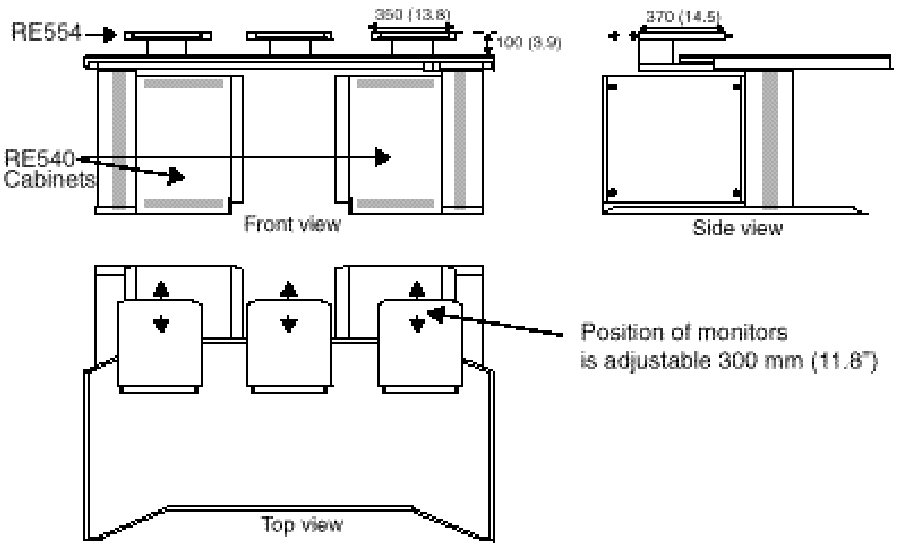


Figure 3-97. Operator Table with Cabinets and Monitor Mounting Brackets

RE540

RE540 kneehole table cabinet is used for installation of equipment in control rooms. It is ventilated, complies with IEC 529 protection class IP 21, and has the dimensions shown in the following figure. We do not recommend mounting workstations in these cabinets due to heat rise.

3.6.2 RM500 Cabinets

The RM500 cabinet (available in three protection classes) is used for installation of Advant Controller 400 Series in control rooms. Two protection classes are ventilated, and comply with

IEC 529 protection class IP 21, and IP41. The third protection class has no ventilation and complies with IEC 529 IP5.

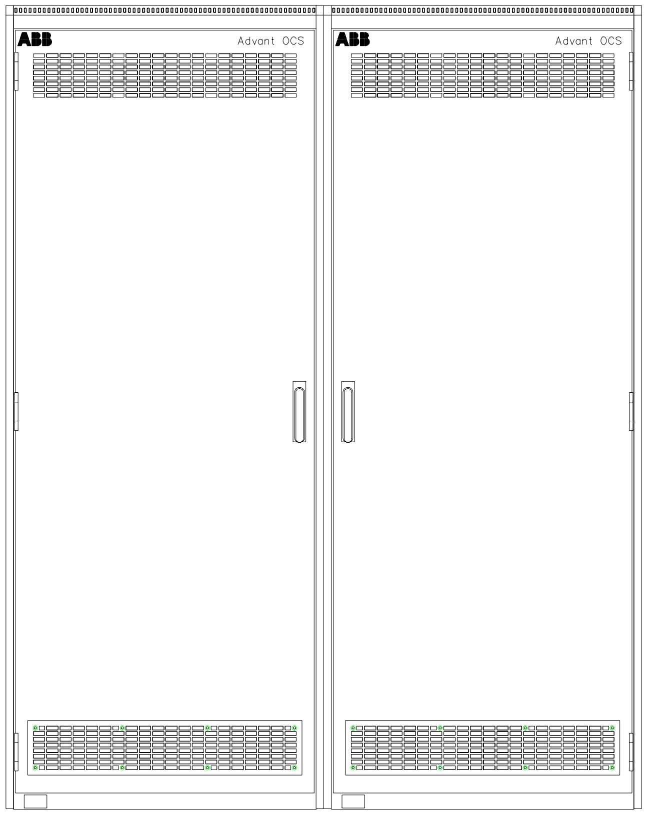


Figure 3-98. RM500 Cabinet - Front View

Two versions, the RM500V1 and RM500V2 are available in different sizes. RM500V1 cabinets are provided with a single or a double door.

The cabinets are delivered in a light grey RAL 7035 Structure color. All frame components are made of alu-zinc-coated steel and the welded parts are electro-galvanized.

A grounding point (an M10 screw) is located towards the front left hand corner of the cabinet.

Single as well as double cabinets are used to house an actual installation, or a combination of single-double cabinets (not screwed together on delivery).

- RM500 is prepared for installation of subracks, process connection units and terminal blocks. Subracks are used to house circuit boards and other plug-in units.
- RM500V1 features a 19-inch and a 24-inch installation width. The latter is applied to process connection equipment. The 24-inch installation width and shallow cabinet design facilitates the installation and the maintenance. RM500V2 only features the 19-inch installation width.

- Entrance to the rear of the cabinet is not necessary. Controller hardware is physically installed and electrically connected from the front.
  Certain equipment, like the S100 I/O subrack, is mounted in a hinged frame in the cabinet. This enables entrance and possible maintenance and repair of parts of the subrack which are only accessible from the rear, for example, units for voltage regulation.
- The cabinet front door is hung at either the left-hand or the right-hand side adapted to the final cabinet configuration determined at the design. Please check that the position of the hinges is acceptable with respect to the final location of the cabinets on site.
- A double door variant is available for the RM500V1.
- Process wiring usually enters through the floor of the cabinet.
- Normally, there are no intermediate walls between cabinets designated to one controller installation.
  Intermediate walls are used between different controllers in a row of cabinets or between a controller and other equipment to suppress interference.

A folding working surface is available. This provides an ESD-protected workplace which you should always use when you are working with installation of circuit boards, e.g., strapping.

Cabinet Configuration

Depending on the number of circuit boards necessary to control the process, the Advant Controller 460 can contain up to one controller subrack plus five I/O subracks located in up to six cabinets.

The controller subrack is always installed in the left-hand cabinet.

Single or double cabinets are used. Only the last one (to the right) can be a single cabinet.

I/O subracks and their associated connection units are, where possible, located in the same cabinet.

You can add an extra cabinet (number seven) to the right of a given configuration, if necessary, to house connection units. This cabinet cannot contain an I/O subrack.
For connection units in the extra cabinet, use extended-length cables to join the I/O subracks.

The controller subrack is mounted close to the rear backplane of the cabinet.

An I/O subrack is mounted in a hinged frame while the connection units for the different I/O boards are mounted in the rear backplane. Use the 24-inch installation width for the connection units in RM500V1.

The following Figure shows a **typical** cabinet configuration in a RM500V1 cabinet. The location of subracks, connection units and power supply equipment is standardized. However, the design is always adapted to the actual application and shown in the delivery-specific documentation.

All units in the cabinet are identified in accordance with the item designation system used for the Advant OCS products manufacturing.

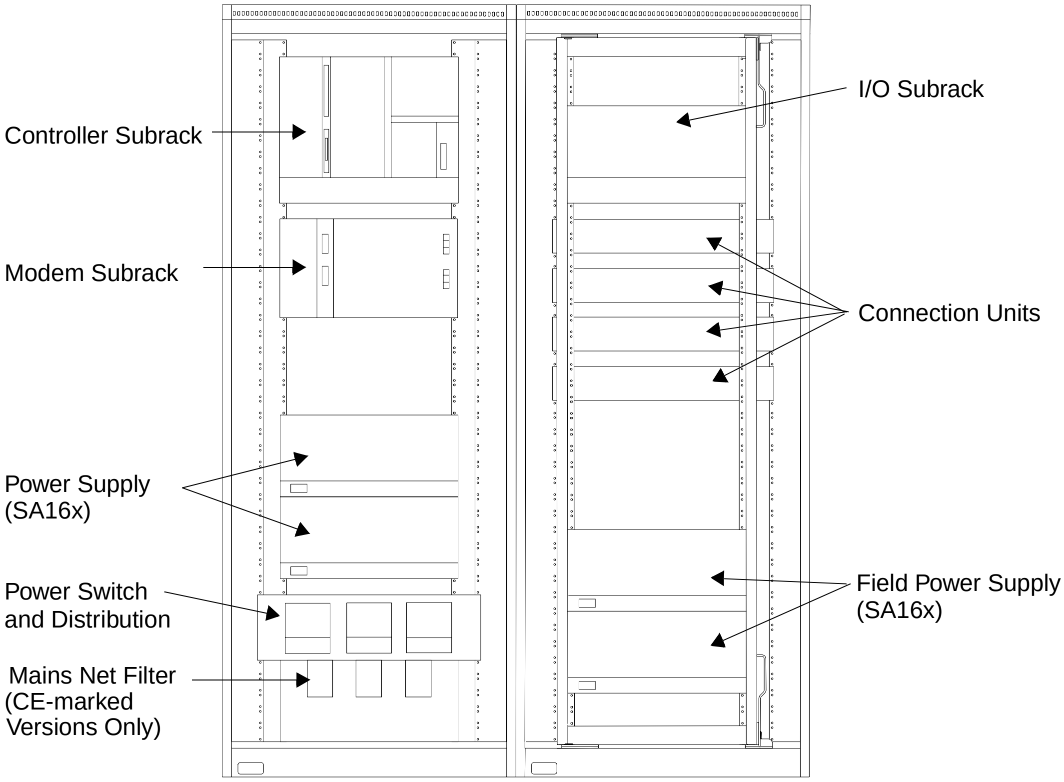


Figure 3-99. Typical Cabinet minimum Configuration, Redundant Power Supply

3.6.2.1 Dimensions and Weight

The dimension and weight of the RM500 cabinets are given in the following table.

Table 3-67. RM500 Cabinet Measurements

Characteristics	**Cabinet Type**		
	RM500V1 Height = 1925 mm (75.8 inch.)	**RM500V1 Height = 2125 mm (83.7 inch.)**	**RM500V2 Height = 2225 mm (87.6 inch)**
Dimensions			
Cabinet(1) WxDxH	800x512x1925 mm (31.5x20.2x75.8 inch.)	800x512x2125 mm (31.5x20.2x83.7 inch.)	700x637x2225 mm (27.6x25.1x87.6 inch.)
End Panel(2) W1xD1	20x530 mm (0.8x20.9 inch.)	20x530 mm (0.8x20.9 inch.)	20x655 mm (0.8x25.8 inch.)
Cable Entry W2xD2	660x311 mm (26.0x12.2 inch.)	660x311 mm (26.0x12.2 inch.)	560x436 mm (22.0x17.2 inch.)
Weight(3)	150-200 kg (330-440 lbs)	150-200 kg (330-440 lbs)	150-200 kg (330-440 lbs)
Doors	Single/Double	Single/Double	Single
Mounting Planes	19”/24”	19”/24”	19”
Swing Radius(4)			
Single Door (SD)	793 mm (31.2 inch.)	793 mm (31.2 inch)	693 mm (27.3 inch.)
Double Door (DD)	415 mm (16.3 inch.)	415 mm (16.3 inch.)	-
Subrack (S100 I/O) in Hinged Frame (SR)	600 mm (23.6 inch.)	600 mm (23.6 inch.)	600 mm (23.6 inch.)

(1) The dimensions includes door and rear plate.
(2) W1xD1 shows the dimension for a single end panel. When mounting two end panels to a cabinet add 2x20 mm at the cabinet width, W but use D1 as cabinet depth.
(3) The weight does not include equipment to be installed within the cabinet.
(4) The space required for door(s) and the hinged frame. See following Figure for dimensions.

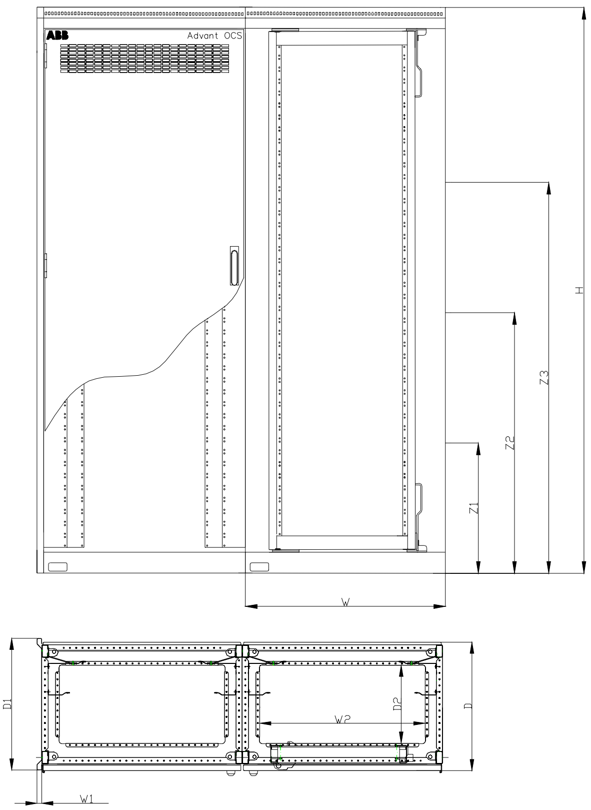


Figure 3-100. Mounting Cabinets together - Screw Position

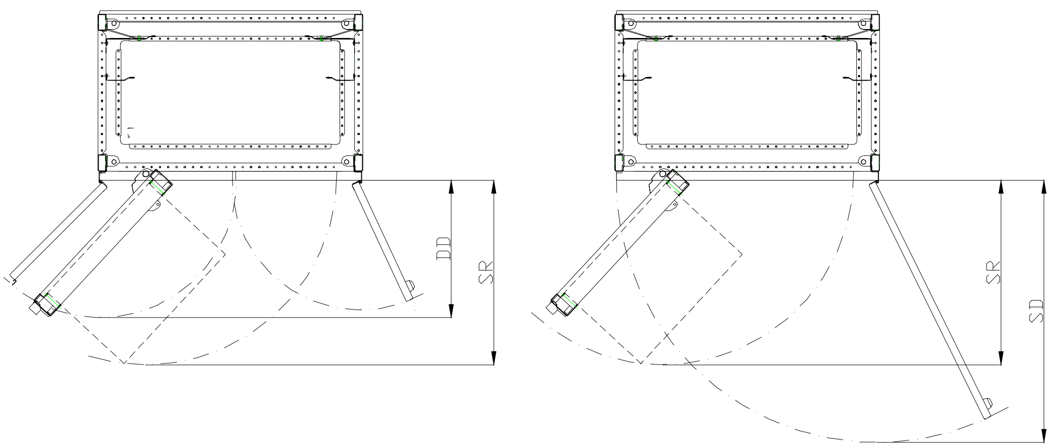


Figure 3-101. Swing Radius for Door(s) and Hinged Frame

3.6.2.2 Protection Rating

Cabinets are available for different environmental protection classes:.

Table 3-68. RM500 Cabinet Protection Classes

Type	Protection class RM500
Ventilated, **not** radio-proof (1) (2)	IP 21
Ventilated, radio-proof (2)	IP 21
Ventilated (3)	IP 41
Sealed	IP 54
Sealed with heat exchanger (4)	IP 54

(1) Advant Controller 460 with S100 I/O, installed in this cabinet is **not** verified for CE-marking.
(2) Standard cabinet without filter on ventilation grilles.
(3) Ventilation grilles are covered with metallic net to prevent insects to enter the cabinet. A heater is included to heat the cabinet when the controller is not in use.
(4) Available as a standard sealed cabinet with heat exchanger as an option.

Table 3-69. Available Degree of Protection Ratings for RM500

	RM500V1 H=1925 mm (75.8 inch.)			RM500V1 H=2125 mm (83.7 inch)			RM500V2 H=2225 mm (87.6 inch.)		
	IP21	**IP41(1)**	**IP54**	**IP21**	**IP41(1)**	**IP54**	**IP21**	**IP41(1)**	**IP54**
Cabinet with or without hinged frame	X	X	X	X	X	X	X	X	X
Cabinet for OOCU	X	X	X	X	X	X			
Cabinet, NOT verified for CE marking	X			X			X		

(1) IP41 includes a heating element, and the ventilation grilles are covered with nets.

3.6.2.3 Permitted Power Dissipation

The permitted power dissipation in a single RM500 cabinet is given in the following table.

Table 3-70. Permitted Power Dissipation for RM500

Protection Class	15^{o} C Temperature Rise	30^{o} C Temperature Rise
IP21	700 W	1.400 W
IP41	500 W	1.000W
IP54	300 W	600 W

The controller subrack is provided with a fan unit to equalize the temperature difference in the subrack.

Custom cabinetry.

The Advant Controller 400 Series can be mounted in custom cabinetry designed by a certified ABB application center, or in approved customer supplied cabinets.

3.7 Environmental Considerations

3.7.1 General

The immunity of the Advant OCS with Mod 300 Software to environmental conditions is summarized in this section.

The Advant OCS with Mod 300 Software has been designed to withstand the environments encountered in the power and process industries with respect to climatic, mechanical and electrical effects.

Advant OCS with Mod 300 Software products are normally type tested or evaluated to ensure compliance with the environmental requirements specified below.

These requirements can be categorized as follows:

- Resistance to the external environment outside enclosures (including corrosive gases)
- Resistance to the environment inside enclosures
- Electromagnetic Compatibility, EMC

The environmental specifications applicable to purchased computers and peripheral equipment may differ. Please refer to the data sheets of the products concerned.

The degree to which the units withstand environmental influence depends on their components and their design. The system enclosures, the type of cable and how these are routed determine the environmental requirements of the complete system. In particular, these can make it necessary to use sealed and pressurized enclosures and shielded cables.

Particular attention should be paid to corrosive gases, excessive humidity or pollution in the cooling air. Indirect cooling may be necessary.

3.7.2 Requirements Regarding Corrosive Gases

This section applies to operation, transportation and storage of Advant OCS equipment.

The copper corrosion must not exceed 300 Angstrom over 28 days. These requirements are in accordance with ITF SSG 4251 class G1 and ISA-S71.04-1985 class G1.

If this value is exceeded, protective measures must be taken, e.g., encapsulation, dehumidification or gas cleaning with chemical filters.

3.7.3 Resistance to the External Environment

An Advant OCS with Mod 300 Software system in a standard cabinet satisfies the environmental requirements specified in the following two tables. This ensures a long life for the system in normal industrial environments. If the system is to be used in more severe environments, special cabinets should be considered.

3.7.4 Environmental Conditions

The following environmental conditions apply to:

C = Cabinets (Enclosures, Cases, Consoles) to protection Class IP21 (according to IEC 529)

U = Units (Subracks, Plug-in units, Printed circuit boards)

Transportation and Storage

Table 3-71. External Environmental Factors, Transportation and Storage

Requirement		Standard Complied with							
Environment	Limits	IEC 1131 -1, -2		VDE 0160		IEC 721 -3		IEC 654	
		Req.	Test	Req.	Test	Class	Class	Point	Class
Temp., no package (C+U)	Low -40 °C High +70 °C (3)	2.3.1 2.3.1	6.3.4.2 6.3.4.2	5.2.1.1 5.2.1.1	- -	1 K5 1 K5	2K4 2K4	4.3 4.3	Part1 C2 Part1 C2
Temp. change, no package (C+U)	-25 to +70 °C (1)	2.1.1.2	6.3.4.3	-	-	1 K5	2K4	5.1	Part 1:5.1
Humidity, no package (C+U)	RH=5-100%, condensing(2)	2.3.2	6.3.4.4	5.2.1.2	7.2.1	1K5	2K4	4.3	C2
Mechanical		-	-	5.2.2	-	-	-	-	-
Bump, no package (C+U)	100 m/s^2, 16 ms, x, y, z direction (1)	-	-	-	-	1M3	2M1	-	Part 3:5
Fall, in package (C+U)	<10 kg, 1 m, x, y, z dir. 10-40 kg, 0.5 m, x, y, z dir. >40 kg, 0.25 m, x, y, z dir.	2.3.4	6.3.5.4	-	-	-	2M1	-	Part 3:5
Altitude (C+U)	3000 m	2.3.3	-	5.2.1.3 (3)	-	1K5	2K4	-	Part 1:6.2

(1) For Advant Station 100 Series engineering workplaces, the following values apply:
Low: -30° C, High: +60° C; changes in temperature not specified.
All verifications are done according to applicable standards, e.g. IEC 68-2-1, -2, -3, -6, -13, -14, -27, -29, -30, -32.

(2) For disk drives, the following values apply: Humidity (RH): 5-95%, non-condensing (transportation); Vibration: 2.5 m/s2, 5-200 Hz; Shock: 25 m/s2, 10 ms.

(3) 3265 m.

Operation

Table 3-72. External Environmental Factors, Operation

Requirement		Standard complied with							
Environment	**Limits**	**IEC 1131 -1, -2**		**VDE 0160**		**IEC 721 -3**		**IEC 654**	
		Req.	**Test**	**Req.**	**Test**	**Class**	**Class**	**Point**	**Class**
Temperature (C) (U)	Low, non-condensing (1) 0 °C High +40 °C Low, non-condensing (2) 0 °C High +70 °C	2.1.1.1 2.1.1.1 2.1.1.1 2.1.1.1	6.3.3 6.3.3 6.3.3 6.3.3	5.2.1.1 5.2.1.1 5.2.1.1 5.2.1.1	- - - -	- - - -	3K4 3K4 3K4 3K4	4.2 4.2 4.2 4.2	Part 1 B3 B3 Bx Bx
Temp. (C) gradients (1) (U)	±10 °C/h, 0/40 °C ±10 °C/h, 0/70 °C	- -	6.3.4.3 6.3.4.3	- -	- -	- -	3K4 3K4	5.1 5.1	Part 1:5.1
Humidity (C+U)	RH=5-95%, abs. 1 -29 g/m3, non-condensing (2)	2.1.1.3 level RH2	-	5.2.1.2	-	-	3K3	4.2	B3
Mechanical vibration (C) (U) (1)	±0.075 mm, 10-55 Hz, 10 m/s², 55-150 Hz, x, y, z dir. ±0.15 mm, 10-55 Hz, 20 m/s², 55-150 Hz, x, y, z dir.	2.1.3.1 2.1.3.1	6.3.5.1 6.3.5.1	5.2.2 5.2.2	7.2.2 7.2.2	- -	3M4 (3) 3M4 (3)	- -	Part 3 V.H. 3 V.H.4
Shock (C+U)	150 m/s², 11 ms, half sine, x, y, z dir. (2)	2.1.3.2	6.3.5.2	5.2.2	-	-	3M4	-	Part 3:5
Altitude (C+U)	2000 m	2.1.1.6	-	5.2.1.3	-	-	3K4 (4)	-	Part 1:6.1
Pollution degree (C+U)	Degree 2 acc. to IEC 664 and 664A	1.4.43 2.1.1.4	-	5.2.1.4	5.7.2.3	3S2	-	-	-
Acoustic noise (C)	<55 dB(A)	-	-	4.2	7.2.5	-	-	-	-

(1) For Advant Station 100 Series engineering workplaces, the low temperature is +5°C.
(2) For disk drives, the following values apply: Temperature: 10/46 °C; Humidity (RH): 20-80%; Vibration: 2.5 m/s², 5-200 Hz; Shock: 25 m/s², 10 ms.
(3) Not across the whole range.
(4) 70 kPa.

Mains Voltage And Mains Frequency

Table 3-73. Mains Voltage And Frequency

Supply	Requirements
Mains voltage	$V_{nom,}$ -15% to +10%
Mains frequency	50 or 60 Hz, ± 10%

3.7.5 Electromagnetic Compatibility and Electrical Safety

Advant OCS equipment meets the requirement specified in EMC Directive 89/336/EEC and in Low Voltage Directive 73/23/EEC. Compliance is verified for the following standards:

EN 50081-2 EMC Emission

EN 50082-2 EMC Immunity

EN 60950, EN 61010-1, EN 60439-1 Electrical safety

Each product and its packaging is provided with a CE marking and a Declaration of Conformity Document. Certain exceptions from the general compliance exist and are described in the valid Price List and Product Guide.

From January 1, 1996 most electrical and electronic products made, sold, or taken into service in Europe (with the exception of Switzerland) must carry a CE marking. The purchaser is responsible for ordering only CE marked equipment which complies to EMC testing, approval and documentation requirements. If the purchaser modifies or repackages that equipment, he is then responsible for the CE marking of his equipment.

The resistance to interference for equipment not CE marked (sold outside Europe) is verified in accordance with national and international standards for industrial equipment in electromagnetic environments as described in the following table.

Table 3-74. Test Requirements for Interference

Interference Factor	Requirements		Standard
1. Conducted Interference	Class 3	Class 4	SS 4361503 unless otherwise stated
	2-4 KV	4-8 KV	
- Spark (fast transient)	2/1 KV	4/2 KV	IEC 1000-4-4, classes 3&4
- Fast Transient (burst)	1/0.5 KV	2.5 KV	Units with varistor protection
- 1 MHz (damped Oscill)			Also: IEC 255-4, Class 3 IEEE 472-1974 ANSI C.37.90a-1974
- Impulse (1.2/50 us)	3 KV	5 KV	Units with varistor protection Also: IEC 255-4, Class 3 IEEE 472-1974 ANSI C.37.90a-1974
- 50Hz	250 V	250 V	10/50uF coupling capacitors
2. ESD Interference (at the enclosure port)	Class 3, 15 KV		SS 4361522, IEC 801-2 IEC 1000-4-2 (contact/air)
3. Radio Interference (standard cabinetry)	10 V/m		IEC 1000-4-3 IEC 1000-4-6
4. Low Freq. Mag. Field	30 A/m (3 A/m for monitors)		IEC 1000-4-8
5. Insulation (mains voltage 60-300 VAC)	2000 VAC		SS EN 60439-1 IEC439-1

Note: RE500 Series cabinets are equipped with wrist straps and an ESD-proof work shelf for maintenance of circuit boards in the field.

The installation environments for specific products can be found in the applicable product documentation. Class 3 represents the industrial environment, and Class 4 represents the high voltage outdoor switch gear environment.

CE Marking

A CE label will be placed on the equipment cabinet on or near the product label. The following is an example of a CE Label:

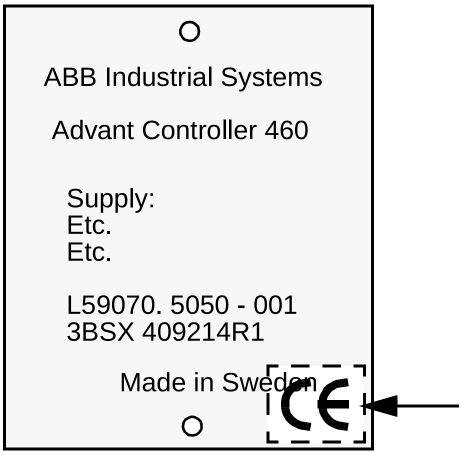


Figure 3-102. Example, CE Label

3.7.6 High Voltage Switchgear Applications

For those parts of Advant OCS with MOD 300 Software that are not intended or designed for direct connection to external high voltage switchgear, intermediate relays and special measurement value converters are used as intermediate links (tested in accordance with SS 4361503, class 4).

3.7.7 Lightning Strike Protection

Industries and power plants are normally equipped with well integrated grounding networks which are installed as part of the power distribution system. In such installations it is not necessary to install protection against lightning strike.

Protection against lightning strike is always necessary when:

- Cables extend beyond the area covered by the ground line network
- Cables are located above ground or when overhead cables are used.

3.7.8 Inductive Load Suppression

Inductive loads such as relays and contactors directly connected to Advant OCS with MOD 300 Software do not have to be suppressed. The necessary suppression components (varistors or snubbers - RC units) are installed on the circuit boards.

3.7.9 The Laying of Field Cables

There are no special requirements for the laying of field and communication cables connected to Advant OCS with MOD 300 Software, except:

- Cables for short-distance communication without modems should always be routed 10 cm (4”) away from other cables.
- All cables connected to the system should be run 30 cm (12”) away from power cables with system voltages exceeding 250 V between the phase and ground and 10 cm (4”) away from cables belonging to the classes “PL4” and “PL5”.

3.7.10 Types of Field Cables

Shielded cables are always required for:

- Communications
- High-frequency pulse transmission
- Low Level analog signals e.g. Pt100 and thermocouples
- Analog application with a system accuracy >= 12 bits

For other applications it is possible to use standard cables on the market. Digital and analog signals of the same type can be run in the same cable.

3.7.11 Installation Instructions

Installation instructions for the applicable product can be found in:

- Advant Station Hardware User’s Guide
- Advant Controller User’s Guide

Chapter 4 Ordering Information

4.1 Advant Controller Ordering Information

There are two Advant Controller models, the Advant Controller 410 used for small to medium applications which do not require redundancy and Advant Controller 460 with 1:1 redundancy for larger applications. These controllers have different hardware but share many of the same components.

4.1.1 Advant Controller 460 and S100 I/O Ordering Information

CE Marking:

All electronic equipment sold in Europe (with the exception of Switzerland) must display a CE Marking which states that the equipment meets the requirements specified in the EMC Directive 89/336 and in Low Voltage Directive 73/23/EEC.

CE kits must be ordered for Advant Controllers 460 (AC 460) housed in cabinets which will be delivered to Europe. These kits contain special isolation hardware which allow the equipment to comply to CE requirements, along with the CE label. All RM5xx cabinets are verified for CE Marking.

They may be ordered as follows:

Table 4-1. CE Markings, AC 460 and S100 I/O in RM5xx Cabinet

Description	Consists of	Ordering No.
CE Marking, RM5xx cabinet mounted delivery. Main power supply filter is included	---------	3BUR000887R1
CE Marking, RM5xx loose parts delivery. Main power supply filter is not included and must be ordered separately	---------	3BUR000888R1

NOTE: The RM5xx cabinets must be ordered separately. The items in the table above are then added to the cabinets to meet CE certification.

4.1.1.1 Basic Unit

The minimum configuration for the Advant Controller 460 is provided by the basic unit which consist of:

Table 4-2. Advant Controller 460 Basic Unit

	Description	Qty.
RF522	Subrack and Backplane	1
SR511	Primary Power Regulator	2
TC520	Monitor	1
SC540	DCN Communications Submodule	2
CS512	DCN Interface Module	2
RA102	ESD Board and equipment	1
TK451	Cable, 24V - Rack	1
TK456V021	Cable, 24V - Fan	1
TK458	Cable, Fan - TC520	1
RC510	Fan	1

Table 4-3. Advant Controller 460 Basic Unit

Description	Consists of	Article No.
Advant Controller 460 Basic Unit with 18 SU backplane to fit RM5xx cabinet, without CPU	AC460A01	3BUR001285R1

NOTE: Includes (1) RF522 subrack and 18SU backplane, (2) SR511 regulators, (1) TC520 monitor, (1) RC510 fan, (2) SC530 DCN C2 carriers, (2) CS512 DCN interface.

4.1.1.2 Options

Table 4-4. Processor Modules 1, 2, & 3

Description	Consists of	Article No.
Processor Module, 8MB. (Order two processors for redundancy)	PM510V08	3BSE008373R2
Processor Module, 16MB. (Order two processors for redundancy)	PM510V16	3BSE008358R2
Processor Module Upgrade Kit, converts 8MB processor to 16MB.	MB540	3BSE008499R1

The AdvaControl Basic Software License is required per Processor Module (or redundant pair).

Table 4-5. AdvaControl Basic Software Licenses

Description	Article No.
AdvaControl Basic Software License for up to 400 I/O signals	3BUR001516R1
AdvaControl Basic Software Incremental License for 401-800 I/O signals	3BUR001518R1
AdvaControl Basic Software Incremental License for 801-1600 I/O signals	3BUR001519R1
AdvaControl Basic Software Incremental License for greater than 1600 I/O signals	3BUR001520R1
AdvaControl Basic Software Redundancy License Version 14.4 for AC 460 Required if a redundant Processor Module pair is used	3BUR001530R1

NOTE: Incremental licenses are additive. (For example if you need a license for >1600 I/O signals, you must order the Basic License for 400I/O signals + the Incremental 401-800 + the Incremental 801-1600 + the Incremental > 1600 I/O signals)

The Primary History Log License is required per Processor Module (or redundant pair).

Table 4-6. Primary History Log

Description	Article No.
Primary History Log Software License Version 2.7 Licensed per Control Module	3BUR001895R1

Table 4-7. Carrier Modules

Description	Consists of	Article No.
SC510 Carrier Module without CPU, supports two submodules.	SC510	3BSE003832R1

NOTE: Two Carrier modules maximum per CPU or redundant CPU.

Table 4-8. S100 I/O Bus Extension

Description	Consists of	Article No.
CI540 S100 I/O Bus Extension Submodule	CI540	3BSE001077R1
CI540 S100 I/O Redundant Bus Extension Submodule	CI540K01	3BUR000597R1

Table 4-9. Optical Bus Extension

Description	Consists of	Article No.
TC560 Optical Modem, for optical fiber 2x50/125 or 2x62.5/125 um, ST-style connectors.	TC560V1	3BSE014164R1
TX560 Terminator (Must be ordered if no I/O subrack is included at the near-side.	TX560	3BSE005881R1
TK560 Interconnector (Order the same number of TK560 as modems. If TX560 is needed, order the same number of TK560 as modems minus one.	TK560	3BSE005880R1
TK580 Cable Assembly, for connection to CI540 (Must be ordered)	TK580	3BSC950057R1
TK580V007 Cable Assembly, for connection to CI540 when more than one modem is used (Order one less than modems)	TK580V007	3BSC950057R2

NOTE: Optical bus only available for non-redundant S100 LAN.

Table 4-10. TRIO Interface Submodules

Description	Consists of	Article No.
Submodule for TRIO	CI560	3BUC980002R1
Redundant Submodules for TRIO	CI560K01	3BUR000598R1

Table 4-11. MVI Submodules

Description	Consists of	Article No.
MODBUS Comm. interface, 2 channel	CI532V02	3BSE003827R1
Allen-Bradley Data Highway communication interface, 2 channel	CI532V04	3BSE003829R1
Generic/Termchar Comm. interface, 2 channel	CI532V05	3BSE007297R1
Smart Platform comm. interface, 2 channel	CI532V06	3BUR001065R1
Smart Platform Software, single platform license	---------	3BUR001645R1
Smart Platform Software, one additional platform license	---------	3BUR001647R1
HART Protocol Comm. interface to converter, multidrop, with cables	----------	3BUR001399R1
HART Protocol Comm. interface to SHIM, point to point, with cables	----------	3BUR001400R1
MODBUS PLUS comm. interface, 2 channel	CI537V01	3BUR000899R1
Short distance modem for cable length,10Km point to point up to 1Km at 19.2K baud, 24VDC. Alternative modem for field-side DSTC X008.	TC562	3BSC630049R1
Cable Assembly for connection of CI532 to TC562 modem	TK595	3BSE006830R1

Table 4-12. Advant Fieldbus 100 on Twisted Pair Cable

Description	Consists of	Article No.
AF 100 Communication Interface, includes CI522A, TC512V1 modem for twisted pair, and TK803 cable.	CI522AK04	3BSE018451R1
AF 100 Communication Interface for cable redundancy, includes CI522A, (2) TC512 modem for twisted pair, and (2) TK803 cable.	CI522AK05	3BSE018452R1
AF 100 Communication Interface for bus redundancy, includes (2)CI522A, (2) TC516 modem for twisted pair, and (4) TK803 cable.	CI522AK06	3BSE018453R1
AF 100 Connection Kit 150 ohms includes TC505 terminal block and TC501V150 terminator	TC505K03	3BSE009616R1

4.1.1.3 Communications

Table 4-13. Mics. Comm. Equipment

Description	Consists of	Article No.
Short distance modem for cable length,10Km point to point up to 1Km at 19.2K baud, 120/230VAC.	DSTC X008	5751030-1
Cable Assembly for connection of CI532 to C153x modem	TK577	3BSE004650R1
Modem/T-box Subrack for 9 units type TC512, TC516, TC530, TC532, or TC562.	RF541	3BSE003912R1
Modem/T-box Mounting Plate for 2 units type TC512, TC516, TC530, TC532, or TC562.	RA543	3BSE004691R1
Voting Unit, 24VDC to modem TC562 if redundant 24V is used.	SS110	3BSE007698R1

Table 4-14. MOD Interface

Description	Consists of	Article No.
DCN T-Box with interface cable, 3 m	TK530K01	3BUR000546R1
Fiber optic DCN T-Box with interface cable, 3 m	TC532K01	3BUR000547R1
Cable Assembly DCN 3 m (10 ft.)	TK510V030	3BUR000118R3
Cable Assembly DCN 15 m (49 ft.)	TK510V115	3BUR000118R15

NOTE: 1. The Advant DCN Cables were created to meet new EMC standard of the European community for Advant Systems. They are interchangeable with traditional DCN Cables with the following exception: the Advant Cables cannot be used on an existing system that has isolated the DCN ground. The Advant DCN Cable is electrically different because it has a braided ground that is physically tied to the connector and cannot be isolated by the interface modules.
2. See Advant Accessories Price List for additional MOD items.

4.1.1.4 Power System

Table 4-15. CPU Power Regulator

Description	Consists of	Article No.
SR511 24/5V Regulator used for redundancy	SR511	3BSE000863R1

Table 4-16. Main 120VA.C. Power Supply (RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply, 120V ac, for CPU and I/O subrack 1 Includes SA167, SX554, SX558, TK402V014	SA167K11	3BUR000846R1
Power Supply, 120V ac, for I/O subrack 2 Includes SA161, SX554, TK402V027	SA161K01	3BSE003575R1
Power Supply, 120V ac, for I/O subracks 2 & 3 Includes SA167, SX554, TK402V027	SA167K02	3BSE003577R1

Table 4-16. Main 120VA.C. Power Supply (RM5xx Cabinet)

Description	Consists of	Article No.
Red. Power Supply, 120V ac, for CPU and I/O subrack 1 Includes (2) SA167, SX554, SX558, TK402V014, TK451	SA167K12	3BUR000847R1
Red. Power Supply, 120V ac, for I/O subrack 2 Includes (2) SA161, SX554, TK402V027	SA161K02	3BSE003581R1
Red. Power Supply, 120V ac, for I/O subracks 2 & 3 Includes (2) SA167, SX554, TK402V027	SA167K04	3BSE003583R1

Table 4-17. Main 230VA.C. Power Supply (RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply, 230V ac, for CPU and I/O subrack 1 Includes SA168, SX554, SX558, TK402V014	SA168K11	3BUR000848R1
Power Supply, 230V ac, for I/O subrack 2 Includes SA162, SX554, TK402V027	SA162K01	3BSE003576R1
Power Supply, 230V ac, for I/O subracks 2 & 3 Includes SA168, SX554, TK402V027	SA168K02	3BSE003578R1
Red. Power Supply, 230V ac, for CPU and I/O subrack 1 Includes (2) SA168, SX554, SX558, TK402V014, TK451	SA168K12	3BUR000849R1
Red. Power Supply, 230V ac, for I/O subrack 2 Includes (2) SA162, SX554, TK402V027	SA162K02	3BSE003582R1
Red. Power Supply, 230V ac, for I/O subracks 2 & 3 Includes (2) SA168, SX554, TK402V027	SA168K04	3BSE003584R1

Table 4-18. Single Main D.C. Power Supply (RM5xx Cabinet)

Description	Consists of	Article No.
Basic Power Supply, 24/48V dc, for CPU and I/O subrack 1	SX550, SD150, SX554, TK582V014	3BSE003585R1
Expansion Power Supply, 24/48V dc, for I/O subrack 2, or subracks 2 & 3	SD150, SX554, TK582V027	3BSE003586R1
Redundant Basic Power Supply, 24/48V dc, for CPU and I/O subrack 1	TK541, (2)SX550, (2)SD150	3BSE003587R1
Redundant Expansion Power Supply, 24/48V dc, for I/O subrack 2, or subracks 2 & 3	(2)DSSA150A, (2)SX554, (2)TK582V027	3BSE003588R1

Table 4-19. Main D.C. Power Supply without DC/DC converter (RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply - Basic Energy Reserve & Switch Units, 24V dc, for CPU and I/O subrack 1	DSSB170, SX555, SX557	3BSE003589R1
Power Supply - Expansion Energy Reserve Unit, 24V dc, for I/O subrack 2, or subracks 2 & 3	DSSB170, SX557	3BSE003590R1

Table 4-20. Field Equipment Single Sensor Power Supplies (for RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply, 120V ac, 24V dc (SA161K03)	SA161, SX554, TK402V027	3BSE003591R1
Power Supply, 230V ac, 24V dc (SA162K03)	SA162, SX554, TK402V027	3BSE003592R1

Table 4-21. Field Equipment Redundant Sensor Power Supplies (for RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply, 120V ac, 24V dc (SA161K04)	(2)SA161, (2)SX554, (1)DSSS170, (2)TK402V027, (2)TK457V030	3BSE003596R1
Power Supply, 230V ac, 24V dc (SA162K04)	(2)SA162, (2)SX554, (1)DSSS170, (2)TK402V027 (2)TK457V030	3BSE003597R1

Table 4-22. Power Distribution

Description	Consists of	Article No.
Power Distribution Unit AC 230V, 300VA	SV540	3BSE004264R1
Power Distribution Unit AC 120V, 300VA	SV541	3BSE004265R1
Power Distribution Unit Change-over, AC 230V, 300VA	SV542	3BSE005001R1
Power Distribution Unit Change-over, AC 120V, 300VA	SV543	3BSE005002R1
Power Distribution Unit Main Exp. AC 250V, 35A	SX541	3BSE004254R1
Power Distribution Unit Main Aux. AC 250V, 25A	SX542	3BSE004255R1
Power Distribution Unit Main Exp. DC 60V, 50A	SX551	3BSE004259R1
Power Distribution Unit Main AC 250V, 35A	SX558	3BUR000669R1

Table 4-23. Main Supply Filter

Description	Consists of	Ordering No.
Main Power Supply Filter, 250V, 20A	---------	3BSC740007R1
Main Power Supply Filter, 250V, 55A	---------	3BSC740008R1
Main Power Supply Filter, 250V, 80A. For DC main supply, 24VDC.	---------	3BSC740009R1
Mounting Sheet for three 20A power filters	---------	3BSE016510R1

Table 4-23. Main Supply Filter (Continued)

Description	Consists of	Ordering No.
Mounting Sheet for two 55A and one 20A power filter	---------	3BSE016511R1
Mounting Sheet for two 80A and one 20A power filter	---------	3BSE016512R1

4.1.1.5 S100 I/O with AC 460

NOTE: The following S100 I/O Subracks are for use in RM5xx style cabinets.

Table 4-24. S100 I/O Subracks

Description	Consists of	Article No.
I/O Subrack with single 5V regulator	DSRF182AK02	3BSE014078R1
I/O Subrack with redundant 5V regulator	DSRF187AK02	3BSE014079R1
Diode Unit, 24V, 25A, used with redundant power supplies for I/O	DSSS170	4897 0001-A
Voting Unit, auto A-B switch required when using redundant power supplies with redundant 5V regulator on S100 I/O, mounts on DSRF185 or DSRF186	DSSS171	3BSE005003R1

Table 4-25. Single S100 I/O Bus Connection

Description	Consists of	Article No.
Connection Kit for S100 I/O bus. Includes DSBC175, DSTK183, TK575, and DSTC176. For I/O Subrack No. 1.	DSBC175K01	3BUR001805R1
Connection Kit for S100 I/O bus. Includes DSBC175, DSTK183, and TK517V040. For I/O Subracks No. 2 or No. 4.	DSBC175K02	3BUR001806R1
Connection Kit for S100 I/O bus. Includes DSBC175, DSTK183, and DSTK195. For I/O Subracks No. 3 or No. 5.	DSBC175K03	3BUR001807R1

Table 4-26. Redundant S100 I/O Bus Connection

Description	Consists of	Article No.
Connection Kit for redundant S100 I/O bus. Includes (2) DSBC175, TK567, (2) TK575, and (2) DSTC176. For I/O Subrack No. 1.	DSBC175K04	3BUR001808R1
Connection Kit for redundant S100 I/O bus. Includes (2) DSBC175, TK567, and (2) TK517V040. For I/O Subracks No. 2 or No. 4.	DSBC175K05	3BUR001809R1
Connection Kit for redundant S100 I/O bus. Includes (2) DSBC175, TK567, and (2) DSTK195. For I/O Subracks No. 3 or No. 5.	DSBC175K06	3BUR001810R1

S100 I/O Modules

Table 4-27. S100 I/O Analog Inputs

Description	Consists of	Article No.
High Level Analog Input, 16 Ch, 12 bit, diff. input, 0 to +/-10V, 0 to +/-20mA, 250 ohm shunt, 0.1%, includes: conn. unit DSTA131, & cable DSTK150	DSAI 130K01	5730 030-UC
High Level Analog Input, 32 Ch, 12 bit, single ended, 0 to +/-10V, 0 to +/-20mA, 250 ohm 0.1% shunt, includes: conn. units (2)DSTA002, & cable DSTK152	DSAI 133K01	5730 032-BA
RTD Input 3-wire, Pt100, 31 (+1 ref.) Ch, 12 bit, -100/+320C, -200/+640C, includes: conn. unit DSTA146, & cable DSTK202	DSAI 146K01	3BSE009679R1
RTD Input 4-wire, Pt100, 14 (+2 ref.) Chs, 12/13 bit, -40/+40C, -100/+320C, -200/+640C, includes: conn. unitDSTA151, & cable DSTK160	DSAI 151K01	5730 030-UK
Thermocouple Input, 14 (+2 ref.&1 comp) Ch, 12 bit, for grounded transducers, includes: conn. unit DSTA156, & cable DSTK187	DSAI 155AK01	5730 030-UM
Thermocouple Input, 14 (+2 ref.&1 comp) Ch, 12 bit, for floating transducers, includes: conn. unit DSTA156, & cable DSTK186	DSAI 155AK02	5730 030-UL
Thermocouple Conn Unit 14 Ch, with Cold junction, 1 deg C accuracy	DSTA 155	5712 0001-KD

Table 4-28. S100 Redundant Analog Input

Description	Consists of	Article No.
Redundant Analog Input 32 Ch, 12 bit, single ended, 0 to +/-10V, 0 to +/-20mA, 250 ohm 0.05% shunt, includes: (2) conn. units DSTA002, & cable DSTK152	DSAI 133K02	5730 032-BB

Table 4-29. S100 Analog Outputs

Description	Consists of	Article No.
Analog Output, 4 Channel isolated, 12 bit, 0 to +/-10V, 0 to +/-20mA, includes: conn, unit DSTA160, & cable DSTK153	DSA0110K01	5730 030-UN
Analog Output, 8 Channel non-isolated, 12 bit, 0 to +/-10V, 0 to +/-20mA, includes: conn, unit DSTA170, & cable DSTK153	DSAO120K01	5730 030-UP

Table 4-30. S100 Analog Input/Output

Description	Consists of	Article No.
Analog I/O, 8In-8Out Chs, Single Ended, 12 bit, single ended, 0 to +/-10V, 0 to +/-20mA, 250 ohm 0.05% shunt, includes: conn. unit DSTA001, & cable DSTK153	DSAX110K01	5730 032-BC
Redundant Analog I/O, 8In-8Out Chs, Single Ended, 12 bit, single ended, 0 to +/-10V, 0 to +/-20mA, 250 ohm 0.05% shunt, includes: conn. unit DSTA001, & cables (2) DSTK153	DSAX110K02	5730 032-BD

Table 4-31. Analog Isolation Amplifier

Description	Consists of	Article No.
Analog Isolation Amp 3KVA, 1 Ch, 0 to +/-10V, 0 to +/-20mA, Accuracy: linearity 0.3%, bipolar unsymmetrical 0.5%, supply 24 VDC	DSTY 101	5712 0001-KY

NOTE: Not verified for CE marking. Can not be used together with HART bus.

Table 4-32. S100 Pulse Input

Description	Consists of	Article No.
Pulse Encoder Input, 12 bit, 10KHz, 5,12,24VDC, 5.6K ohm, includes: conn unit DSTD 150A, & cable DSTK160	DSDP150K01	5730 030-UU

Table 4-33. S100 Digital Inputs

Description	Consists of	Article No.
Digital Input, 32 Ch, 24VDC, scanning or interrupt, Includes: conn unit DSTD 150A, & cable DSTK150	DSDI110AK01	5730 032-BE
Digital Input, 4 x 8 Ch, scanning or interrupt, for conn units DSTD195, 196, 197, 198 includes cable DSTK165	DSDI110AK02	5730 032-BF
Digital Input, 4 x 8 Ch, scanning only, for conn units DSTD195, 196, 197, 198 includes cable DSTK165	DSDI 115K01	5730 030-UA
Connection Unit, 8 Channel, 24VAC/DC, galvanically isolated	DSTD 195	3BSE004724R1
Connection Unit, 8 Channel, 24VDC bias	DSTD 196	3BSE004725R1
Connection Unit, 8 Channel, 120VAC/DC, galvanically isolated	DSTD 197	3BSE004726R1
Connection Unit, 8 Channel, 230VAC, galvanically isolated	DSTD 198	3BSE004727R1
Terminal Unit for Distr. of 24VDC	DSSX 166	5347 049-CR
Voting Unit for redundant connection units using redundant power supplies (i.e. DSTD 108, DSTD 195, 196, 198). Can also be used for redundant power to short distance modems such as the TC562.	SS110	3BSE007698R1

Table 4-34. S100 Digital Outputs

Description	Consists of	Article No.
Digital Output, 4x8 Channel 24VDC for conn units DSTD108 & 108L includes cable DSTK165	DSDO110K01	5730 032-CX
Termination Panel, 8 Chan.24-250VAC/DC relay, max load 44W-DC, 720VA-AC, 3Amps, min load 0.1Amp	DSTD 108	5616 0001-ABD
Termination Panel, 8 Chan. for low current loads, 24-250VAC/DC relay, max load 200mA or 5VA, min load 1mA or 0.05VA	DSTD 108L	5716 0001-ABW

Table 4-35. S100 Digital Input/Output

Description	Consists of	Article No.
Universal Digital I/O, 32 Channel, for use with I/O Conditioning Modules, Includes: (2) conn units DSTX180, & cable DSTK152	DSDX180K01	3BUR000594R1

Table 4-36. Digital I/O Conditioning Modules

Description	Consists of	Article No.
Digital I/O Conditioning Module Input 24VDC, 8.5mA	DI010	3BSC170011R1
Digital I/O Conditioning Module Output 24/48VDC, 1A	DO010	3BSC170011R2
Digital I/O Conditioning Module Input 120VAC, 10mA	DI015	3BSC170011R3
Digital I/O Conditioning Module Input 240VAC, 7A	DI020	3BSC170011R4
Digital I/O Conditioning Module Output 120VAC, 2A	DO015	3BSC170011R5
Digital I/O Conditioning Module Output 240VAC, 2A	DO020	3BSC170011R6
Digital I/O Conditioning Module Input, Dry Contact	DI012	3BSC170011R7

Table 4-37. Redundant Digital Input/Output Modules

Description	Consists of	Article No.
Redundant Universal Digital I/O, 32 Channel, for use with I/O Conditioning Modules, Includes: (2) conn units DSTX180, & (2) cable DSTK152	DSDX180K02	3BUR000595R1

NOTE

Ordering Information for S100 I/O connection to ELCON Intrinsic Safety System may be found in the *S100 I/O Technical Supplement*.

Table 4-38. S100 Mounting Bar for RM5xx Cabinet

Description	Consists of	Article No.
Terminal Carrier 24” 3S for conn. units	RA 121	3BSE005465R1
Terminal Carrier 19” 3S for conn. units	RA 120	3BSE005464R1

NOTE: Longer I/O connection cables can be ordered. In addition to the 3m DSTK I/O connection cables, 15m and 30m lengths are available. These cables connect between the I/O module and the connection unit. The new longer length cables can be ordered from the Advant OCS Spare Parts Price List.

Table 4-39. Assembly and Test by ABB

Description	Consists of	Article No.
Assembly and test of Subrack mounted in RM5xx cabinet, price per rack, I/O, and CPU, applicable if assembled by ABB Automation AB, Sweden	---------	3BSE016033R1

4.1.1.6 MOD 6000 Direct I/O to S100 I/O Conversion Kits

Table 4-40. MOD 300 Direct I/O to S100 I/O Analog Connections

Description	Consists of	Article Number
MOD to S100 Analog Conversion Panel	TA510	3BUR980033R1
Analog I/O Board, 8 inputs/8 outputs	DSAX 110	57120001-PC
Analog Input Board, 32 inputs	DSAI 133	57120001-PS
Cable Assembly, flat 2.5m, for DSAX 110	DSTK 153	26390603-G
Cable Assembly, flat 3.0m, for DSAI 133	DSTK 152	26390603-K

Table 4-41. MOD 300 Direct I/O to S100 I/O Thermocouple Connections

Description	Consists of	Article Number
MOD to S100 Thermocouple Conversion Panel	TA511	3BUR980035R1
Analog Input Board, 32 inputs	DSAI 155A	3BSE014162R1
Cable Assembly, round/flat 3.0m, for DSAI 155A	DSTK 160	26390603-U

Table 4-42. MOD 300 Direct I/O to S100 I/O Digital Connections

Description	Consists of	Article Number
MOD to S100 Digital Conversion Panel	TA513	3BUR980034R1
Digital Input/Output Board, 32 inputs/outputs	DSDX 180	3BSE003859R1
Cable Assembly, flat 2.5m, for DSDX 180	DSTK 153	26390603-G

4.1.1.7 Packaging Options

Table 4-43. RM5xx Cabinets IP21, CE Marked

Description	Consists of	Article No.
Cabinet IP21 vented, 800W x 512D x 2125H mm, Cabinet No.1, 4, 6, & 7	RM501	3BSE016045R1
Cabinet IP21 vented, 800W x 512D x 2125H mm, Cabinet No.1, 4, 6, & 7 Not CE Marked	RM531	3BSE016153R1
Cabinet IP21 with hinged frame, vented, 800W x 512D x 2125H mm, Cabinet No.2, 3, & 5	RM511	3BSE016054R1
Cabinet IP21 with hinged frame, vented, 800W x 512D x 2125H mm, Cabinet No.2, 3, & 5 Not CE Marked	RM541	3BSE016156R1
Cabinet IP21 vented, 800W x 512D x 1925H mm, Cabinet No.1, 4, 6, & 7	RM504	3BSE016048R1
Cabinet IP21 vented, 800W x 512D x 1925H mm, Cabinet No.1, 4, 6, & 7 Not CE Marked	RM534	3BSE016154R1
Cabinet IP21 with hinged frame, vented, 800W x 512D x 1925H mm, Cabinet No.2, 3, & 5	RM514	3BSE016057R1
Cabinet IP21 with hinged frame, vented, 800W x 512D x 1925H mm, Cabinet No.2, 3, & 5 Not CE Marked	RM544	3BSE016157R1

Table 4-44. RM5xx Cabinets IP41, CE Marked

Description	Consists of	Article No.
Cabinet IP41 vented, 800W x 512D x 2125H mm, Cabinet No.1, 4, 6, & 7	RM502	3BSE016046R1
Cabinet IP41 with hinged frame, vented, 800W x 512D x 2125H mm, Cabinet No.2, 3, & 5	RM512	3BSE016055R1
Cabinet IP41 vented, 800W x 512D x 1925H mm, Cabinet No.1, 4, 6, & 7	RM505	3BSE016049R1
Cabinet IP41 with hinged frame, vented, 800W x 512D x 1925H mm, Cabinet No.2, 3, & 5	RM515	3BSE016058R1

Table 4-45. RM5xx Cabinets IP54, CE Marked

Description	Consists of	Article No.
Cabinet IP54 sealed, 800W x 512D x 2125H mm, Cabinet No.1, 4, 6, & 7	RM503	3BSE016047R1
Cabinet IP54 sealed with hinged frame, 800W x 512D x 2125H mm, Cabinet No.2, 3, & 5	RM513	3BSE016056R1
Cabinet IP54 sealed, 800W x 512D x 1925H mm, Cabinet No.1, 4, 6, & 7	RM506	3BSE016050R1
Cabinet IP54 with hinged frame, sealed, 800W x 512D x 1925H mm, Cabinet No.2, 3, & 5	RM516	3BSE016059R1

Table 4-46. RM5xx Cabinet Accessories

Description	Consists of	Article No.
Replacement of single doors to double doors (per single cabinet)	for RM5xx	3BSE016260R1
Front Plate with customer designed text	for RM5xx	3BSE016259R1
End Panel 72 in. (1925H x 20W mm)	for RM5xx	3BSE016252R1
End Panel 84 in. (2125H x 20W mm)	for RM5xx	3BSE016253R1
Shield Plate 72 in. (1925H x 20Wmm)	for RM5xx	3BSE016255R1
Shield Plate 84 in. (2125H x 20W mm)	for RM5xx	3BSE016256R1
Locking Device cylinder	for RM5xx	3BSE016258R1
Heat Exchange with Side Panel 72 in. (1925 mm), 230VAC, Air-Air	for RM5xx	3BSE016262R1
Heat Exchange with Side Panel 72 in. (1925 mm), 120VAC, Air-Air	for RM5xx	3BSE016265R1
Heat Exchanger with Side Panel 84 in. (2125 mm), 230VAC, Air-Air	for RM5xx	3BSE016263R1
Heat Exchanger with Side Panel 84 in. (2125 mm), 120VAC, Air-Air	for RM5xx	3BSE016266R1

4.1.2 Advant Controller 410 and S100 I/O Ordering Information

CE Marking:

All electronic equipment sold in Europe (with the exception of Switzerland) must display a CE Marking which states that the equipment meets the requirements specified in the EMC Directive 89/336 and in Low Voltage Directive 73/23/EEC.

CE kits must be ordered for Advant Controllers 460 housed in cabinets which will be delivered to Europe. These kits contain special isolation hardware which allow the equipment to comply to CE requirements, along with the CE label. All RM5xx cabinets are verified for CE Marking.

They may be ordered as follows:

Table 4-47. CE Markings, AC410 and S100 I/O in RM5xx Cabinet

Description	Consists of	Ordering No.
CE Marking, RM5xx cabinet mounted delivery. Main power supply filter is included	---------	3BSE018472R1
CE Marking, RM5xx loose parts delivery. Main power supply filter is not included and must be ordered separately	---------	3BSE018473R1

NOTE: The RM5xx cabinets must be ordered separately. The items in the table above are then added to the cabinets to meet CE certification.

4.1.2.1 Basic Unit

Table 4-48. Advant Controller 410 Basic Unit in RM5xx Cabinet

Description	Consists of	Article No.
AC410 with single 5V regulator and 8MB processor.	AC410C01	3BUR001281R2
AC410 with redundant 5V regulator and 8MB processor.	AC410C02	3BUR001282R2
Voting Unit, auto A-B switch required when using redundant power supplies	DSSS171	3BSE005003R1
Processor Upgrade Kit, converts PM 150V04, 4MB processor to 8MB.	MB542	3BSE009600R1

NOTES:

Non-redundant Includes: DSRF185 I/O Subrack, DSSR122 5V Regulator, PM150 CPU, (2) CS512 DCN Interface.

Redundant Includes: DSRF186 I/O Subrack, (3) DSSR170 5V Regulator, PM150 CPU, (2) CS512 DCN Interface.

The AdvaControl Basic Software License is required per AC 410 Basic Unit.

Table 4-49. AdvaControl Basic Software Licenses

Description	Article No.
AdvaControl Basic Software License for up to 200 I/O Signals	3BUR001512R1
AdvaControl Basic Software Incremental License for 201-400 I/O Signals	3BUR001513R1
AdvaControl Basic Software Incremental License for 401-800 I/O Signals	3BUR001514R1
AdvaControl Basic Software Incremental License for greater than 800 I/O Signals	3BUR001515R1

NOTE: Incremental licenses are additive. (For example if you need a license for >800 I/O Signals, you must order the Basic License for 200 I/O Signals + the Incremental 201-400 + the Incremental 401-800 + the Incremental > 800 I/O Signals)

The Primary History Log License is required per AC 410 Basic Unit.

Table 4-50. Primary History Log

Description	Article No.
Primary History Log Software License Version 2.7 Licensed per Control Module	3BUR001895R1

4.1.2.2 Options

Table 4-51. Hardware Options - I/O Submodules

Description	Consists of	Article No.
Submodule for TRIO Fieldbus	CI560	3BUC980002R1
Submodule for Redundant TRIO Fieldbus	CI560K01	3BUR000598R1

Table 4-52. MVI Submodules

Description	Consists of	Article No.
MODBUS Comm. interface, 2 channel	CI532V02	3BSE003827R1
Allen-Bradley Data Highway communication interface, 2 channel	CI532V04	3BSE003829R1
Generic/Termchar Comm. interface, 2 channel	CI532V05	3BSE007297R1
Smart Platform comm. interface, 2 channel	CI532V06	3BUR001065R1
Smart Platform Software, single platform license	---------	3BUR001645R1
Smart Platform Software, one additional platform license	---------	3BUR001647R1
HART Protocol Comm. interface to converter, multidrop, with cables	----------	3BUR001399R1
HART Protocol Comm. interface to SHIM, point to point, with cables	----------	3BUR001400R1
MODBUS PLUS comm. interface, 2 channel	CI537V01	3BUR000899R1
Short distance modem for cable length,10Km point to point up to 1Km at 19.2K baud, 24VDC. Alternative modem for field-side DSTC X008.	TC562	3BSC630049R1
Cable Assembly for connection of CI532 to TC562 modem	TK595	3BSE006830R1

Table 4-53. Advant Fieldbus 100 on Twisted Pair Cable

Description	Consists of	Article No.
AF 100 Communication Interface, includes TC520V1, TC512 modem for twisted pair, and TK593 cable.	CI520K07	3BSE009613R1
AF 100 Communication Interface for cable redundancy, includes TC520V1, (2) TC512 modem for twisted pair, and (2) TK593 cable.	CI520K08	3BSE009617R1
Connection Kit 150 ohm, includes TC505 connection terminal and TC501V150 drop cable.	TC505K03	3BSE009616R1

4.1.2.3 Communications

Table 4-54. Miscellaneous Communication Equipment

Description	Consists of	Article No.
Modem/T-box Subrack for 9 units type TC530, TC532, or TC562.	RA541	3BSE003912R1
Modem/T-box Mounting Plate for 2 units type TC530, TC532, or TC562.	RA543	3BSE004691R1
Bracket, 19” for mounting 2 T-boxes	RX506	3BUC910018R1
Voting Unit for 24VDC to redundant TC562 modems	SS110	3BSE007698R1
Cable Assembly for connection of CI532 to C153x modem	TK577	3BSE004650R1
Short distance modem for cable length,10Km point to point up to 1Km at 19.2K baud, 120/230VAC.	DSTC X008	5751 030-1

Table 4-55. MOD Interface

Description	Consists of	Article No.
DCN T-Box with Interface Cable, 3 m	TC530K01	3BUR000546R1
Fiber optic DCN T-box with interface cable, 3 m	TC532K01	3BUR000547R1
Cable Assembly, DCN, 3 m (10’)	TK510V030	3BUR000118R3
Cable Assembly, DCN, 15 m (49’)	TK510V115	3BUR000118R15

NOTE:

1. The Advant DCN Cables were created to meet new EMC standard of the European community for Advant Systems. They are interchangeable with traditional DCN Cables with the following exception: the Advant Cables cannot be used on an existing system that has isolated the DCN ground. The Advant DCN Cable is electrically different because it has a braided ground that is physically tied to the connector and cannot be isolated by the interface modules.

2. See Advant Accessories Price List for additional MOD items.

4.1.2.4 Power System

Table 4-56. Main 120VA.C. Power Supply (RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply, 120V ac, for CPU and I/O subrack 1 Includes SA167, SX554, SX558, TK402V014	SA167K11	3BUR000846R1
Red. Power Supply, 120V ac, for CPU and I/O subrack 1 Includes (2) SA167, SX554, SX558, TK402V014, TK451	SA167K12	3BUR000847R1

Table 4-57. Main 230VA.C. Power Supply (RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply, 230V ac, for CPU and I/O subrack 1 Includes SA168, SX554, SX558, TK402V014	SA168K11	3BUR000848R1
Red. Power Supply, 230V ac, for CPU and I/O subrack 1 Includes (2) SA168, SX554, SX558, TK402V014, TK451	SA168K12	3BUR000849R1

Table 4-58. Single Main D.C. Power Supply (RM5xx Cabinet)

Description	Consists of	Article No.
Basic Power Supply, 24/48V dc, for CPU and I/O subrack 1	SX550, SD150, SX554, TK582V014	3BSE003585R1
Redundant Basic Power Supply, 24/48V dc, for CPU and I/O subrack 1	TK541, (2)SX550, (2)SD150	3BSE003587R1

Table 4-59. Main D.C. Power Supply without DC/DC Converter (RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply - Basic Energy Reserve & Switch Units, 24V dc, for CPU and I/O subrack 1	DSSB170, SX555, SX557	3BSE003589R1

Table 4-60. Field Equipment Single Sensor Power Supplies (for RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply, 120V ac, 24V dc (SA161K03)	SA161, SX554, TK402V027	3BSE003591R1
Power Supply, 230V ac, 24V dc (SA162K03)	SA162, SX554, TK402V027	3BSE003592R1

Table 4-61. Field Equipment Redundant Sensor Power Supplies (for RM5xx Cabinet)

Description	Consists of	Article No.
Power Supply, 120V ac, 24V dc (SA161K04)	(2)SA161, (2)SX554, (1)DSSS170, (2)TK402V027, (2)TK457V030	3BSE003596R1
Power Supply, 230V ac, 24V dc (SA162K04)	(2)SA162, (2)SX554, (1)DSSS170, (2)TK402V027 (2)TK457V030	3BSE003597R1

Table 4-62. Power Distribution

Description	Consists of	Article No.
Power Distribution Unit AC 230V, 300VA	SV540	3BSE004264R1
Power Distribution Unit AC 120V, 300VA	SV541	3BSE004265R1
Power Distribution Unit Change-over, AC 230V, 300VA	SV542	3BSE005001R1
Power Distribution Unit Change-over, AC 120V, 300VA	SV543	3BSE005002R1
Power Distribution Unit Main Exp. AC 250V, 35A	SX541	3BSE004254R1
Power Distribution Unit Main Aux. AC 250V, 25A	SX542	3BSE004255R1
Power Distribution Unit Main Exp. DC 60V, 50A	SX551	3BSE004259R1
Power Distribution Unit Main AC 250V, 35A	SX558	3BUR000669R1

Table 4-63. Main Supply Filter

Description	Consists of	Ordering No.
Main Power Supply Filter, 250V, 20A	---------	3BSC740007R1
Main Power Supply Filter, 250V, 55A	---------	3BSC740008R1
Main Power Supply Filter, 250V, 80A. For DC main supply, 24VDC.	---------	3BSC740009R1
Mounting Sheet for three 20A power filters	---------	3BSE016510R1
Mounting Sheet for two 55A and one 20A power filter	---------	3BSE016511R1
Mounting Sheet for two 80A and one 20A power filter	---------	3BSE016512R1

4.1.2.5 S100 I/O with AC 410

Table 4-64. S100 I/O Analog Inputs

Description	Consists of	Article No.
High Level Analog Input, 16 Ch, 12 bit, diff. input, 0 to +/-10V, 0 to +/-20mA, 250 ohm shunt, 0.1%, includes: conn. unit DSTA131, & cable DSTK150	DSAl 130K01	5730 030-UC
High Level Analog Input, 32 Ch, 12 bit, single ended, 0 to +/-10V, 0 to +/-20mA, 250 ohm 0.1% shunt, includes: conn. units (2)DSTA002, & cable DSTK152	DSAl 133K01	5730 032-BA
RTD Input 3-wire, Pt100, 31 (+1 ref.) Ch, 12 bit, -100/+320C, -200/+640C, includes: conn. unit DSTA146, & cable DSTK202	DSAl 146K01	3BSE009679R1
RTD Input 4-wire, Pt100, 14 (+2 ref.) Chs, 12/13 bit, -40/+40C, -100/+320C, -200/+640C, includes: conn. unitDSTA151, & cable DSTK160	DSAl 151K01	5730 030-UK
Thermocouple Input, 14 (+2 ref.&1 comp) Ch, 12 bit, for grounded transducers, includes: conn. unit DSTA156, & cable DSTK187	DSAl 155AK01	5730 030-UM
Thermocouple Input, 14 (+2 ref.&1 comp) Ch, 12 bit, for floating transducers, includes: conn. unit DSTA156, & cable DSTK186	DSAl 155AK02	5730 030-UL
Thermocouple Conn Unit 14 Ch, with Cold junction, 1 deg C accuracy	DSTA 155	5712 0001-KD

Table 4-65. S100 Redundant Analog Input

Description	Consists of	Article No.
Redundant Analog Input 32 Ch, 12 bit, single ended, 0 to +/-10V, 0 to +/-20mA, 250 ohm 0.05% shunt, includes: (2) conn. units DSTA002, & cable DSTK152	DSAI 133K02	5730 032-BB

Table 4-66. S100 Analog Outputs

Description	Consists of	Article No.
Analog Output, 4 Channel isolated, 12 bit, 0 to +/-10V, 0 to +/-20mA, includes: conn, unit DSTA160, & cable DSTK153	DSA0110K01	5730 030-UN
Analog Output, 8 Channel non-isolated, 12 bit, 0 to +/-10V, 0 to +/-20mA, includes: conn, unit DSTA170, & cable DSTK153	DSAO120K01	5730 030-UP

Table 4-67. S100 Analog Input/Output

Description	Consists of	Article No.
Analog I/O, 8In-8Out Chs, Single Ended, 12 bit, single ended, 0 to +/-10V, 0 to +/-20mA, 250 ohm 0.05% shunt, includes: conn. unit DSTA001, & cable DSTK153	DSAX110K01	5730 032-BC
Redundant Analog I/O, 8In-8Out Chs, Single Ended, 12 bit, single ended, 0 to +/-10V, 0 to +/-20mA, 250 ohm 0.05% shunt, includes: conn. unit DSTA001, & cables (2) DSTK153	DSAX110K02	5730 032-BD

Table 4-68. Analog Isolation Amplifier

Description	Consists of	Article No.
Analog Isolation Amp 3KVA, 1 Ch, 0 to +/-10V, 0 to +/-20mA, Accuracy: linearity 0.3%, bipolar unsymmetrical 0.5%, supply 24 VDC	DSTY 101	5712 0001-KY

Table 4-69. S100 Pulse Input

Description	Consists of	Article No.
Pulse Encoder Input, 12 bit, 10KHz, 5,12,24VDC, 5.6K ohm, includes: conn unit DSTD 150A, & cable DSTK160	DSDP150K01	5730 030-UU

Table 4-70. S100 Digital Inputs

Description	Consists of	Article No.
Digital Input, 32 Ch, 24VDC, scanning or interrupt, Includes: conn unit DSTD 150A, & cable DSTK150	DSDI110AK01	5730 032-BE
Digital Input, 4 x 8 Ch, scanning or interrupt, for conn units DSTD195, 196, 197, 198 includes cable DSTK165	DSDI110AK02	5730 032-BF
Digital Input, 4 x 8 Ch, scanning only, for conn units DSTD195, 196, 197, 198 includes cable DSTK165	DSDI 115K01	5730 030-UA
Connection Unit, 8 Channel, 24VAC/DC, galvanically isolated	DSTD 195	3BSE004724R1
Connection Unit, 8 Channel, 24VDC bias	DSTD 196	3BSE004725R1
Connection Unit, 8 Channel, 120VAC/DC, galvanically isolated	DSTD 197	3BSE004726R1
Connection Unit, 8 Channel, 230VAC, galvanically isolated	DSTD 198	3BSE004727R1
Terminal Unit for Distr. of 24VDC	DSSX 166	5347 049-CR
Voting Unit for redundant connection units using redundant power supplies (i.e. DSTD 108, DSTD 195, 196, 198). Can also be used for redundant power to short distance modems such as the TC562.	SS110	3BSE007698R1

Table 4-71. S100 Digital Outputs

Description	Consists of	Article No.
Digital Output, 4x8 Channel 24VDC for conn units DSTD108 & 108L	DSDO110K01	5730 032-CX
Termination Panel, 8 Chan.24-250VAC/DC relay, max load 44W-DC, 720VA-AC, 3Amps, min load 0.1Amp	DSTD 108	5616 0001-ABD
Termination Panel, 8 Chan. for low current loads, 24-250VAC/DC relay, max load 200mA or 5VA, min load 1mA or 0.05VA	DSTD 108L	5716 0001-ABW

Table 4-72. S100 Digital Input/Output

Description	Consists of	Article No.
Universal Digital I/O, 32 Channel, for use with I/O Conditioning Modules, Includes: (2) conn units DSTX180, & cable DSTK152	DSDX180K01	3BUR000594R1

Table 4-73. Digital I/O Conditioning Modules

Description	Consists of	Article No.
Digital I/O Conditioning Module Input 24VDC, 8.5mA	DI010	3BSC170011R1
Digital I/O Conditioning Module Output 24/48VDC, 1A	DO010	3BSC170011R2
Digital I/O Conditioning Module Input 120VAC, 10mA	DI015	3BSC170011R3
Digital I/O Conditioning Module Input 240VAC, 7A	DI020	3BSC170011R4
Digital I/O Conditioning Module Output 120VAC, 2A	DO015	3BSC170011R5
Digital I/O Conditioning Module Output 240VAC, 2A	DO020	3BSC170011R6
Digital I/O Conditioning Module Input, Dry Contact	DI012	3BSC170011R7

Table 4-74. Redundant Digital Input/Output Modules

Description	Consists of	Article No.
Universal Digital I/O, 32 Channel, for use with I/O Conditioning Modules, Includes: (2) conn units DSTX180, & (2) cable DSTK152	DSDX180K02	3BUR000595R1

NOTE

Ordering Information for S100 I/O connection to ELCON Intrinsic Safety System may be found in the *S100 I/O Technical Supplement*.

Table 4-75. S100 Mounting Bar for RM5xx Cabinet

Description	Consists of	Article No.
Terminal Carrier 24” 3S for conn. units	RA 121	3BSE005465R1
Terminal Carrier 19” 3S for conn. units	RA 120	3BSE005464R1

NOTE: Longer I/O connection cables can now be ordered. In addition to the 3m DSTK I/O connection cables, 15m and 30m lengths are available. These cables connect between the I/O module and the connection unit. The new longer length cables can be ordered from the Advant OCS Spare Parts Price List.

Table 4-76. Assembly and Test by ABB

Description	Consists of	Article No.
Assembly and test of Subrack mounted in RM5xx cabinet, price per rack, I/O, and CPU, applicable if assembled by ABB Industrial Systems AB, Sweden	---------	3BSE016033R1

4.1.2.6 MOD 6000 Direct I/O to S100 I/O Conversion Kits

Table 4-77. MOD 300 Direct I/O to S100 I/O Analog Connections

Description	Consists of	Article Number
MOD to S100 Analog Conversion Panel	TA510	3BUR980033R1
Analog I/O Board, 8 inputs/8 outputs	DSAX 110	57120001-PC
Analog Input Board, 32 inputs	DSAI 133	57120001-PS
Cable Assembly, flat 2.5m, for DSAX 110	DSTK 153	26390603-G
Cable Assembly, flat 3.0m, for DSAI 133	DSTK 152	26390603-K

Table 4-78. MOD 300 Direct I/O to S100 I/O Thermocouple Connections

Description	Consists of	Article Number
MOD to S100 Thermocouple Conversion Panel	TA511	3BUR980035R1
Analog Input Board, 32 inputs	DSAI 155A	3BSE014162R1
Cable Assembly, round/flat 3.0m, for DSAI 155A	DSTK 160	26390603-U

Table 4-79. MOD 300 Direct I/O to S100 I/O Digital Connections

Description	Consists of	Article Number
MOD to S100 Digital Conversion Panel	TA513	3BUR980034R1
Digital Input/Output Board, 32 inputs/outputs	DSDX 180	3BSE003859R1
Cable Assembly, flat 2.5m, for DSDX 180	DSTK 153	26390603-G

4.1.2.7 Packing Options

Table 4-80. RM5xx Cabinets IP21, CE Marked

Description	Consists of	Article No.
Cabinet IP21 vented, 800W x 512D x 2125H mm, Cabinet No.1, 4, 6, & 7	RM501	3BSE016045R1
Cabinet IP21 vented, 800W x 512D x 2125H mm, Cabinet No.1, 4, 6, & 7 Not CE Marked	RM531	3BSE016153R1
Cabinet IP21 with hinged frame, vented, 800W x 512D x 2125H mm, Cabinet No.2, 3, & 5	RM511	3BSE016054R1
Cabinet IP21 with hinged frame, vented, 800W x 512D x 2125H mm, Cabinet No.2, 3, & 5 Not CE Marked	RM541	3BSE016156R1
Cabinet IP21 vented, 800W x 512D x 1925H mm, Cabinet No.1, 4, 6, & 7	RM504	3BSE016048R1

Table 4-80. RM5xx Cabinets IP21, CE Marked (Continued)

Description	Consists of	Article No.
Cabinet IP21 vented, 800W x 512D x 1925H mm, Cabinet No.1, 4, 6, & 7 Not CE Marked	RM534	3BSE016154R1
Cabinet IP21 with hinged frame, vented, 800W x 512D x 1925H mm, Cabinet No.2, 3, & 5	RM514	3BSE016057R1
Cabinet IP21 with hinged frame, vented, 800W x 512D x 1925H mm, Cabinet No.2, 3, & 5 Not CE Marked	RM544	3BSE016157R1

Table 4-81. RM5xx Cabinets IP41, CE Marked

Description	Consists of	Article No.
Cabinet IP41 vented, 800W x 512D x 2125H mm, Cabinet No.1, 4, 6, & 7	RM502	3BSE016046R1
Cabinet IP41 with hinged frame, vented, 800W x 512D x 2125H mm, Cabinet No.2, 3, & 5	RM512	3BSE016055R1
Cabinet IP41 vented, 800W x 512D x 1925H mm, Cabinet No.1, 4, 6, & 7	RM505	3BSE016049R1
Cabinet IP41 with hinged frame, vented, 800W x 512D x 1925H mm, Cabinet No.2, 3, & 5	RM515	3BSE016058R1

Table 4-82. RM5xx Cabinets IP54, CE Marked

Description	Consists of	Article No.
Cabinet IP54 sealed, 800W x 512D x 2125H mm, Cabinet No.1, 4, 6, & 7	RM503	3BSE016047R1
Cabinet IP54 with hinged frame, sealed, 800W x 512D x 2125H mm, Cabinet No.2, 3, & 5	RM513	3BSE016056R1
Cabinet IP54 sealed, 800W x 512D x 1925H mm, Cabinet No.1, 4, 6, & 7	RM506	3BSE016050R1
Cabinet IP54 with hinged frame, sealed, 800W x 512D x 1925H mm, Cabinet No.2, 3, & 5	RM516	3BSE016059R1

Table 4-83. RM5xx Cabinet Accessories

Description	Consists of	Article No.
Replacement of single doors to double doors (per single cabinet)	for RM5xx	3BSE016260R1
Front Plate with customer designed text	for RM5xx	3BSE016259R1
End Panel 72 in. (1925H x 20W mm)	for RM5xx	3BSE016252R1
End Panel 84 in. (2125H x 20W mm)	for RM5xx	3BSE016253R1
Shield Plate 72 in. (1925H x 20Wmm)	for RM5xx	3BSE016255R1
Shield Plate 84 in. (2125H x 20W mm)	for RM5xx	3BSE016256R1
Locking Device cylinder	for RM5xx	3BSE016258R1
Heat Exchange with Side Panel 72 in. (1925 mm), 230VAC, Air-Air	for RM5xx	3BSE016262R1
Heat Exchange with Side Panel 72 in. (1925 mm), 120VAC, Air-Air	for RM5xx	3BSE016265R1
Heat Exchanger with Side Panel 84 in. (2125 mm), 230VAC, Air-Air	for RM5xx	3BSE016263R1
Heat Exchanger with Side Panel 84 in. (2125 mm), 120VAC, Air-Air	for RM5xx	3BSE016266R1

4.1.3 DCN to DCN Interface

The AC410A14 DCN to DCN Interface (D/D) connects a traditional MOD 300 DCN (token passing) ring to another DCN ring.

Table 4-84. Media Conversion Units

Description	Consists of	Ordering No.
DCN to DCN Interface which includes: DSRF 185 (2), PM150V08 (2), DSSR122 (2), SB171 (2), Plug-in Unit for T-Boxes (2), CS512 (4), and TC530K01 (4)	AC410A14	3BUR001860R1

4.2 Remote I/O Ordering Information

4.2.1 Taylor Remote I/O (TRIO) Ordering Information

4.2.1.1 TRIO Termination Rack 6188Y

The TRIO Termination Rack is a half depth rack used for mounting TRIO blocks and associated equipment.

Hardware Description: Half depth rack with rails and mounting hardware for 15 TRIO blocks. One door is included. Three Power On/Off switches per TRIO mounting row are optional.

Dimensions:

Without Doors or Panels:

Height- 77in (1956mm)

Width- 30in (762mm)

Depth- 15in (381mm)

With Doors or Panels:

Height- 77in (1956mm)

Width- 32in (813mm)

Depth- 16in (406mm)

Guidelines/Limits:

The maximum number of TRIO blocks per rack is 15. A Bulk Power Supply is required for 24VDC blocks or 24VDC field inputs/outputs. If power is included, a maximum of 4 rows is permitted. TRIO block types and arrangements are specified on separate worksheets.

Ordering Information:

6188YA(a)0(b)0(c)A

(a) 0- None

3- 234V, 50HZ ACPDP

7- 117V, 50/60HZ ACPDP

(b) 0- None

1- BUPS w/o Digital Term. Fan Assy.

2- BUPS w/ Digital Term. Fan Assy.

3- Digital Term. Fan Assy. only

(c) x Number of Rows (x = 1 to 5) (3 TRIO blocks/row)

(d) 0- No switches or terminal blocks

1- No switches, all terminal blocks

2- All switches, all terminal blocks

3- All switches, no terminal blocks

(e) 0- None (no cabinetry)

1- Half Depth Rack

3- Certified for CE Marking

Ordering Information for Taylor Remote I/O (TRIO) Blocks

CE Marking

All TRIO Blocks are CE Marked at delivery except for the following:

- 6246B 8 Circuit Isolated Input/Output Block
- 6200D Hand Held Monitor

Table 4-85. TRIO Ordering Information

Description	Catalog Number		
	Complete Unit	Electronic Assembly	Terminal Assembly
Analog Block (4 inputs/2 outputs)			
115V, 50/60 Hz	6230BP10710	6230BP10720	6230BP10730
24/48VDC	6230BP10810	6230BP10820	6230BP10830
Current Source Analog Block (4 inputs/2 outputs)			
115V, 50/60 Hz, 125VDC	6231BP10910	6231BP10920	6231BP10930
24/48VDC	6231BP10810	6231BP10820	6231BP10830
Current Source Analog Input Block (6 inputs, AC 400 only)			
115V, 50/60 Hz, 125VDC	6235BP10910	6235BP10920	6235BP10930
24/48VDC	6235BP10810	6235BP10820	6235BP10830
Current Source Analog Output Block (6 outputs, AC 400 only)			
115V, 50/60 Hz, 125VDC	6236BP10910	6236BP10920	6236BP10930
24/48VDC	6236BP10810	6236BP10820	6236BP10830
Thermocouple Input Block (6 inputs)			
115V, 50/60 Hz, 125VDC	6232BP10710	6232BP10720	6232BP10730
24/48VDC	6232BP10810	6232BP10820	6232BP10830
RTD Input Block (6 inputs)			

Table 4-85. TRIO Ordering Information (Continued)

Description	Catalog Number		
	Complete Unit	**Electronic Assembly**	**Terminal Assembly**
115V, 50/60 Hz, 125VDC	6233BP10910	6233BP10920	6233BP10930
24/48VDC	6233BP10810	6233BP10820	6233BP10830
8 Circuit Low Leakage Input/Output Block			
115V, 50/60 Hz	6245BP10710	6245BP10720	6245BP10730
16 Circuit Input Block			
115V, 50/60 Hz	6247BP10710	6247BP10720	6247BP10730
16 Circuit Source Input/Output Block			
24VDC	6240BP10411	6240BP10421	6240BP10431
24/48VDC	6240BP10412	6240BP10422	6240BP10432
16 Circuit Sink Input/Output Block			
24VDC	6240BP10811	6240BP10821	6240BP10831
24/48VDC	6240BP10812	6240BP10822	6240BP10832
32 Circuit Source Input/Output Block			
12/24VDC	6241BP10411	6241BP10421	6241BP10431
32 Circuit Sink Input/Output Block			
5/12/24VDC	6241BP10812	6241BP10822	6241BP10832
8 Circuit Isolated Input/Output Block			
115V 50/60HZ,125VDC (Standard diagnostics)	6246BP10810	6246BP10820	6246BP10830
115V 50/60HZ,125VDC) (Restricted output diagnostics)	6246BP10811	6246BP10821	6246BP10831
16 Circuit Relay Output Block			
115/230VAC (Normally Open)	6248BP10811	6248BP10821	6248BP10831
115/230VAC (Normally Closed)	6248BP10812	6248BP10822	6248BP10832
High Speed Counter (2 or 4 counters)			
	6234BP10910	6234BP10920	6234BP10930
Hand Held Monitor			

Table 4-85. TRIO Ordering Information (Continued)

Description	Catalog Number		
	Complete Unit	**Electronic Assembly**	**Terminal Assembly**
	6200DP10800		
Bus Switch Modules			
115VAC/125VDC	6203FP10900		
24/48VDC	6203FP10800		

Note: For TRIO accessories consult *TRIO Product Guide Supplement*.

4.2.2 S800 I/O Ordering Information

S800 I/O, including configuration guidelines, are described in detail in Chapter 3.

4.2.2.1 Communications

Table 4-86. Field Communication Interface

Description	Article Number
CI810V2 AF100 Field Communication Interface, Includes: (2) AF100 internal modems, 0.5MB FLROM, 0.5MB SRAM, 16MHz	3BSE013224R1
CI820K01 S800 Redundant Communication Interface, Includes: 2 CI820, TB815, TB806 and TK801	3BSE001625R1
Label set FCI	3BSC970089R1
Label set, item designation	3BSC970091R1

Table 4-87. Upgrade Kit for CI810 Software

Description	Article Number
Basic System Software CI810 3.5” Diskette	3BSE011736R1
CI810SW Upgrade Label Kit (20 pcs)	3BSE011318R1
TK527V030 Interface Cable, L=3m	3BSC950004R1

Table 4-88. Advant Fieldbus 100

Description	Article Number
TC501V120 Terminator, 120ohm for twisted pair	3BSC550038R2
TC501V150 Terminator, 150ohm for twisted pair	3BSC550038R3
TC505 AF100 Trunk Tap, main trunk cable tap to local trunk cable, trunk shield decoupling	3BSC840067R1
TC515V1 Repeater Modem for AF 100, twisted pair to twisted pair, 24VDC.	3BSE013243R1
AF100K03 Connection Kit, Single	3BSE006251R1

NOTE: The TC501 150ohm terminator is generally used.

4.2.2.2 S800 I/O Modules

Table 4-89. S800 I/O Modules

Description	Article Number
AI810 Analog Input 1*8ch, 0(4)-20 mA, 0-10V, 12bit, single ended, 0.2%, Rated Iso. 50V	3BSE008516R1
AI820 Analog Input 1*4ch,(+/-) 0(4)-20 mA, 0-10V, 12bit, differential, 0.2%, Rated Iso. 50V	3BSE008544R1
AI830 RTD Analog Input 1*8ch,Pt100, Ni100/120, Cu10, Rated Iso. 50V	3BSE008518R1
AI835 Thermocouple/mV Analog Input 1*8ch, Rated Iso. 50V	3BSE008520R1
AO810 Analog Output 1*8ch, 0(4)-20 mA, 0-10V, 15bit, RL max 500/1000 ohms, Rated Iso. 50V	3BSE008522R1
AO820 Analog Relay Output 4*1ch, (+/-) 0(4)-20 mA, 0-10V, 12bit, individually isolated, 500 ohm max., Rated Iso. 50V	3BSE008546R1
DI810 Digital Input 24V, 2*8ch, Rated Iso. 50V	3BSE008508R1
DI814 Digital Input 24V, 2*8ch, Rated Iso. 50V	3BUR001454R1
DI820 Digital Input 120VAC, 8*1ch, Rated Iso. 250V	3BSE008512R1
DI821 Digital Input 230VAC, 8*1ch, Rated Iso. 250V	3BSE008550R1

Table 4-89. S800 I/O Modules (Continued)

Description	Article Number
DO810 Digital Output 24V, 2*8ch, Short circuit proof, Rated Iso. 50V	3BSE008510R1
DO814 Digital Output 24V, 2*8ch, Short circuit proof, Rated Iso. 50V	3BUR001455R1
DO820 Digital Input 24-230V, 8*1ch, 3Amp AC, 42W, Rated Iso. 250V	3BSE008514R1

Table 4-90. Label Sets for I/O Modules

Description	Article Number
Label set 16ch I/O box	3BSC970087R1
Label set 8ch I/O box	3BSC970088R1
Label set 4ch I/O box	3BSC970060R3

Table 4-91. Module Termination Unit (MTU)

Description	Article Number
TU810V1 Compact MTU, 2*8 signal terminals, rated iso. 50V	3BSE013230R1
TU811V1 Compact MTU, 2*8 signal terminals, rated iso. 250V	3BSE013231R1
TU812V1 Compact MTU	3BSE013232R1
TU814V1 Compact MTU, 2*8 signal terminals, rated iso. 50V, for use with MOD 300 Direct I/O to S800 I/O conversion kit.	3BSE013233R1
TU830V1 Extended MTU, 2*16 signal terminals, rated iso. 50V	3BSE013234R1
TU831V1 Extended MTU, 2*8 signal terminals, rated iso. 250V	3BSE013235R1
TU835V1 Extended MTU, 8 fused terminals, rated iso. 50V	3BSE013236R1
TU836V1 Extended MTU, 2*4 fused terminals, rated iso. 250V	3BSE013237R1
TU837V1 Extended MTU, 8*1 isolated fused terminals, rated iso. 250V	3BSE013238R1
Label set, MTU device	3BSC970090R1

Table 4-92. Modulebus Communication Parts

Description	Article Number
TB805 Bus Outlet, modulebus extension cable adaptor 25D, female	3BSE008534R1
TB806 Bus Inlet, modulebus extension cable adaptor 25D, male	3BSE008536R1
TK801V003 Modulebus Shielded Extension Cable 25D, male/female, length 0.3m	3BSC950089R1
TK801V006 Modulebus Shielded Extension Cable 25D, male/female, length 0.6m	3BSC950089R2
TK801V012 Modulebus Shielded Extension Cable 25D, male/female, length 1.2m	3BSC950089R3
TB807 Modulebus terminator	3BSE008538R1
TB820V1 Modulebus Optical Modem, 24V,Isolation 50V	3BSE013246R1
TB810 Modulebus Optical Port	3BSE008560R1
TB811V015 Optical Cable, L= 1.5m	3BSC950107R1
TB811V050 Optical Cable, L= 5m	3BSC950107R2
TB811V150 Optical Cable, L= 15m	3BSC950107R3
TB812V015 POF Cable, simplex, L= 1.5m	3BSC950118R1
TB812V050 POF Cable, simplex, L= 5m	3BSC950118R2
TB812V150 POF Cable, simplex, L= 15m	3BSC950118R3

4.2.2.3 MOD 300 (6000) Direct I/O to S800 I/O Conversion Kits

Table 4-93. MOD 300 Direct I/O to S800 I/O Conversion Kits

Description	Article Number
TK616V030 Analog Conversion Cable, 3m	3BUR001406R3
TK616V060 Analog Conversion Cable, 6m	3BUR001406R6
TK616V090 Analog Conversion Cable, 9m	3BUR001406R9
TK616V112 Analog Conversion Cable, 12m	3BUR001406R12

Table 4-93. MOD 300 Direct I/O to S800 I/O Conversion Kits (Continued)

Description	Article Number
TK616V115 Analog Conversion Cable, 15m	3BUR001406R15
TK616V118 Analog Conversion Cable, 18m	3BUR001406R18
TK616V121 Analog Conversion Cable, 21m	3BUR001406R21
TK616V124 Analog Conversion Cable, 24m	3BUR001406R24
TK616V127 Analog Conversion Cable, 27m	3BUR001406R27
TK616V130 Analog Conversion Cable, 30m	3BUR001406R30
TK617V030 Digital Conversion Cable, 3m	3BUR001451R3
TK617V060 Digital Conversion Cable, 6m	3BUR001451R6
TK617V090 Digital Conversion Cable, 9m	3BUR001451R9
TK617V112 Digital Conversion Cable, 12m	3BUR001451R12
TK617V115 Digital Conversion Cable, 15m	3BUR001451R15
TK617V118 Digital Conversion Cable, 18m	3BUR001451R18
TK617V121 Digital Conversion Cable, 21m	3BUR001451R21
TK617V124 Digital Conversion Cable, 24m	3BUR001451R24
TK617V127 Digital Conversion Cable, 27m	3BUR001451R27
TK617V130 Digital Conversion Cable, 30m	3BUR001451R30
TK814V030 Analog/Digital Extension Cable, 3m	3BUR001508R3
TK814V060 Analog/Digital Extension Cable, 6m	3BUR001508R6
TK814V090 Analog/Digital Extension Cable, 9m	3BUR001508R9
TK814V112 Analog/Digital Extension Cable, 12m	3BUR001508R12
TK814V115 Analog/Digital Extension Cable, 15m	3BUR001508R15
TK814V118 Analog/Digital Extension Cable, 18m	3BUR001508R18
TK814V121 Analog/Digital Extension Cable, 21m	3BUR001508R21
TK814V124 Analog/Digital Extension Cable, 24m	3BUR001508R24
TK814V127 Analog/Digital Extension Cable, 27m	3BUR001508R27
TK814V130 Analog/Digital Extension Cable, 30m	3BUR001508R30
TK816 Digital Cable Kit, Connects TK617 to TU814 MTU	3BUR001542R1
TK217 Single Block Cable Kit for TU814 MTU, analog or digital	3BUR001560R1

4.2.2.4 Power Supply

Table 4-94. S800 Power Supplies

Description	Article Number
SD811 Power supply, 100-240VAC to 24VDC, 2.5A, rated iso. 250V	3BSC610022R1
SD812 Power supply, 100-240VAC to 24VDC, 5A, rated iso. 250V	3BSC610023R1

4.2.2.5 Cabinets

Table 4-95. Wall Cabinets

Description	Article Number
RE810 Wall Cabinet, 800Wx1000Hx300D mm, IP65	ITSA 382210-A
Top hat rail, 35x7.5mm, 700 mm length	ITSA 382210-13
Top hat rail, 35x7.5mm, 1200 mm length	ITSA 382210-14

4.3 Advant Station 500 Series Ordering Information

The following provides configuration guidelines and ordering information for Advant Stations. Two versions of the Advant Station 500 Series are available; AS520 and AS530.

Figure 4-1. Advant Station 520 & Advant Station 530 Configuration

Table 4-96. Advant Station Functional Compatibility

Function	Advant Station Model
Operator Workplace	AS520
Enterprise Historian Workplace	AS520, AS530

4.3.1 Operator Workplace Ordering Information

There are different types of operator workplaces each providing a set of optional functions to insure the flexibility required to support a variety of applications. While their primary function is as an operator interface, stations include additional options.

Basic Operator Workplace

This is a dedicated operator workplace with AdvaCommand that supports the basic tools for operator display creation.

AdvaBuild Display Builder, is optionally available with this station.

Operator Workplace with AdvaBuild options

This station has all the functionality of the basic operator workplace, plus it provides DCS control database creation tools and download capability. Tools are available for all three control languages (CCF, TCL & TLL).

AdvaBuild Basic Functions is required for this station. AdvaBuild Display Builder, Display Environment Builder, TCL Builder, TLL and PLC Builder are optionally available.

Operator Workplace with AdvaInform options

With all of the functionality of the basic operator workplace, this station also provides basic configuration and recording capabilities for AdvaInform functions such as historical data logging and archiving. Report creation and presentation, SPC, and PDL utilities are optional.

Note that you do not need this unit to view historical data. Display of history data is supported by any operator workplace.

AdvaBuild Display Builder is optionally available.

Operator Workplace with Batch 300 software

This station supports all of the functionality of the basic operator workplace in addition to the full implementation of batch configuration, control and management. Note that this station is not required to view batch data. Batch information is available on any operator workplace.

AdvaBuild Display Builder is optionally available with this station.

The TCL Builder is a required option for this station.

Batch 300 software must be ordered with this system.

4.3.1.1 System Unit and Software

Table 4-97. System Units

Description	Article No.
Advant Station 520/B180L operator workplace with one video output. Includes: PCX523K01	3BSE019310R1
Advant Station 520/B180L operator workplace with two video outputs. Includes: PCX524K01	3BSE019311R1
Advant Station 520/B180L operator workplace with 256 Mbytes of memory and two video outputs. Includes: PCX525K01	3BSE019312R1
ABB Adaptation for the Advant Station 520/B180L with MOD software	3BUR001763R1
Real Time Accelerator 16 MB with DCN Interface and USB port Module PU518K01	3BSE019653R1

NOTE:

1. Operator Keyboards, RTA boards and color monitors must be ordered separately.

Table 4-98. AdvaCommand Basic Functions Server Licenses, Ver1.7

Description	Article No.
AdvaCommand Basic Software License for up to 200 loops	3BUR001722R2
AdvaCommand Basic Software Incremental License for 201-400 loops	3BUR001723R1
AdvaCommand Basic Software Incremental License for 401-800 loops	3BUR001724R1
AdvaCommand Basic Software Incremental License for 801-1600 loops	3BUR001725R1
AdvaCommand Basic Software Incremental License for greater than 1600 loops	3BUR001726R1

NOTE: A loop is defined as a label that references a device or collection of up to eight FCMs. Incremental licenses are additive. (For example if you need a license for >1600 loops, you must order the Basic License for 200 loops + the Incremental 201-400 + the Incremental 401-800 + the Incremental 801-1600 + the Incremental > 1600 loops)

NOTE: Server licenses include one AdvaCommand X Workplace client.

Table 4-99. AdvaCommand X Workplace Client License

Description	Article No.
AdvaCommand X Workplace additional users license	3BUR001728R1
X-station Software License and CD ROM media	3BSE011782R2

NOTE: Up to 4 X-clients allowed. Server licenses include one AdvaCommand X Workplace client, therefore, three additional X-client licenses may be ordered. Use of remote clients requires the purchase of X-station software.

NOTE: 64 MB of Server RAM required for each X-client.Software Options

Software Options

Only one software option: AdvaBuild, AdvaInform or Batch 300 may be run on each Operator Station.

Table 4-100. AdvaBuild Options

Description	Article No.
AdvaCommand Basic Software License version 1.7 for up to 0 nodes as a standalone AdvaBuild station.	3BUR001745R1
AdvaBuild Basic Software License version 2.7 for up to 4 nodes for AdvaCommand Ver 1.7	3BUR001729R1
AdvaBuild Basic Software Incremental License for 5 to 7 nodes.	3BUR001416R1
AdvaBuild Basic Software Incremental License for 8 to 10 nodes.	3BUR001417R1
AdvaBuild Basic Software Incremental License for greater than 10 nodes.	3BUR001418R1
AdvaBuild Basic Software Additional Users License	3BUR0001475R1
AdvaBuild Display Builder version 1.9	3BUR001730R1
AdvaBuild Environment Builder version 1.7	3BUR001731R1
AdvaBuild TCL Builder	3BUR001732R1
AdvaBuild TLL Builder	3BUR001733R1
AdvaBuild PLC Builder	3BUR001734R1

NOTE: A node is defined as any connection to the DCN. Incremental licenses are additive. (For example if you need a license for >10 nodes, you must order the Basic License for 4 nodes + the Incremental 5 to 7 + the Incremental 8 to 10 + the Incremental > 10 nodes)

Table 4-101. AdvaInform Options for up to 250 points

Description	Article No.
AdvaInform History version 2.3	3BUR001737R1
AdvaInform PDL version 2.3	3BUF000095R1
AdvaInform SPC version 2.3	3BUF000101R1
AdvaInform Reports version 2.3	3BUF000107R1
AdvaInform SQL Access version 2.2	3BUR001741R1

Table 4-102. AdvaInform Options for up to 500 points

Description	Article No.
AdvaInform History version 2.3	3BUR001738R1
AdvaInform PDL version 2.3	3BUF000096R1
AdvaInform SPC version 2.3	3BUF000102R1
AdvaInform Reports version 2.3	3BUF000108R1
AdvaInform SQL Access version 2.2	3BUR001742R1

Table 4-103. AdvaInform Options for up to 1,000 points

Description	Article No.
AdvaInform History version 2.3	3BUR001739R1
AdvaInform PDL version 2.3	3BUF000097R1
AdvaInform SPC version 2.3	3BUF000103R1
AdvaInform Reports version 2.3	3BUF000109R1
AdvaInform SQL Access version 2.2	3BUR001743R1

Table 4-104. AdvaInform Options for up to 2,500 points

Description	Article No.
AdvaInform History version 2.3	3BUR001740R1
AdvaInform PDL version 2.3	3BUF000098R1
AdvaInform SPC version 2.3	3BUF000104R1
AdvaInform Reports version 2.3	3BUF000110R1
AdvaInform SQL Access version 2.2	3BUR001744R1

Table 4-105. OS Software, Batch 300 Option

Description	Article No.
Batch 300 Basic Software version 2.1	3BUR001464R1
Batch 300 Software Incremental License for 6 to 10 units, version 2.1	3BUR001465R1

Table 4-105. OS Software, Batch 300 Option (Continued)

Description	Article No.
Batch 300 Software Incremental License for 11 to 25 units, version 2.1	3BUR001466R1
Batch 300 Software Incremental License for 26 or greater units, version 2.1	3BUR001467R1

NOTES:

1. AdvaBuild Basic Functions and AdvaInform History requires an additional 2 GB external hard disk and a minimum of 96 Mbytes of total RAM. Only one additional software option: AdvaBuild, AdvaInform or Batch 300 per each operator workplace.

2. AdvaInform History must be ordered to use, AdvaInform SPC and AdvaInform PDL. AdvaInform Production Data Logger is for use with Batch 300 software.

3. When ordering the operator workplace with Batch functionality, the Batch 300 software must be ordered along with an additional 2GB hard disk drive, and AdvaBuild TCL Builder.

Table 4-106. SQL Interface Software

Description	Article No.
SQL*Net and ODBC 1.0 for Windows NT/95, single user license	3BSE011772R2
SQL*Net and ODBC 1.0 for Windows NT/95, five user license	3BSE011773R2
SQL*Net and ODBC 1.0 for Windows NT/95, twenty user license	3BSE011774R2
SQL*Net and ODBC 1.0 for Windows media	3BSE014234R2

Table 4-107. Cross Reference Utility

Description	Article No.
Cross Reference Utility kit for all versions	3BUR001900R1

Keyboards

Table 4-108. Standard HP Keyboards

Description	Consists of	Article No.
Localized Keyboard Kit with North American PS/2 keyboard, PS/2 3 button mouse, documentation	IH556ENK02	3BSE017899R1
Localized Keyboard Kit with German PS/2 keyboard, PS/2 3 button mouse, documentation	IH556DEK02	3BSE017900R1
Localized Keyboard Kit with North American HP-HIL keyboard, 3 button mouse, documentation, 2 US pwr cords	IH555ENK01	3BSE013907R1
Localized Keyboard Kit with German HP-HIL keyboard, 3 button mouse, documentation, 2 European pwr cords	IH555DEK01	3BSE013908R1

Table 4-109. Universal Keyboards

Description	Consists of	Article No.
Universal Mechanical Keyboard for English language, USB cable (5m) and AC adapter	IH532ENK01	3BSE019205R1
Universal Membrane Keyboard for English language, USB cable (5m) and AC adapter	IH542ENK01	3BSE019207R1
Universal Mechanical Keyboard for German language, USB cable (5m) and AC adapter	IH532DEK01	3BSE019206R1
Universal Membrane Keyboard for German language, USB cable (5m) and AC adapter	IH542DEK01	3BSE019208R1
Annunciator Keyboard Kit, membrane PSAP keyboard (one max per operator workplace), one power supply unit and USB cable 5m	IH572K01	3BSE019209R1
AC/DC adapter, Input: 100-240VAC / output: 12VDC 3.6A, for powering of IH512/522/532/542/572 USB keyboards. The DC cable, 1.8m (6 ft.), is permanently attached to the converter. The 2-pin DC connector fits directly into the conn. on the keyboard.	SD524	3BSC610036R1
USB cable assembly, 5m (16 ft.). For attachment of USB keyboards on the USB bus. USB type A plug in one end, type B plug in the other.	TKX517V050	3BSC950159R1

Table 4-109. Universal Keyboards (Continued)

Description	Consists of	Article No.
Bag with 25 pcs blank light beige keycaps. Size LxWxH: 18.3x18.3x9.3mm. For the IH510/511/512 and IH530/531/532 ABB mechanical keyboards	IH502V01	3BSC820045R1
Bag with 10 pcs blank dark beige keycaps. Size LxWxH: 18.3x18.3x9.3mm. For the IH510/511/512 and IH530/531/532 ABB mechanical keyboards	IH502V02	3BSC820045R2

Table 4-110. Data Key Security

Description	Consists of	Article No.
Data Key Serial Reader/Writer Unit	MX513V01	3BUC640016R1
Serial Memory Data Key	MX514	3BUC640017R1

4.3.1.2 Hardware Options

A second monitor can be connected to the AS520 and requires an additional graphics card.

Table 4-111. Monitors

Description	Consists of	Article No.
Color Monitor 17” high resolution 1280 x 1024 for Northern Hemisphere, frame rate 60/72 Hz	IM5411	3BSE017838R1
Color Monitor 19” high resolution 1280 x 1024 for Northern and Southern Hemisphere, frame rate 60/75 Hz	IM538	3BSE015076R1
Color Monitor 20” rack mount, without touchscreen resolution 1280 x 1024	IM521K05	3BUR000860R1
Color Monitor 20” rack mount, with touchscreen resolution 1280 x 1024	IM521K06	3BUR000861R1
Power Supply for IM521K06 monitor with touchscreen	IM536	3BUC610005R1
Color Monitor 21”, table top with touchscreen	IM540V1	3BUR001776R1
Color Monitor 21” high resolution 1280 x 1024 for Northern and Southern Hemisphere, frame rate 50/60/75 Hz	IM539	3BSE015077R1

Table 4-112. Monitor Cables

Description	Consists of	Article No.
Cable Kit, RGB and HP-HIL, for video and keyboard, 15m (49’) includes 3 coax cables, 1 HP-HIL cable, 2 HP-HIL modems, 1 HP-HIL kybd cable, BCN jack-jack connector	TC550K03	3BSE006083R2
Cable Kit, RGB and HP-HIL, for video and keyboard, 30m (98’) includes 3 coax cables, 1 HP-HIL cable, 2 HP-HIL modems, 1 HP-HIL kybd cable, BCN jack-jack connector	TC551K03	3BSC006084R2
Coax Cable Kit, 15m RGB and HP-HIL, for video only, BCN jack-jack connector, for monitors with attached video cables (IM532)	TC529K15	3BSE007708R1
Coax Cable Kit, 30m RGB and HP-HIL, for video only, BCN jack-jack connector, for monitors with attached video cables (IM532)	TC529K30	3BSC007709R1

Table 4-113. X-Terminals

Description	Consists of	Article No.
X-window Base Station - North America, one video output, no monitor, resolution 1280 x 1024, frame rate 60/50/72 Hz, 12 MB RAM, with PS/2 keyboard	ID518K01	3BSE013672R1
X-window Base Station - German, one video output, no monitor, resolution 1280 x 1024, frame rate 60/50/72 Hz, 12 MB RAM, with PS/2 keyboard	ID518K02	3BSE013673R1
X-station Memory 4 MB expansion for ID518	MB558	3BSC120065R1
X-station Memory 8 MB expansion for ID518	MBX515	3BSC120072R1

Table 4-114. Graphic Cards

Description	Consists of	Article No.
520 Graphics Card Kit, one graphics channel with 3M Video Cable (520 only)	IC515K01	3BSE014818R1

Table 4-115. Keyboard Accessories

Description	Consists of	Article No.
3-Button Trackball	IH580	3BSC640001R1
PSAP keyboard, SB512 pwr. sup. and TK404 pwr cable	IH570	3BSE009893R1
Upgrading Set, for mounting Operator Keyboard, Membrane, IH520EN/DE/SV behind panel	RX501	3BSE004113R1
Power Supply, required on all AS510 and AS515 to power PSAP or if on-line replacement of keyboard is required. Order 19” mounting brkt RX506 if using 6000 cabinet.	SB512	3BSE002098R1
Keyboard Audio Enhancement Kit, for IH530,IH540, and IH570 Advant keyboards	IH587K01	3BUR001145R1

Note: The IH570 PSAP needs an external power supply SB512 to power the 192 LEDs.

Communications

Table 4-116. MOD Interface

Description	Consists of	Article No.
DCN T-Box with interface cable, 3m	TC530K01	3BUR000546R1
Fiber Optic DCN T-Box with interface cable, 3m	TC532K01	3BUR000547R1
DCN Cable, 3 m (10 ft.)	TK510V030	3BUR000118R3
DCN Cable, 15m (49 feet)	TK510V115	3BUR000118R15
Advant Service Kit (North America only), with instruction book, includes: direct connect modem with modem connection cables to; Advant Station, T-box, AC460, Model B and SC Controllers, VT terminal, and Multibus processor.	TK401K01	3BUR001146R1

NOTE: 1. The DCN Cables were created to meet new EMC standard of the European community for Advant Systems. They are interchangeable with traditional DCN Cables with the following exception: the Advant Cables cannot be used on an existing system that has isolated the DCN ground. The DCN Cable is electrically different because it has a braided ground that is physically tied to the connector and cannot be isolated by the interface modules.

2. See Advant Accessories Price List for additional Advant OCS items.

Table 4-117. TCP/IP Interface

Description	Consists of	Article No.
Transceiver Set for one MB 300 LAN or GCOM comm set or TCP/IP comm set for Thicknet	MB300K01	5730 030-VN
Transceiver Adaptor for Thin Lan with BNC T 50 Ohm used on MB300K01	TX501	5217 423-24
Tool Kit for Transceiver installation for Thicknet Comm	MB300K02	5751 029-2
Cable Assembly to connect system unit to (TCP/IP) Ethernet Transceiver L= 5m	TK576V050	3BSC950055R1
Cable Assembly to connect system unit to (TCP/IP) Ethernet Transceiver L= 15m	TK576V115	3BSC950056R1
Cables and Accessories for ThickLAN		
Coaxial Cable ThickLAN(AUI) L=23.4 M (77 Feet) for MB300, GCOM or TCP/IP	COAX K8	2639 0799-A
Coaxial Cable ThickLAN(AUI) L=70.2 M (231 Feet) for MB300, GCOM or TCP/IP	COAX K9	2639 0799-C
Coaxial Cable ThickLAN(AUI) L=117.0 M (385 Feet) for MB300, GCOM or TCP/IP	COAX K10	2639 0799-E
Line Connector, ThickLAN(AUI) for MB300, GCOM, or TCP/IP	COAX K11	5217 423-19
In-line Terminator Set, ThickLAN(AUI) Type N for MB300, GCOM, or TCP/IP	COAX K12	5730- 030-HY
Cables and Accessories for ThinLAN		
Coaxial Cable ThinLAN (BNC) 50 ohm (raw cable, no connectors)	RG58 C/U	1689 0033-5
Connector ThinLAN (BNC) 50 ohm	RG58K01	5217 423-22
Terminator ThinLAN (BNC) 50 ohm	RG58K02	5217 423-23

NOTES:

1. Transceiver equipment required for connection to TCP/IP plant network if thicknet is used.

2. Coax cable K8, K9, & K10 combines for lengths up to 491.4m.

3. Maximum length for ThinLAN without repeaters is 150m. For longer distances, industrial environment, or connection to plant network use ThickLAN.

Table 4-118. Printers

Description	Consists of	Article No.
Wide (A3) alpha-numeric/graphic printer, with Epson and IBM Proprinter protocols, for 120 V AC power, with serial cable	EP539-1	3BSC630118R1
Wide (A3) alpha-numeric/graphic printer, with Epson and IBM Proprinter protocols, for 230 V AC power, with serial cable	EP540-1	3BSC630119R1
Cable Assembly, RS-232 extension cable, 15 m for printers 1925/1926/4111	TK524V115	3BSC950024R1
Short Distance Modem, for cable length 15 to 300 m, 120/230V ac, switch selectable	DSTC X008	5751 030-1
Ribbon Cable, with connectors for connection of printers to DSTC X008 modem, L =(0.5m)	DSTK156V05	2639 0638-A
HP Laser jet 8000 Printer, 120V, 50/60 Hz with 3m cable. Duplex printing option and 8 Mbyte memory can be ordered separately.	EP526K01	3BSE016941R1
HP Laser jet 8000 Printer, 230V, 50/60 Hz with 3m cable. Duplex printing option and 8 Mbyte memory can be ordered separately.	EP527K01	3BSE016943R1
Color InkJet Printer, A4/A3, with Postscript Level 2 and PCL5C protocols and 12 Mbyte RAM. ECP two-way parallel port. 10BaseT (Twisted Pair), 10Base2 (BNC), and parallel. Parallel cable incl. No RAM slot available. For 110 - 240 V AC (autoselecting).	EP510	3BSE630151R1
Laser Printer, A4, with Postscript Level 2, PCL5, and PCL6 protocols and 4 Mbyte RAM. Print speed 16 pages per minute. Parallel interface as standard. For 110-115 V AC	EP528K01	3BSE017836R1
Laser Printer, A4, with Postscript Level 2, PCL5, and PCL6 protocols and 4 Mbyte RAM. Print speed 16 pages per minute. Parallel interface as standard. For 220 - 240 V AC	EP529K01	3BSE017837R1
Cable Assembly, Centronics interface parallel, 15 M	TK541V115	3BSC950036R15
TCP/IP Interface, for printer EP526/EP527K01	CIX514	3BSC210036R1
Cable Assembly, serial printer to Advant DE9 Socket-DB25 PIN, 9 m for connection to Genicom	TK578V090	3BUR000509R9
8MB SDRAM, for printer EP526/527, EP528/529	MBX512	3BSC120068R1

Table 4-118. Printers (Continued)

Description	Consists of	Article No.
Duplex Printing Accessory, for printer EP526/EP527K01	EP502	3BSC630109R1
Duplex Printing Accessory, for printer EP528/EP529K01	EP503	3BSC630122R1

Power System

Table 4-119. Power System

Description	Consists of	Article No.
Power distribution unit for rack mounting, acc. to IEC-320 with one inlet & six outlets 250V 10A, includes six power cords	SX520K01	3BSE001691R1
UPS, 10 minutes, input 120V, output 800 VA/560W	SV530	3BSC610032R1
UPS, 10 minutes, input 230V, output 800 VA/560 W	SV531	3BSC610033R1
By-pass switch, 120V, for SV530 UPS	SX521	3BSC820051R1
By-pass switch, 230V, for SV531 UPS	SX522	3BSC820052R1
Cord Set, with molded power connector EN 60320 at both ends	TK574	3BSC950031R25
Cord Set, with IEC-320 female connector at one end, European male connector at the other	-----------	5385-430-2
Cable Assembly Power Cord from SX520 power distribution to US receptacle - 3 prong plug, 3 m	TK408V030	3BUC950012R1
Cable Assembly Power Cord from SX520 power distribution to open end wire - for hard wiring, 3 m	TK409V030	3BUC950013R1
Cable Assembly 25D to Term. Block for connection of UPS SV530/531 in relay mode, 15M	TK564V115	3BSC950114R1
Cable Assembly 25D to DE9 socket for connection of UPS SV530/531 in serial mode, 15M	TK621V115	3BSC950134R1

Table 4-120. Disk Units for AS520

Description	Consists of	Article No.
Internal disk 9 Gbyte, wide single ended UltraSCSI interface for Advant Station 520 & 530 system units	MDX512	3BSC630098R1
Redundant Disk Array (RDA) as Bootable Disk order this item if the disk array will be the root disk	__________	3BUR001240R1
Redundant Disk Array for rack mounting, enclosure includes 2 power supplies, (4) SCSI interface controls	MP551	3BUC630021R1
Mounting Kit, Redundant Disk Array for console mounting	MP551K01	3BUR001841R1
Cable assembly for RDA, 68 pin HD plug	TK501	3BUC950032R1
Disk Drive 9 Gbyte capacity, for use on MP551 Disk Array	MP553	3BUC630023R1
Disk Drive 18 Gbyte capacity, for use on MP551 Disk Array	MP554	3BUC630024R1

NOTES:

1. Redundant Disk Array MP551 include housings and associated hardware, disk drives must be ordered separately.

2. An additional hard drive is required when ordering the following optional software packages: AdvaBuild Basic Functions, AdvaInform History, and Batch 300.

Table 4-121. UltraSCSI External Disk

Description	Consists of	Article No.
Standalone Disk 9 Gbyte, wide single ended UltraSCSI interface for Advant Station 520 & 530 system units	MP550V2	3BSE016547R1

Table 4-122. Disk Tape Units

Description	Consists of	Article No.
DAT Tape Recorder, compressed 8 Gbyte, non-compressed 4 Gbyte, includes SCSI Interface SCSI cable and terminator, stand alone	MT516	3BSE016474R1
DAT Tape Recorder, compressed 24 Gbyte, non-compressed 12 Gbyte, includes SCSI Interface SCSI cable and terminator, stand alone	MT517	3BSE016475R1
Tape package with five 90M tapes, 2 Gbyte non-compressed, 4 Gbyte compressed	MT501K02	3BSE018353R1
Tape package with five 120M tapes, 4 Gbyte non-compressed, 8 Gbyte compressed	MT502K02	3BSE018354R1
Tape package with five 125M tapes, 12 Gbyte non-compressed, 24 Gbyte compressed	MT503K02	3BSE018355R1

Table 4-123. CD-ROM Units

Description	Consists of	Article No.
CD-ROM Drive internal 5.25”, 12x data transfer rate, for installation in AS520	MD529V1	3BSC630080R1
CD-ROM Drive internal 5.25”, 12x data transfer rate, for installation in AS520i	MD532	3BSC630091R1
DVD/CD-ROM Drive stand-alone, 12x data transfer rate, with cable and terminator	MD538	3BSE018862R1

Table 4-124. SCSI Cables

Description	Consists of	Article No.
Cable Assembly SCSI interface Cable 1.5 M high density to low density connector	TK543V015	3BSC950038R1
Cable Assembly SCSI interface cable 0.5 m low density connector at each end	TK548V005	3BSC950046R3
Cable Assembly SCSI interface cable 1.0 m low density connector at each end	TK548V010	3BSC950046R2

Table 4-124. SCSI Cables

Description	Consists of	Article No.
Cable Assembly SCSI interface cable 2.0 m low density connector at each end	TK548V020	3BSC950046R1
Cable Assembly SCSI interface, required for use with IC510 or CI580 Serial Expansion Units	TK583V010	3BSC950064R1
Cable Assembly SCSI interface, for single-ended 68 pin to 50 pin connector, 2m (6.5’)	TK588V020	3BSC950108R1
Terminator SCSI interface, for single-ended 68 pin used on MP538 mass storage system only	TK509	3BSC840080R1
Cable Assembly SCSI interface, for fast-wide SCSI 68 pin connectors, 2.5m (8.2’)	TK562V025	3BSC950082R1
Terminator SCSI interface, for fast-wide SCSI 68 pin	TX506	3BSC840060R1

Table 4-125. Second Level Cache RAM for AS520

Description	Consists of	Article No.
Second Level Cache 1 Mbyte (2x512KB cards)	MB555	3BSC690039R1

Table 4-126. Memory Extension for AS520

Description	Consists of	Article No.
Additional memory, 128 Mbyte ECC RAM add-on (2x64MB cards)	MBX511	3BSC690043R1
Additional memory, 256 Mbyte ECC RAM add-on (2x64MB cards)	MBX513	3BSC690048R1

Note: A minimum of 96 MB RAM is required for AdvaBuild or AdvaInform optional software

4.3.1.3 Packaging Options

Table 4-127. Packaging Options, RE5xx Series

Description	Consists of	Ordering No.
Operator table with manual adjustment	RE550	3BSC930007R1
Operator table with mechanic parallel control	RE551	3BSC930008R1
Operator table with electrical parallel control	RE552	3BSC930009R1
Extension table, pie 45 degrees	RE553	3BSC930010R1
Monitor mounting bracket	RE554	3BSC930011R1
Kneehole Cabinet	RE540	3BSC930006R1
Cover for RE540 with two fans and pwr. sup	RE501	3BSE014218R1
Cabinet, environmental protection IP21 (IEC 529)	RM557	3BSE017134R1
Flange kit for rack 19” mounting in RE540 and RM557 cabinets	RX520K01	3BSE005474R1
Power distribution in RM500 cabinets	-----------	3BSE009179R1

NOTE: The Advant Station 500 Series and its options are CE marked at delivery. The marking appears on the workstation and the cabinet if applicable.

4.3.2 Enterprise Historian Workplace Ordering Information

Refer to the *Enterprise Historian Product Guide* for ordering information.

4.4 System Documentation Ordering Information

Documentation is the key to efficient installation, operation, and maintenance of the Control System. It is the communications channel through which the user can obtain factual information about all aspects of the system.

Since large amounts of technical information are necessary to adequately support any system, ABB has developed a documentation series with the most effective mix of standard and custom documentation for each system.

System documentation consists of the Documentation Reference Set.

Documentation Reference Set

The Documentation Reference Set represents a multi-volume collection of operating, installation, and maintenance instructions plus pertinent instruction books for each different type of product in the system. These manuals are assembled into several volumes for use by operations and maintenance personnel. Instruction books such as reference manuals, software manuals, and configuration manuals are included.

The Reference Set includes coverage of ABB manufactured items as well as Original Equipment Manufacturer (OEM) instructions.

The system documentation can be ordered as; a Documentation Reference Set which contains every book for all the products available, as binders which contain all the manuals listed under a particular topic, or as individual manuals specific to each topic.

Table 4-128. Advant Documentation Reference Set

Description	Article No.
World Wide Web Access to Advant OCS Documentation for one year, single user subscription	3BUR001228R0001
World Wide Web Access to Advant OCS Documentation for one year, subscription for group of five users in one geographical location	3BUR001503R0001
Advant OCS with MOD 300 software Reference Set on CD-ROM	3BUR000805R0301
Advant OCS Reference Set	3BUR000196R1701

NOTES: Reference Set documentation contains all books for all types of stations.

The World Wide Web is a dynamic document, and it is constantly updated with the latest information.

Table 4-129. Advant OCS Individual Binders

Description	Article No.
Version 14 MOD 300 Reference Set without Multibus	3BUR000194R1001
Advant Controller and I/O manual	3BUR000682R0501
Advant Controller 460 Users Guide	3BUR000570R0301
Advant Controller 410 Users Guide	3BUR000571R0101
S800 I/O Users Guide	3BUR000873R0201
Advant Fieldbus 100 User’s Guide	3BSE000506R0601

Table 4-129. Advant OCS Individual Binders

Description	Article No.
S100 I/O Users Guide	3BUR000572R0201
Taylor Remote I/O TRIO Users Guide	3BUR000232R0301
AS500 Operator Station Basic Unit	3BUR000197R1001
OS AdvaBuild Options- Binder 1	3BUR000357R1201
OS AdvaBuild Options-Binder 2	3BUR000564R0901
OS AdvaInform Options	3BUR000853R0501
OS Batch 300 Options	3BUR000358R0601

NOTE: Binders contain all books/manuals listed under the particular topic. Individual manuals are also available through ABB, but are not listed in this Product Guide.

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