Distributed Diagnostics and Machine Control Software

(Cat. Nos. 6401-DDMC, 6403-DDMC, 6401-SDSC)

Product Data

Achieve more machine uptime and availability with easy-to-use diagnostic tools. Distributed Diagnostics and Machine Control (DDMC), with its patented SDS technology, is a system for the PLC-5 family of processors. DDMC includes re-usable application software, and provides an intelligent, windowing environment for operating, troubleshooting, and maintaining machinery. The following features help reduce startup and commissioning time.

- extensive monitoring and editing utilities
- 6200 Series-based online histogram utilities for DDMC instructions
- inherent integration and diagnostics with the servo system
- comprehensive documentation and reports, including Pareto charts of the most frequent or critical faults, which help achieve continuous improvement
DDMC is an industrial automation system that comprises programmable controllers, operator interfaces, motion control, communications, and software. The system architecture lets you configure DDMC to your manufacturing needs. DDMC is ideal in transfer lines, material handling, packaging, assembling, and other machine applications.

The system is like a high-tech detective that tells you immediately what, where, and when trouble occurs.

It is a highly flexible system in which you can use single or multiple PLC-5 processors to create either a centralized or distributed configuration. Processors communicate with each other over the Data Highway Plus™ network.

Special instructions in the PLC-5 processor include:

- Smart Directed Sequencer (SDS), for control, diagnostics, and creation of fault messages
- Diagnostic Fault Annunciator (DFA), a monitoring-only instruction for generation of fault messages

All of these provide fault detection and automatic messaging capabilities in the DDMC system. You enter SDS and DFA instructions into ladder logic in 6200 Series software.

When a fault is detected, the SDS instruction sends a message over the Data Highway Plus network to the operator interface terminal where the same software automatically assembles the appropriate diagnostic message with text from ladder logic documentation.

This diagnostic message helps reduce downtime associated with troubleshooting your equipment, because it specifies the device that caused the fault condition and the step in the sequence when and where the fault occurred. Figure 1 illustrates how DDMC uses the SDS instruction to detect a fault and how both instructions the diagnostic information packet to the operator interface for assembly.
Figure 1
DDMC System Architecture

1. PLC-5 instructions detect a fault condition in real time.

2. PLC-5 processor sends encoded message to operator interface on Data Highway Plus.

3. DDMC Application Software in the Operator Interface uses exported 6200 text files and automatically builds a message with encoded message packet.

4. Concatenated message is displayed on CRT and passed out COM 1 port to other annunciator devices.

SDS/DFA

Data Highway Plus

PLC-5

Input to PLC-5

Marquee Dataliner™

6200 Text Data Base

Diagnostic Message (Single Window)

T60
Benefits

Combine control, diagnostics, display, and information management into a single structure for easy maintainability throughout your production system. These requirements formerly demanded separate programs or logic, and in some cases separate technologies or hardware platforms. Having programs created in various languages such as ladder, C, and BASIC creates an environment that is expensive and difficult to keep current as you make changes to your equipment. The DDMC approach consolidates these functions into one structure so that you can more easily maintain your system.

Figure 2
Schematic Drawing of DDMC Implementation
Provide a single window into the control system. With an integrated DDMC system, a single platform provides a centralized window into the machine and its control system. This one window can be used for programming, commissioning, operating, and maintaining the machine.

This DOS-based man-machine interface can be used for programming DDMC system technologies such as PLC-5 processors, IMC™ motion controllers, ControlView™ and PanelView™.

**Important:** Pass-through allows programs for the servo controllers and operator interface devices, connected on the remote I/O link, to be downloaded using the same Data Highway Plus connection that is in place for the 6200 Series software.

**Minimize risk and investment with a range of diagnostic solutions.** DDMC provides instructions that can work alone with 6200 Series software or with DDMC operator interface and machine monitoring software. The powerful state-based control Smart Directed Sequencer (SDS) instruction provides a rule-based alternative to ladder logic. The Diagnostic Fault Annunciator (DFA) instruction augments traditional ladder logic by providing monitoring-only capability.

Both instructions are in the form of a Custom Application Routine (CAR) and can be downloaded into any of today’s PLC-5 family of processors without having to upgrade firmware. Once there, the CARs can be used as often as you need them.
Detect faults with a system distributed for speed, accuracy, reliability, and economics. In a DDMC system, diagnostic detection for I/O and other faults is performed within the PLC-5 processor. That means that DDMC won’t miss intermittent faults and faults due to high-speed inputs to local I/O that are overlooked by existing parasitic systems. Parasitic systems often rely on intercepting remote I/O communications and thus may not use real-time I/O information.

Because the real-time information exists inside the PLC-5, the DDMC system is a common-sense, practical approach to control and accurate diagnostics. Non-time-critical functions that could affect scan time and performance such as fault annunciation, display, and information handling are accomplished in the operator interface.

The DDMC operator interface has been designed to accommodate multiple PLC® processors over a Data Highway Plus network. This makes DDMC a wise and economical choice for assembly machines with distributed controllers, manufacturing cells, or areas with multiple PLC-5-controlled machines.

Reduce traditional software development costs and improve the quality and quantity of information with automatic message generation. With the SDS instruction, explicit messages are automatically constructed. These messages are configured by using the text imported from the ladder diagram documentation and instruction configuration. Traditionally, fault messages had to be stored individually, which meant more work and software. These canned messages were all too often incomplete and abbreviated.

Meet control and productivity requirements while using your established diagnostic techniques with a range of tools and technologies. Just as there is need for a family of control products to cover a host of applications, there is also a need for a range of diagnostics to provide optimum solutions — and that range begins with diagnostic instructions. Each SDS instruction can work by itself or in conjunction with the comprehensive operator interface software that is accessed through 6400-DDMC Machine Management Software (MMS). You can also apply the SDS instruction in a range of levels and methodologies.

Use the DFA instruction to incorporate into the system traditional diagnostics or other ladder logic-based diagnostics, or to provide a powerful monitoring and annunciating tool for constantly monitored conditions such as lube levels and motor overloads.

The SDS and DFA instructions can also provide messages that can give you guidance. Not only can the smart DDMC technology tell you what is wrong, it can also tell you what to do to correct the problem.
A DDMC system consists of the following instructions you enter through 6200 Series software:

- Smart Directed Sequencer (SDS) instruction
- Diagnostic Fault Annunciator (DFA) instruction

**SDS Instruction**

An integral part of the DDMC system is the Smart Directed Sequencer (SDS) instruction as displayed in 6200 Series software. The SDS is a state-based instruction that resides in ladder logic. The state-based instruction lets you develop control and diagnostic programs by using state logic. The SDS instruction is provided as a custom application routine (CAR) that is downloadable into the PLC-5 processor through 6200 Series software prior to instruction entry. The CAR occupies one program file and is referenced when entering an SDS instruction. Figure 4 shows the SDS instruction as it appears in 6200 Series software.

*Figure 4*
Smart Directed Sequencer Instruction Terminal Display (PLC-5 processor)

The SDS instruction works like a drum sequencer in that it controls outputs as it moves from step to step. Unlike the traditional sequencer, the SDS instruction can move to any step and does not rely on any particular sequencer order. For conditions and destinations to move from one step to another, the system depends upon several factors: transitions, timers, or equations that consist of Boolean conditions.

The SDS instruction allows two basic types of logic equations that determine the next step.
Transitional Equations
Transitional equations provide traditional state-based control, that is, a transitional equation defines the destination step based on the transition (either ON— > OFF or OFF— > ON of a desired input).

Using transition you can:

- create explicit, accurate diagnostics on individual devices
- achieve precise state-based control

Combinatorial Equations
A combinatorial equation defines the destination step based on the steady state values and the relationship between a collection of inputs. This lets you accommodate complex combinations in the instruction while keeping the number of steps within a configuration to a minimum. You can define up to 4 logical AND combinations in an 8 input SDS instruction. You can define up to 8 ANDed conditions in a 16- or 32-input SDS instruction.

Using the combinatorial feature of the SDS instruction, you can:

- replace complex ladder logic required for permissives in a state transition SDS instruction
- obtain diagnostic information on logical serial conditions (use for operator guidance)
- develop “shadow mode” diagnostics — the instruction follows what the machine is doing without controlling any outputs — it essentially monitors the ladder logic much like a maintenance person would do
SDS Instruction Templates
Each SDS instruction contains a sequence of user-defined steps that guide the logical flow of the instruction, for example, Ready, Advancing, Advanced, etc. These steps vary depending on your application. Information for each step is easily configured through a fill-in-the-blanks configuration template. This template contains fields for the following:

1. inputs and outputs (you enter actual names for control items rather than obscure addresses)
2. transitions of the inputs or equations for combined inputs
3. destination steps
4. output states
5. step timer (how long until a timeout occurs)
6. message ON or OFF

Figure 5 shows an example of the SDS instruction’s step table (Edit Step screen) with a transitional feature, a combinatorial feature, and a timer function. An SDS step timer provides these functions:

- watchdog timer
- dwell
- control outputs for a specified period
- generate overtime conditions, e.g., (WARNING: in this step too long)
Figure 5
SDS Instruction Shows Combinatorial Function

An Example of SDS Methodology
Figure 6 shows the methodology used to apply a state-based SDS instruction to a hydraulic cylinder. This involves decomposing the cylinder into mechanisms, defining inputs and outputs, and identifying steps in the sequence.
Figure 6
State-based SDS Implementation Methodology for a Hydraulic Cylinder

**SDS IMPLEMENTATION**
1. Decompose into mechanisms
2. Name mechanisms/SDS
3. Define I/O
4. Name steps
5. Define step I/O states

**Auto Message**
HYDRAULIC CYLINDER was ADVANCING when HOME LS faulted
DFA Instruction

The Diagnostic Fault Annunciator (DFA) instruction is a monitoring only instruction; that is, it monitors inputs you define, but it cannot control outputs. Valid inputs can be:

- storage points, such as binary bits
- counter/timer done bits
- outputs (real or logical)
- any valid bit address
- lube level sensors
- alarms
- fault bits set by another device (like an IMC motion controller) or by ladder logic

Figure 7 shows a DFA instruction as it appears in 6200 Series software.

Figure 7
Diagnostic Fault Annunciator Instruction Terminal Display

If you currently have diagnostics programmed in ladder logic, you can use the DFA instruction to generate messages when a fault occurs. In addition, you can create other types of operational and diagnostic messages with the DFA instruction, such as tool change messages and operating instructions.

Figure 8 shows an example of the DFA configuration template where you can define a message of up to 50 characters.
Benefits of Using DDMC Instructions

Automatic message generation saves you time and effort. You needn’t create canned messages or update stored messages for each type of fault that occurs. The software uses the names you entered into templates in 6200 Series programming software. Once these names are entered, you don’t have to enter them again in some other display device.

Configure messages that your operators understand. When you configure your instructions, you enter actual names for control items, not obscure addresses. The diagnostic messages that the software generates contain the names for the control items strung together with connector words to form a sentence. You can list the segments in any order and choose the connector words to form a sentence your operators understand.

You don’t need integration software to link fault detection to message annunciation. Most diagnostic systems today use a report generation program to activate a stored message when a fault occurs. Using our approach, messages are automatically generated through the operator interface software; therefore, a fault-detection link is not needed.
Implementing DDMC Instructions to Specific Levels

You can implement DDMC instructions at different operational levels, depending on the amount of diagnostics and control that you need for your application. Each level provides incremental increases in terms of diagnostic coupling. Choose as much of DDMC as you need for your job. If the DDMC levels were vehicles, for instance, you wouldn’t buy an 18-wheeler to move a sofa — to move three milling machines, yes!

**Figure 9**
DDMC Flexibility Levels

**Important:** A Level 3 Implementation does not limit you to only using the SDS instruction for control and diagnostics. You may also include Level 1 and Level 2 implementations for diagnostics outside of the Level 3 SDS instruction, for example, lube faults or overloads.
Table 1
Description of DDMC Levels

<table>
<thead>
<tr>
<th>This level</th>
<th>Uses this DDMC instruction</th>
<th>Control is handled by:</th>
<th>Diagnostics are handled by:</th>
<th>Message Generation is handled by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DFA</td>
<td>ladder logic</td>
<td>ladder logic</td>
<td>DFA</td>
</tr>
<tr>
<td>2</td>
<td>SDS and DFA</td>
<td>ladder logic</td>
<td>SDS</td>
<td>SDS and DFA</td>
</tr>
<tr>
<td>3</td>
<td>SDS and DFA</td>
<td>SDS and ladder logic</td>
<td>SDS</td>
<td>SDS and DFA</td>
</tr>
</tbody>
</table>

In addition to operational levels, you can implement DDMC for operator guidance messages.

DDMC Instruction Monitoring Tools

Each DDMC instruction contains displays that help you commission the control program with status screens for showing configuration, timing, sequencing, and current states of inputs and outputs. For example, the I/O monitor screen shows the status of all inputs and outputs. Figure 10 shows the I/O monitor screen for the SDS instruction.

**Figure 10**
I/O Monitor Screen, 6200 Series Software

A step history screen (Figure 11) shows the steps in the SDS instruction as they occur and the time it takes for each to occur.
Figure 11
SDS Step History Screen, 6200 Series software

An input history screen (Figure 12) shows inputs in your SDS and DFA instructions as they transition from ON to OFF, and the time it takes each input to transition. An extended status screen provides you with information from the data base in user-friendly terms.

Figure 12
SDS Input History Screen, 6200 Series software
DDMC Operator Interface Software contains several tools to help you monitor your equipment and diagnose faults. At the core of this facility is the Machine Management Software (MMS). From the MMS main menu, you can access several utilities to help you maintain and troubleshoot your system. Some of the ones you may use include:

- automatic fault logs
- report generation capabilities
- operator guidance files
- motion control device monitor
- zooming capabilities on faults
- diagnostic message configurator
- I/O point monitor
- graphic displays
- pareto analysis of faults for continuous improvements

**Automatic Fault Log**

The automatic fault log in DDMC can provide information for pareto analysis and continuous improvement. Every fault message that is generated by the messaging software is automatically recorded into a fault log (Figure 13). Each message that is sent to the log is automatically date and time stamped. The system also logs the time the fault clears so that the duration of each fault is available in raw or sorted form for analysis. Using the DDMC fault logging capabilities, you can better direct resources right at the major problems and fix those problems that are the most frequent and those that contribute the most to downtime.

![Fault Log](image-url)
Fault Log Reports

Fault log reports can be generated in the DDMC system on a scheduled or demand basis. You can configure standard formats for Borland, ControlView Report Writer, and others. Defaults are also provided. Figure 14 shows the log report format window you use to create a format for the fault log report.

Figure 14
Log Report Format Window

If the system detects an error in the servo, it generates a DDMC fault message that tells the operator where it is. The message is entered in the fault log. In addition, the DDMC software taps its database of IMC error codes and displays a screen that describes the problem and tells you how to solve it. For configuring IMC devices for a DDMC system, refer to page 19.
Here are the Pareto charts that show the TOP 10 MOST FREQUENT FAULTS and the TOP 10 LONGEST DURATION FAULTS. Such charts can give you an instant “library” of the part of your system that may need attention — and when. These charts, combined with the fault logs, enable you to spot maintenance problems before they become major interruptions.

Figure 15
Ten Most Frequent Faults

<table>
<thead>
<tr>
<th>Top 10 Most Frequent Faults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report - Sun Apr 19 00:00:00 1992 to Sun Apr 26 09:52:54 1992</td>
</tr>
<tr>
<td>PART-UNLOADER 5-A MOTOR OVERTEMP</td>
</tr>
<tr>
<td>PART-UNLOADER 5-A Timer - timed out</td>
</tr>
<tr>
<td>ROTARYINDEX MACH Timer - timed out</td>
</tr>
<tr>
<td>DRILL STATION 2 ADV'D LIMIT SWITCH</td>
</tr>
<tr>
<td>CONVEYOR MOTOR 3 FLT 1:000/11</td>
</tr>
</tbody>
</table>

Press a Function Key : F3 DN

Exit

F3

Figure 16
Ten Longest Duration Faults

<table>
<thead>
<tr>
<th>Top 10 Longest Duration Faults</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACHINE FAULT, LUBE FAULT</td>
</tr>
<tr>
<td>STA 3LH FAULT, CONTACTOR OFF</td>
</tr>
<tr>
<td>STA 3LH HP COOLANT timed out because COOLANT ON 164586PS didn’t go ON</td>
</tr>
<tr>
<td>STA 3LH HP COOLANT timed out because COOLANT ON 164586PS didn’t go ON</td>
</tr>
<tr>
<td>STA 3LH FAULT, CONTACTOR OFF</td>
</tr>
</tbody>
</table>

Press a Function Key : F3 DN

Exit

F3

19
Operator Guidance

DDMC presents an “electronic manual” in user-created text files for the system on which the operator is working. The operator can ‘punch up’ such help as REPAIR, PREVENT, and CALIBRATE. For instance, if the operator is using a Computer Numerical Control machine and needs help in analyzing a problem with a probe, he or she accesses the text file for that subject. It is a completely user-configurable utility. HELP screens encapsulate information about the machine and keep it in a central location. You design the menus, create the files, and enter the information you’ll need — precisely for your system.

Figure 17
Operator Guidance File

IMC Motion Control Device Monitor

The IMC Monitoring Utility integrates IMC 120, 121, and 123 motion controls into the DDMC package. When configured, this utility automatically monitors IMC motion controllers for faults, and produce screens that monitor I/O and monitor status. It also obtains detailed fault information that lists probable causes as well as symptoms from a database of more than 140 fault descriptions. All you need do is tell the system the location of the IMC rack, group, slot, and the processor. Refer to Figure 18 and Figure 19 for IMC screens.
Figure 18
IMC Device Configuration Screen

Figure 19
IMC Fault Information Screen
Fault Zoom

The fault zoom function lets you automatically zoom in to another screen in the event of a fault. Graphic screens can be linked to faults so that when a fault message appears, your operator can press a “fault zoom” key (you specify the placement of the key, for example, at the MMS main menu or a graphic screen) and get more detailed graphics or text associated with that fault.

Figure 20
Fault Zoom Configuration Screen

**Diagnostic Message Configurator**

The Diagnostic Message Configurator lets you specify fragments of a diagnostic message from your DDMC instructions and modify or assign your own connector words to create custom diagnostic messages to meet your syntax requirements. You can send these messages to individual marquees, to a printer, or log them in the fault log. We show an example of a diagnostic message below. Words shown in italics are those from your DDMC instruction configuration. Words shown in bold are connector words you assign to tie the fragments together.

```
DRILLSTA.2 WAS ADVANCING WHEN RETURNEDLS TURNED ON
```
With the Diagnostic Message Configurator you can configure up to ten types of messages for display. These messages are:

- zero step
- one valid exit timeout
- error
- initialization error
- input mismatch
- status
- step timeout
- warning timeout
- DFA
- IMC

Although you can configure messages for all of the types shown above, we provide defaults for each — right out of the box.

**Figure 21**  
Diagnostic Message Configurator Screen

In addition you can:

- direct messages to individual marquess in a multidrop configuration

  The system can support up to 32 multidrop devices.

- assign messages a priority level from 1 to 10
- configure a refresh message to update the marquess periodically

  These messages can display the time and date or text.

Standard marquee drivers exist for Allen-Bradley Dataliners, TCP, and UTICOR devices.
I/O Status Messages

DDMC includes a type of refresh message that lets you troubleshoot I/O by using a local marquee — instead of running back and forth to the programming terminal or relying on another operator to give you information. This I/O update message lets you specify an address and have it appear on a marquee along with its status and/or name.

This powerful tool presents an I/O status that is highly visible to help troubleshoot the machine. Figure 22 shows the screen you use to configure the point monitor. Figure 23 shows how the information you configured in Figure 22 is displayed on the message line or marquee.

Figure 22
I/O Point Monitor Message Configuration screen

Figure 23
I/O Point Monitor Message

adv 1s - On
DDMC Custom Graphics

If you have the Mouse GRAFIX® version of DDMC software (cat. no. 6403 — DDMC), you can configure graphic representations of your system. You perform configuration tasks through the Mouse GRAFIX Editor. By configuring display keys within your graphics, you can specify function keys to zoom in on areas of a larger graphic. Figure 24 and Figure 25 show examples of DDMC generated graphics.

**Figure 24**
Graphic Display of a Rotary Index Machine

![Graphic Display of a Rotary Index Machine](image)

**Figure 25**
Zoomed View of Rotary Index Machine, Station 3

![Zoomed View of Rotary Index Machine, Station 3](image)
Selecting a DDMC System

You can purchase one of four DDMC system packages for your application. Refer to Table 2 to select the system that works best for you.

**Table 2**

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Description</th>
<th>With this package, you get:</th>
</tr>
</thead>
<tbody>
<tr>
<td>6401-SDSC</td>
<td>DDMC PLC-5 Diagnostic Instructions</td>
<td>A disk containing:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ SDS CAR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ DFA CAR</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Important:</strong> Once installed in a processor and configured with 6200 Series software, you may disconnect the programming terminal and the instruction will work independently. However, the CAR file must reside on the hard disk of any programming terminal on which you want to monitor or edit the instruction configuration. If it is not, you can only view the instruction block.</td>
</tr>
<tr>
<td>6401-DDMC</td>
<td>DDMC Operator Interface Software and Machine Management Software</td>
<td>6401-SDSC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Automatic Diagnostic Message Interpreter and Constructor for SDS, IMC, DFA, and multiple message types</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Diagnostic Message Configurator for editing text, format, display, priority, style, display destination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ 6200 Database Import Utility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ IMC Monitoring Utility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Selectable marquee drivers for TCP, UTICOR, Allen-Bradley Dataliner</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Maintenance Diary Utility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Weekly Fault Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Fault Report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Context Sensitive Help</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ ControlView Core</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ ControlView A-B Drivers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Fault Zoom</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Important:</strong> 6401-DDMC will display graphics already developed as is intended to ship with the machine.</td>
</tr>
<tr>
<td>6402-DDMC</td>
<td>DDMC Operator Interface Software and Machine Management Software</td>
<td>Same as 6401-DDMC except that it is limited to 300 graphic tags for systems that require title graphics.</td>
</tr>
<tr>
<td>6403-DDMC</td>
<td>DDMC Operator Interface Software and Machine Management Software w/ Graphics</td>
<td>Same as 6401-DDMC plus:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ControlView Mouse GRAFIX Editor</td>
</tr>
</tbody>
</table>

**Important:** All of the above packages are compatible with PLC-5 programming software Release 4.2 and greater and PLC-5/250 programming software Release 4.1 or greater (not included).
To run 6200 Series software and utilize DDMC software, your programming terminal must have the following system hardware:

**Table 3**

**Required System Hardware for 6200 Series Software**

<table>
<thead>
<tr>
<th>Computer Hardware</th>
<th>10 Mbyte hard disk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RAM: 640K PLC-5 4 Mbyte expanded</td>
</tr>
<tr>
<td></td>
<td>floppy disk drive 3 1/2”</td>
</tr>
<tr>
<td></td>
<td>math coprocessor</td>
</tr>
<tr>
<td></td>
<td>monochrome or color monitor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programming Terminal</th>
<th>T35</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T50</td>
</tr>
<tr>
<td></td>
<td>T45</td>
</tr>
<tr>
<td></td>
<td>T47</td>
</tr>
<tr>
<td></td>
<td>T60</td>
</tr>
<tr>
<td></td>
<td>6121</td>
</tr>
<tr>
<td></td>
<td>6123</td>
</tr>
<tr>
<td></td>
<td>6124</td>
</tr>
</tbody>
</table>

Microchannel machines require a 1784-KT2 Series B or COM 1 to 1770-KF2 Series B or 1785-KE

<table>
<thead>
<tr>
<th>Operating System</th>
<th>MS-DOS™ 3.3 or 4.0X</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Limited testing of PLC-5 programming software release 4.2 has been done using DOS 5.0 on 6160-T60 and 1784-KT programming terminals.</td>
</tr>
<tr>
<td></td>
<td>A-B DOS 3.2X (1784-T50 or 1784-T45), 4.01 (1784-T47)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication Hardware</th>
<th>Use the following processor communication interface module 1784-KT</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Optional</th>
<th>parallel or serial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80 or 132, or 255 columns</td>
</tr>
</tbody>
</table>

| Marquee                                | DL10, DL50 Dataliner Displays; 80 character RS-232 or RS-422 (converter is required) |
Support Services

At Allen-Bradley, customer service means experienced representatives at Customer Support Centers in key cities throughout the world for sales service and support. Our value-added services include:

Technical Support

- SupportPlus programs
- telephone support and 24-hour emergency hotline
- software and documentation updates
- technical subscription services

Engineering and Field Services

- application engineering assistance
- integration and start-up assistance
- field service
- maintenance support

Technical Training

- lecture and lab courses
- self-paced computer and video-based training
- job aids and workstations
- training needs analysis

Repair and Exchange Services

- your only “authorized” source
- current revisions and enhancements
- worldwide exchange inventory
- local support

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MS-DOS is a trademark of Microsoft
As a subsidiary of Rockwell International, one of the world’s largest technology companies — Allen-Bradley meets today’s challenges of industrial automation with over 85 years of practical plant-floor experience. More than 11,000 employees throughout the world design, manufacture and apply a wide range of control and automation products and supporting services to help our customers continuously improve quality, productivity and time to market. These products and services not only control individual machines but integrate the manufacturing process, while providing access to vital plant floor data that can be used to support decision-making throughout the enterprise.