GE Fanuc Automation

Programmable Control Products

GE Fanuc Micro PLC User's Guide

GFK-0803B *April 1994*

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

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Preface

This book describes the GE Fanuc Micro PLC. It contains product specifications, installation instructions, and general information needed to set up and use a Micro PLC.

Content of this Manual

Chapter 1. Introduction: begins with a discussion of PLC basics. Chapter 1 also describes the Micro PLC and its programming devices, and provides an overview of the programming features of the Micro PLC.

Chapter 2. The Micro PLC: describes the available types of Micro PLC units, and lists product specifications.

Chapter 3. Installation: explains how to situate and install the Micro PLC, and how to connect I/O devices to the Micro PLC.

Chapter 4. The Hand-held Programmer: describes the Hand-held Programmer and explains how to use it for monitoring and changing data, transferring programs, and changing the operating mode of the Micro PLC.

Chapter 5. The Operator Interface Unit: describes the OIU and explains how to use and program it.

Chapter 7. The Programming Software: explains how to install the programming software. Chapter 6 also describes how to use the software for monitoring and changing data, transferring programs, and changing the operating mode of the Micro PLC.

Appendix A. Cable Pin Assignments: shows pinouts for the cables used with a Micro PLC.

Appendix B. Using a Modem: describes modem setup and cabling.

Appendix C. Using EPROMs or Battery-backed RAM: describes the charging and discharging characteristics of the program storage memory unit provided with some previous versions of the Micro PLC CPU. Appendix C also describes the EPROM Programmer, which can be used with optional EPROMS for program storage and transfer.

Appendix D. Related Products: introduces some products, made by other companies, that can be used to enhance a Micro PLC application.

Related Publications

GE Fanuc Micro PLC Programming Manual (GFK-0804): this book is the reference guide to programming the Micro PLC. Instructions are given for programming with the programming software or with a Hand-held Programmer.

GE Fanuc Micro PLC Self-Teach Manual (GFK–0811): a quick-start guide to understanding and using the Micro PLC.

Technical Assistance

At GE Fanuc, we strive to produce quality documentation. If you should have a problem installing or programming your GE Fanuc Micro PLC, and the information you need is not in this book or the *Micro PLC Programmer's Guide*, you can call GE Fanuc Field Service at 1-800-828-5747.

Jeanne L. Grimsby
Senior Technical Writer

Note

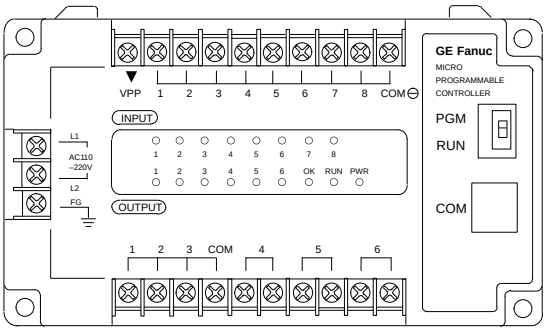
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Chapter 1 Introduction

This chapter explains PLC basics, and introduces the GE Fanuc Micro PLC programmable controller.

- PLC Basics
  - Parts of a PLC
  - PLC Operation
  - PLC Inputs and Outputs
  - PLC Memory
- The GE Fanuc Micro PLC
- Micro PLC CPU and Expander Unit
  - The CPU Unit
  - Expander Units
- Programming and Monitoring Devices
  - Connections between Devices
  - Program Storage in the Micro PLC
- Programming for the Micro PLC
  - Program Format
  - Programming Information
- Monitoring the System
- Ordering Information
- Product Compatibility
- Related Products

PLC Basics



A PLC (programmable controller) is a very specialized type of computer. PLCs come in many sizes and shapes, but they share these characteristics:

□ **They are "ruggedized".**	PLCs are used in factories and other demanding locations.
□ **They are permanently installed.**	PLCs are designed to be mounted on a panel or rack, or installed in a protective box called an enclosure.
□ **They monitor and control other devices and processes.**	Their primary job is to receive electrical signals from input devices, to make decisions based on those signals, and then to send electrical signals to output devices.
□ **After being programmed, they operate "automatically".**	During normal operation, a PLC repeats the same application program many times per second. It operates continuously, performing the same activities over and over again.
□ **Most don't have built–in operator interface devices.**	Because a PLC's main job is communicating with other equipment, an integral keyboard and display screen often aren't necessary.

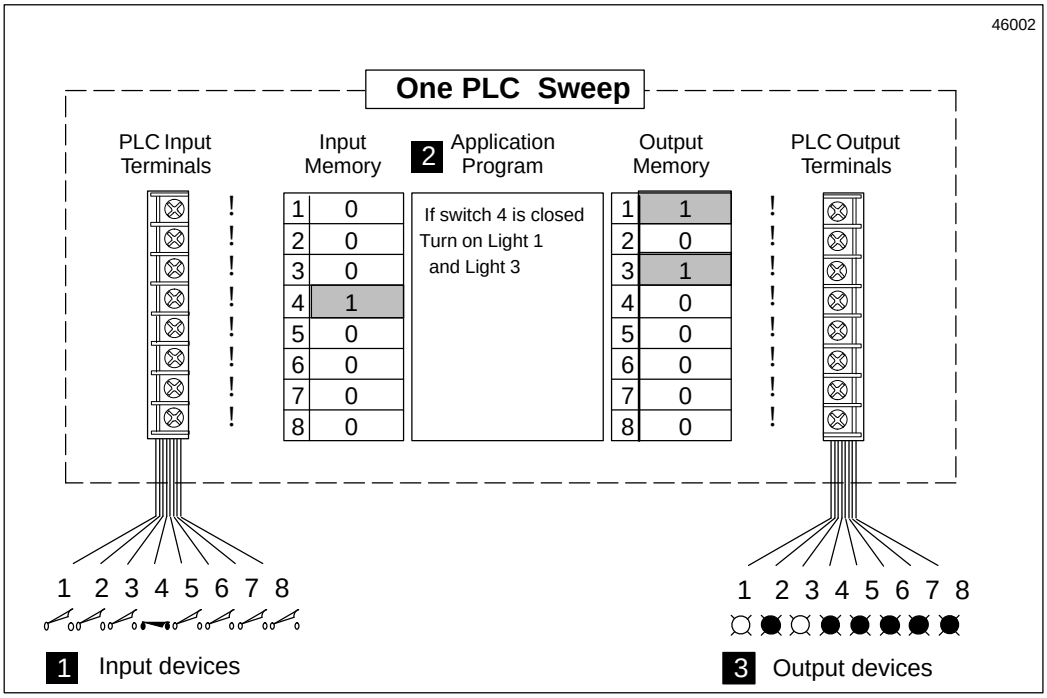
Parts of a PLC

A typical PLC has:

- □ A power supply that converts incoming line power to the DC voltage needed to operate the PLC.
- □ A CPU (central processing unit).
- □ Input and output circuits.
- □ Screw–down terminals for connecting wires from input and output devices to the PLC.

PLC Operation

After being programmed, a programmable controller repeatedly performs a cycle of automatic operations called a “PLC sweep”:



Three basic things happen during a typical PLC sweep:

1. **The PLC receives signals from input devices**.

   - □ New inputs are received at the PLC input terminals.
   - □ Each input signal is associated with a specific location in the PLC’s memory.

   In the example above, there are eight inputs from switches. They are associated with locations 1 – 8 in input memory. When Switch 4 is closed, the content of its memory location is changed to 1.

2. **The PLC executes its application program**.

   - □ It looks at the input data, and may change data in output memory as a result.

   In the example, when the application program detects that Switch 4 is closed (1), it places a 1 in output memory locations 1 and 3.

3. **It sends signals to output devices**.

   - □ Each output signal is also associated with a specific location in PLC memory.
   - □ Outputs are sent from the PLC output terminals.

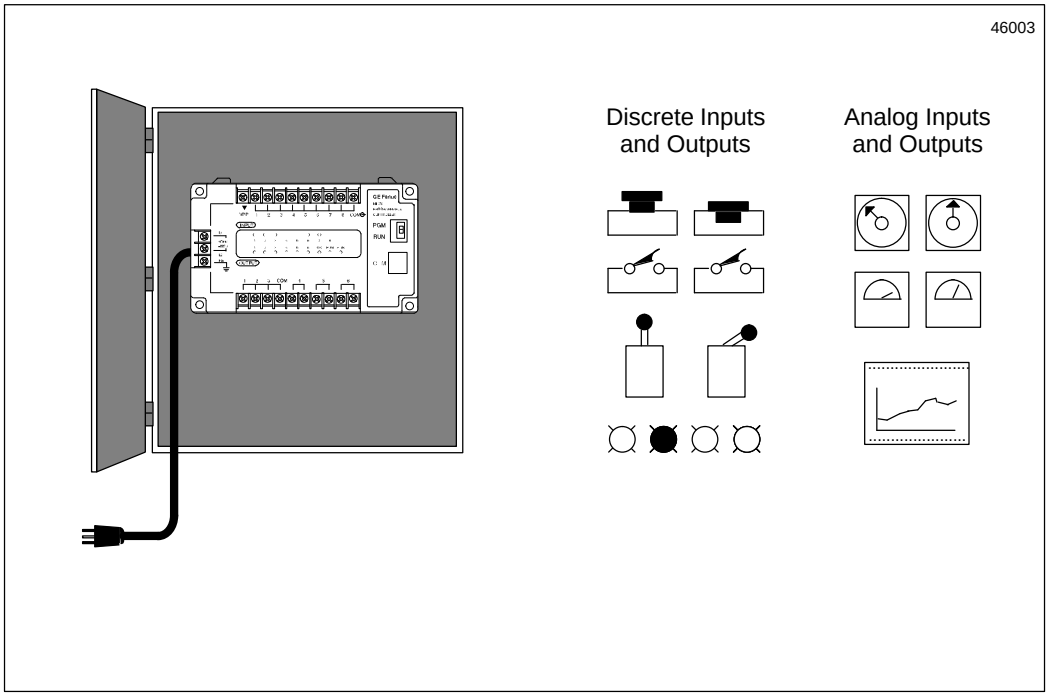
   When Light 1 and Light 3 receive the new data from the PLC, they go on.

PLC Inputs and Outputs

The input and output devices connected to the programmable controller can be on / off devices such as various types of switches, solenoids, pushbuttons, and indicator lights. These are referred to as “discrete” devices. In addition, a suitably–equipped PLC can also receive and / or send information about “analog” data such as temperature measurements, speeds, or electrical currents. Typical types of input and output devices include:

Discrete Inputs	Discrete Outputs
□ Switches	□ Relays
□ Pushbuttons	□ Motorstarters
□ Circuitbreakers	□ Lights
□ Electriceyes	□ Solenoids
□ Contacts	□ Alarms
□ Thumbwheels	□ Valves
Analog Inputs	**Analog Outputs**
□ Potentiometers	□ Motordrives
□ Temperature,flow, humidity, and other transducers	□ Analogvalves
	□ Meters
	□ Actuators
	□ Chartrecorders
	□ Pressuretransducers

The PLC is usually located in an enclosure or other protected place, while the input and output devices are located elsewhere.



PLC Memory

The PLC stores its program data and I/O data in memory. Memory for input and output data is divided into separate areas for discrete and register data. For discrete data, each bit must be accessible to the PLC, so each bit is assigned an "address". For register data, addresses are assigned to groups of 16 bits.

- **Discrete Data**

  Discrete data is data that can be either on (1) or off (0). Examples of discrete input devices are pushbuttons and switches. Indicator lamps and alarm bells are discrete output devices.

  Discrete data is stored in bit memory as represented at right. The illustration shows a 160 individually-addressed bits, with address 1 in the upper left and address 160 in the lower right.

  There are three types of discrete data memory in the Micro PLC:

  - □ **Discrete inputs (I)**
  - □ **Discrete outputs (O)**
  - □ **Internal coils (C)** these discrete memory locations are used in the application program only; they do not correspond to actual devices.

addresses

1	2	3	4	5	6	7	8	...							
0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0
0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0
1	1	1	1	0	0	0	1	1	0	0	1	0	0	0	0
1	1	0	0	0	0	0	1	1	1	0	0	1	0	1	0
0	1	0	1	0	0	0	1	0	1	0	1	0	0	0	0
1	1	0	0	0	0	0	1	1	1	0	0	1	0	1	0
1	1	0	1	0	0	0	1	1	1	0	1	0	0	0	0
1	1	0	0	0	0	0	1	1	0	1	1	1	0	1	1
1	0	0	1	0	0	0	1	1	0	1	1	1	0	0	1
0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	1

... 160

- **Register Data**

  Register memory is represented at right. The illustration shows ten addresses. Each has 16 bits that together contain one value.

  The PLC cannot access individual bits in this area of memory.

  There are three types of register data memory in the Micro PLC:

  - □ **Input Registers (IR)**, used for analog inputs
  - □ **Output Registers (OR)**, used for analog outputs
  - □ **Registers (R)** these memory locations are used in the application program only; they do not correspond to actual devices.

addresses

1	12467
2	12004
3	231
4	359
5	14
6	882
7	24
8	771
9	735
10	0000

The GE Fanuc Micro PLC

The GE Fanuc Micro PLC is a low-cost, easy-to-use, easy-to-install programmable controller with powerful programming features.

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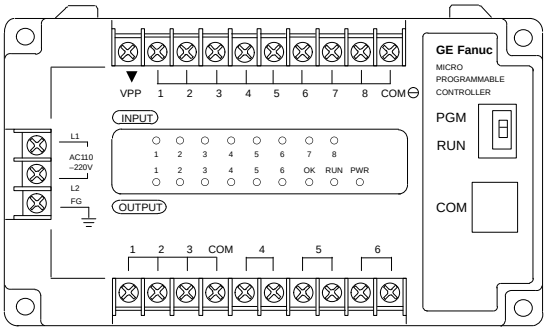

The portability and versatility of the GE Fanuc Micro PLC make it the ideal controller for a wide range of applications such as:

- vending machines
- security systems
- farm machinery
- knitting and sewing machines
- elevators
- commercial washing machines
- printing machines

The Micro PLC is small and light in weight. It can be mounted on a 35mm DIN rail or directly on a vertical panel.

Overview

The Micro PLC family of products includes a range of modules to suit many application needs.

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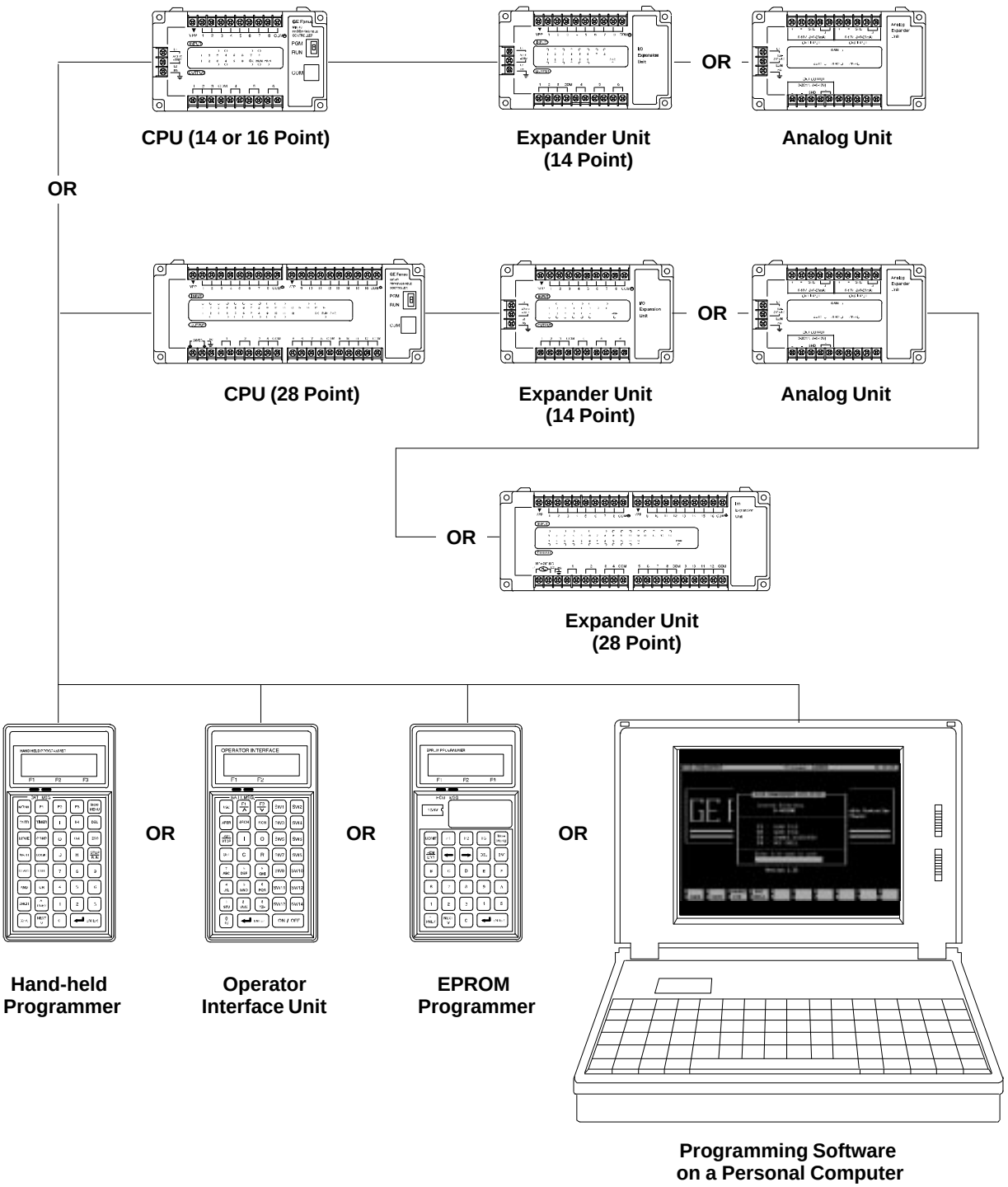

Micro PLC CPU and Expander Unit

A Micro PLC consists of a CPU and I/O unit with or without an Expander unit (I/O only).

An Expander unit can be installed up to approximately one meter from the CPU unit (using an optional one-meter cable).

The CPU Unit

The CPU unit executes the application program. The CPU unit illustrated below has 8 DC inputs and 6 relay outputs. Other types are also available.

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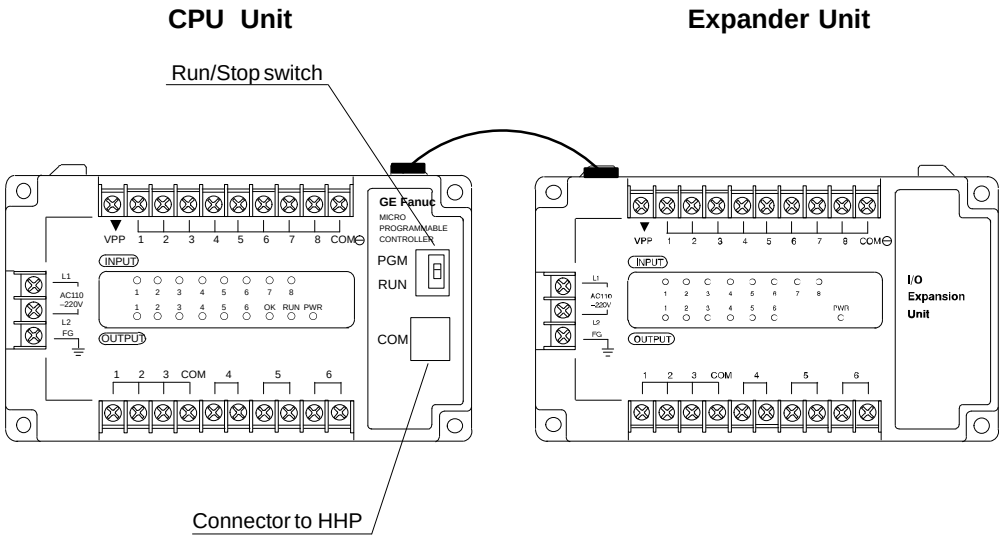

The CPU Unit has a Run / Stop mode selection switch. The PLC operating mode can also be controlled from a Hand-held Programmer or from a computer running the programming software.

The CPU unit also has an RS-232 compatible port equipped with an easy-to-use telephone style connector. This port is used for communications between the Micro PLC and a programming or monitoring device.

Expander Units

Expander units provide extra I/O capacity if needed for an application. Several types of discrete and analog expander units are available.

Programming and Monitoring Devices

System programming and monitoring can be done using a personal computer or Hand-held Programmer. An Operator Interface Unit and EPROM Programmer are also available.

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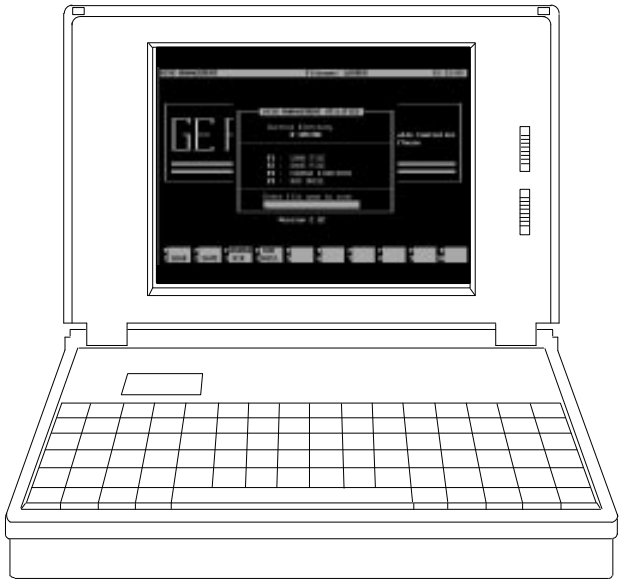
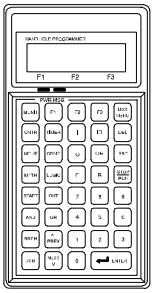
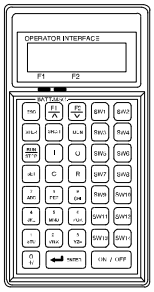


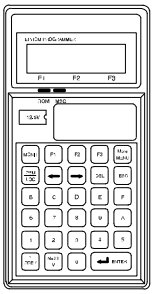
Computer with Programming Software



Hand-held Programmer



Operator Interface Unit



EPROM Programmer

Computer

The programming software for the Micro PLC runs on an IBM PC or equivalent computer. It runs under DOS. Use of a hard disk is strongly preferred, but not required.

The programming software provides ladder logic programming and configurable operator interface displays.

In addition to programming, the programming software can be used for I/O and register monitoring, I/O overrides, PLC mode changes, and online debugging.

Hand-held Programmer

The Hand-held Programmer can be used for statement list programming, I/O and register monitoring, I/O overrides, and PLC mode changes. It can be used online to the PLC, or offline (for program development).

Operator Interface Unit

The Operator Interface Unit can be used for I/O and register monitoring with user messages, I/O overrides, and PLC mode changes. It can display a PLC program, but it cannot create or edit a program.

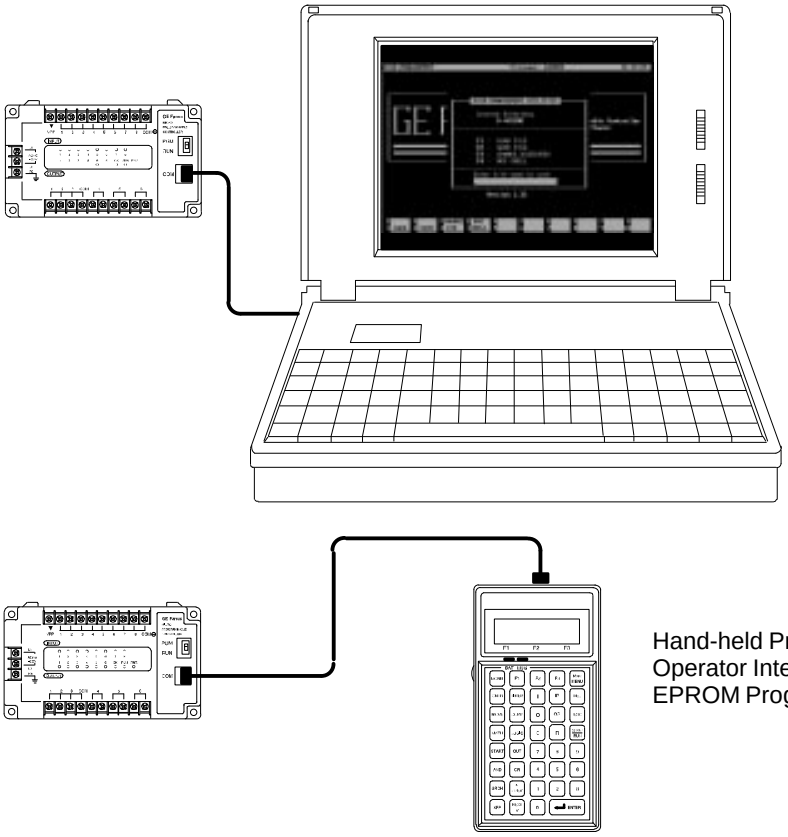
The Operator Interface Unit features 14 programmable software keys that can be set up to display messages about selected data items. During system operation, these keys can be used to easily display and change the 14 chosen data items.

EPROM Programmer

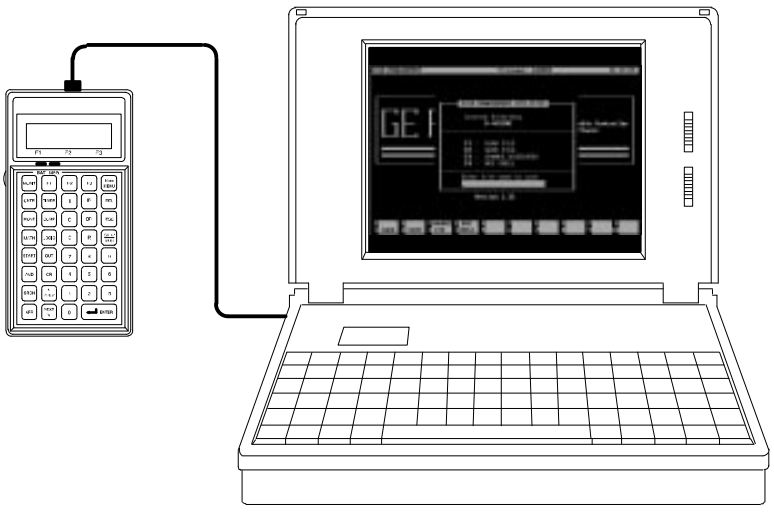
In some applications, EPROMs are used for program distribution or offline storage. The EPROM Programmer can be used to transfer a completed program from a Micro PLC, Hand-held Programmer, or computer, and write it to an EPROM which can optionally be installed in the CPU unit.

Connections between Devices

A personal computer, Hand-held Programmer, Operator Interface Unit, or EPROM Progammer can be connected directly to the Micro PLC for programming, program transfer, or online system monitoring.



In addition, a Hand-held Programmer can be connected to the computer for program transfer.



Programming for the Micro PLC

The GE Fanuc Micro PLC provides a wide variety of program instructions.

The instruction set includes both basic relay-replacement contacts and many advanced program functions:

- Contacts
  - Normally-open Contact
  - Normally-closed Contact
  - Positive Transition Contact
  - Negative Transition Contact
- Outputs
  - Output coil
  - Set coil
  - Reset coil
  - Master Control Relay
  - Skip / Jump
- Timers
  - On Timer
  - Off Timer
- Counters
  - Up Counter
  - Down Counter
- Math functions
  - Addition
  - Subtraction
  - Multiplication
  - Division
- Move functions
  - Move
  - Block Move
  - Indirect Move
- Comparison functions
  - Equal
  - Not Equal
  - Greater Than
  - Less Than
  - Greater Than or Equal to
  - Less Than or Equal to
- Logical operation functions
  - AND
  - Inclusive OR
  - Exclusive OR
  - Shift Right
  - Shift Left
  - Not

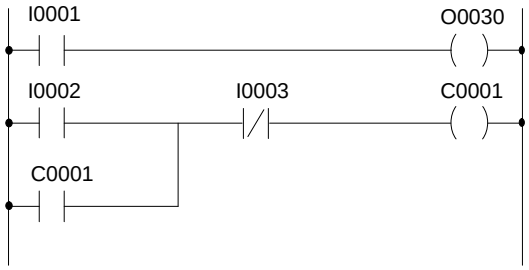
Program Storage in the Micro PLC

An application program created on a Hand-held Programmer or computer is transferred to the Micro PLC, where it is stored in EEPROM memory.

For some older CPU versions, the program is stored in either RAM or or EPROM memory. See Appendix D for more information about program transfer and storage with these older units.

Program Format

Programs created with the programming software are in traditional ladder logic format:



Equivalent programs are easily created on the Hand-held Programmer. For example:

Key Operations	HHP Displays
START I 1 ENTER	STA I001 Empty location
OUT O 3 0 ENTER	OUT O030 Empty location
START I 2 ENTER	STA I002 Empty location
OR C 1 ENTER	OR C0001 Empty location
AND F3 I 3 ENTER	AND NOT I003 Empty location
OUT C 1 ENTER	OUT C0001 Empty location

Programming Information

Explanations of all the functions in the Micro PLC instruction set and complete programming instructions are located in your *Micro PLC Programming Guide* (GFK-0804).

Monitoring the System

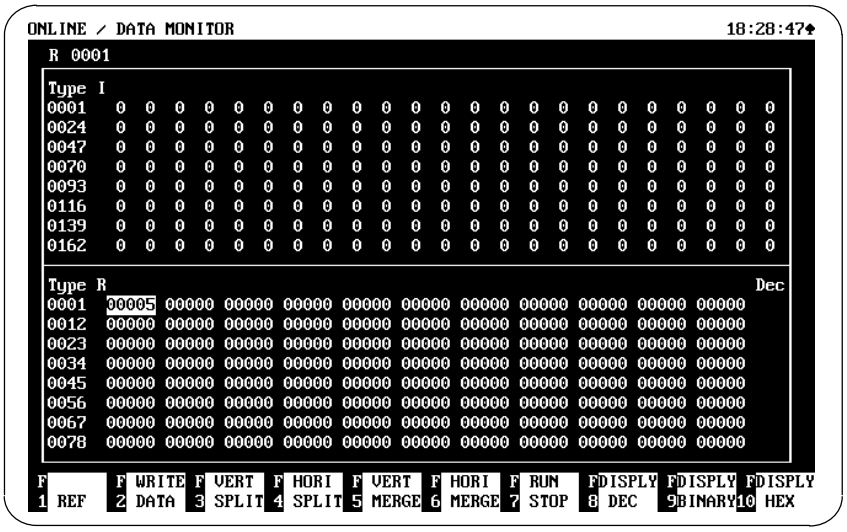
In addition to programming, all of the following operations can be performed using either a Hand-held Programmer or the Micro PLC software:

- Monitoring discrete data in the PLC
- Monitoring register data in the PLC
- Forcing discrete inputs and outputs
- Forcing internal relays
- Modifying register data

For example, monitoring discrete data on the Hand-held Programmer:

Key Operations	HHP Displays
I/O enter number ENTER The operand may be an I, O, IR, OR, C, or R address.	MONITOR I1 Empty Location
I 1 ENTER This example selects input (I) 1. The HHP displays 8 bits of data: I001 to I008	I001 □□□□□□□□R MODIFY FON FOFF
O 1 5 ENTER This example selects output (O) 15. The HHP displays 8 bits of data: O015 to O022	O015 □□□□□□□□R MODIFY FON FOFF

Or using the Micro PLC software:



Discrete or register data is easily displayed, changed, and monitored using either method.

Ordering Information

Product	Order Number
CPU units:	
14 Pts, 8 DC In / 6 Relay Out, (5A) 85–265 VAC Power	IC620MDR014
14 Pts, 8 DC In / 6 Relay Out, 24 VDC Power	IC620MDR114
14 Pts, 8 ACIn / 6AC Out, 85–265 VAC Power	IC620MAA014
16 Pts, 8 DC In / 8 Transistor Out, DC Power	IC620MDD116
28 Pts, 16 DC In / 12 Relay Out, 85-265 VAC Power	IC620MDR028
28 Pts, 16 DC In / 12 Relay Out, 24 VDC Power	IC620MDR128
Expander Units:	
14 Pts, 8 DC In / 6 Relay Out, (5A), 85 – 265 VAC Power	IC620EDR014
14 Pts, 8 ACIn / 6AC Out, 90 – 260 VAC Power	IC620EAA014
28 Pts, 16 DC In / 12 Relay Out, 85-265 VAC Power	IC620EDR028
28 Pts, 16 DC In / 12 Relay Out, DC Power	IC620EDR128
Analog Expander, 2 Analog In / 1 Analog Out	IC620ALG021
Each Expander Unit is shipped with one 70mm (2.7in) Expander Unit Ribbon Cable (this cable permits units to be installed up to approximately 40 mm (1.6 in) apart).	
User Manuals with free Programming Software for PC computer.	IC641SWP020
Hand-held Programmer with programming cable (CBL001)	IC620HHP001
Operator Interface Unit	IC620ACC003
EPROM Programmer (used only with some CPU versions)	IC620ACC001
Set of 4 blank EPROMS, UV erasable	IC620ACC004
Cables:	
meter (19 inch) Expander Unit Ribbon Cable	IC620CBL003
1 meter (39 inch) Expander Unit Ribbon Cable	IC620CBL004
HHP, EPROM Programmer or computer to Micro PLC (includes 9 / 25 pin adapter)	IC620CBL001
HHP or EPROM Programmer to computer, or HHP to EPROM Programmer	IC620CBL002
Starter kit #1: One CPU Unit One Hand-held Programmer One Programming Software diskette (3”) with User Manuals One Programming Cable (includes 9 / 25 pin adapter) Registration Form	IC620MSC001
Starter kit #2: One CPU Unit One Programming Software diskette (3”) with User Manuals One Programming Cable (includes 9 / 25 pin adapter) Registration Form	IC620MSC002
RS-232 to PLC Converter (not usually required)	IC620ACC002

Product Compatibility

The table below shows which Micro PLC products can be used together.

	Software version		Hand-held Programmer version		EPROM Programmer version		14-point Expander Unit version		Analog Expander Unit version	OIU version
	2.35	**2.37/ 2.42**	**001A**	**001B**	**001A**	**001B**	**014A**	**014B**	**021A**	**001A**
CPU Unit, 14-pt, AC										
IC620MDR014A	yes	yes	yes	yes	yes	yes	yes	yes	no	yes
IC620MDR014B	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
IC620MDR014C	no	yes	yes	yes	n/a	n/a	yes	yes	yes	yes
CPU Unit, 14-pt, DC										
IC620MDR114A	yes	yes	yes	yes	yes	yes	yes	yes	no	yes
IC620MDR114B	yes	yes	yes	eys	yes	yes	yes	yes	yes	yes
IC620MDR114C	no	yes	yes	eys	n/a	n/a	yes	yes	yes	yes
CPU Unit. 28-pt, AC										
IC620MDR028**A**	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
IC620MDR028B	no	yes	yes	yes	n/a	n/a	yes	yes	yes	yes
CPU Unit, 28-pt, DC										
IC620MDR128A	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
IC620MDR128B	no	yes	yes	yes	n/a	n/a	yes	yes	yes	yes
CPU Unit, 14-pt, 8 AC In/8 AC Out										
IC620MAA014A	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hand-held Programmer										
IC620HHP001A	yes	yes	n/a	n/a	yes	yes	n/a	n/a	n/a	n/a
IC620HHP001B	yes	yes	n/a	n/a	yes	yes	n/a	n/a	n/a	n/a
EPROM Programmer										
IC620ACC001A	yes	yes	yes	yes	n/a	n/a	n/a	n./a	n/a	n/a
IC620ACC001B	yes	yes	yes	yes	n/a	n.a	n/a	n/a	n/a	n/a

n/a= not applicable

Related Products

Data Access Unit

The Data Access Unit is a panel-mountable, NEMA 4–12 operator interface for a Micro PLC. It displays I/O data, which can be forced and modified using the sealed function keys. No programming is required; the unit is ready to use. The Micro PLC communicates with a Data Access Unit via the COM port.

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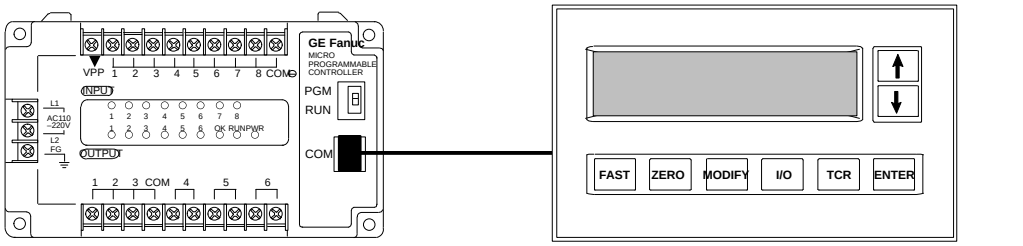

See Appendix D of this manual for more information about this product.

The Micro PLC must be set up to use RTU protocol.

Micro PLC Net

Micro PLC Net is a product that provides point-to-point connection on a multidrop link between Micro PLCs and an application running on a PC–AT computer. The Micro PLC Net product consists of hardware modules to connect each device to the network, and software that establishes communications.

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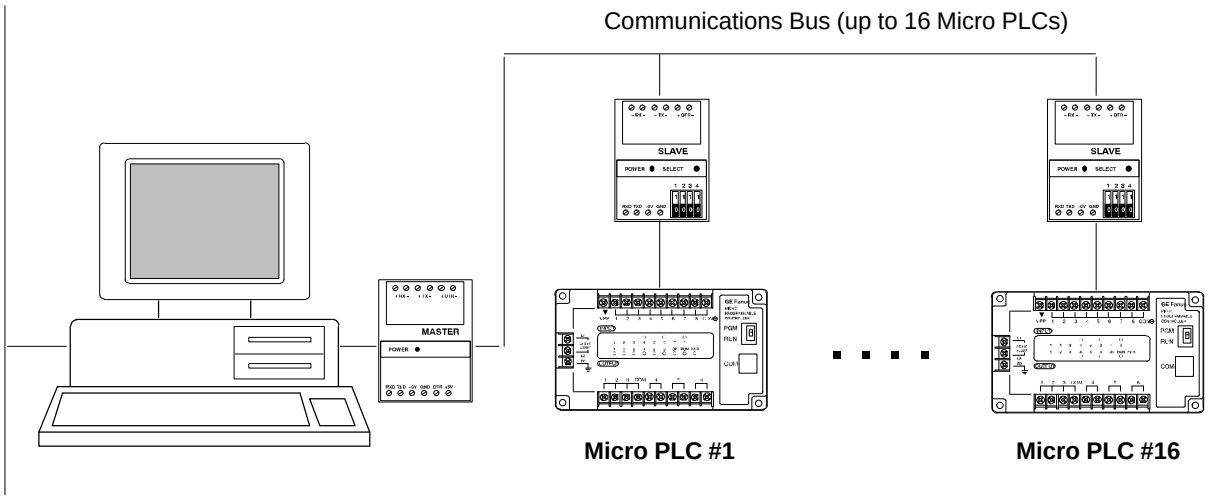


See Appendix D of this manual for more information about this product.

Display (a Data Acquisition, Logging, and Display Program)

DISPLAY is an easy to use program that runs on an IBM–PC,XT, or AT. It allows monitoring of Micro PLCs or other remote devices using RTU protocol. The main features of the Display software are:

- Auto-polling screens to display data from Micro PLCs.

- Independent display of system messages on all Auto-polling screens.
- Ability to display “out-of-range” data.
- Data logging triggered by out-of-range data events.
- Ability to download register data such as recipes to a Micro PLC.
- Manual mode.

This program is provided free with the Micro PLC programming software. See the *Micro PLC Programmer’s Guide* (GFK–0804) for details.

Display can be used in a point-to-point mode, with a computer running Display connected to a single Micro PLC. Display can also be used with Micro PLC Net. Although multiple Micro PLCs may be present on the network, the Micro PLC Net software can only establish a point-to-point link with one Micro PLC at a time.

Micro PLC DDE Driver

The Micro PLC DDE Driver is a software program that can be used to connect DDE-compliant Microsoft™ Windows programs with data in a Micro PLC. It allows linking real-time data from the plant floor into applications for display, logging, or trending. It also allows setting individual parameters or downloading recipes to the Micro PLC from a supervisory computer.

A demonstration version of this program is provided with the programming software. See the *Micro PLC Programmer’s Guide* (GFK–0804) for details

The Micro PLC DDE Driver can be used in a point-to-point mode, with a computer connected to a single Micro PLC. It can also be used with Micro PLC Net. Although multiple Micro PLCs may be present on the network, the Micro PLC Net software can only establish a point-to-point link with one Micro PLC at a time.

Chapter 2 The Micro PLC

This chapter describes the GE Fanuc Micro PLC CPU and Expander Units.

- CPU Units
- Expander Units
  - General Specifications
  - Electrical Specifications
  - Function Specifications
  - Relay Output Specifications
  - Relay Ratings and Lifetimes
  - Input Specifications
  - Memory Map
- Descriptions of CPU Units
  - 14 Point CPU Unit with DC Inputs / Relay Outputs, AC Power
  - 14 Point CPU Unit with DC Inputs / Relay Outputs, DC Power
  - 14 Point CPU Unit with AC Inputs / AC Outputs, AC Power
  - 16 Point CPU Unit with DC Inputs / Transistor Outputs, DC Power
  - 28 Point CPU Unit with DC Inputs / Relay Outputs, DC Power
  - 28 Point CPU Unit with DC Inputs / Relay Outputs, AC Power
- Descriptions of Expander Units
  - 14 Point Expander Unit with DC Inputs / Relay Outputs, AC Power
  - 14 Point Expander Unit with AC Inputs / AC Outputs, AC Power
  - 28 Point Expander Unit with DC Inputs / Relay Outputs, DC Power
  - 28 Point Expander Unit with DC Inputs / Relay Outputs, AC Power
  - Analog Expander Unit

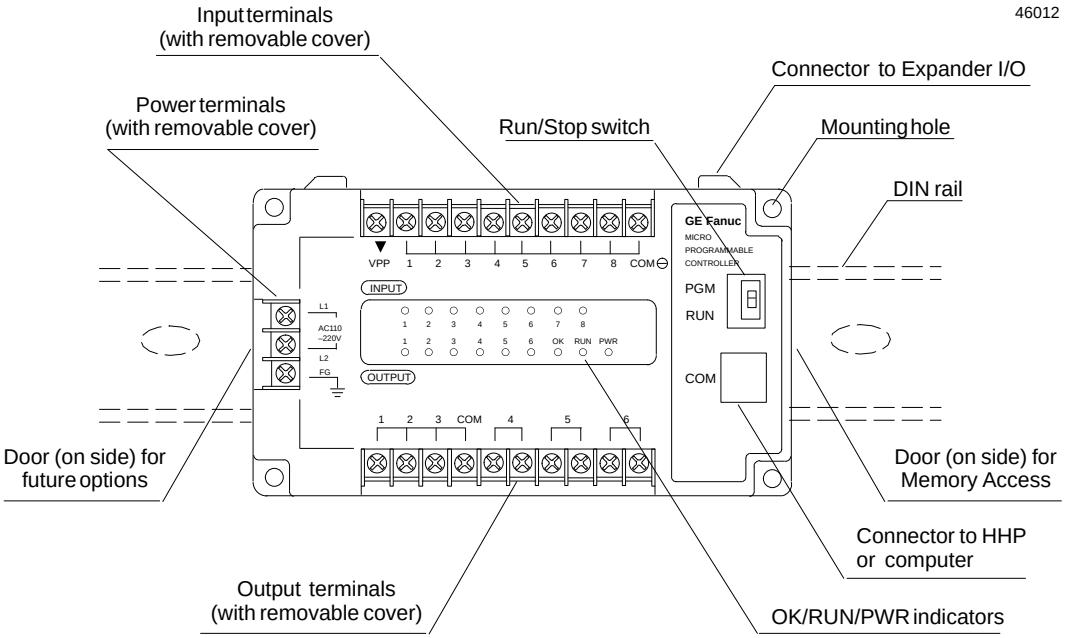
CPU Units

The CPU unit executes the application program. It has an easily-accessible RS– 232 compatible communications port and mode-selection switch. CPU units are available for AC or DC power. The following types of Micro PLC CPU Units are available:

- 14 Point CPU Unit with DC Inputs / Relay Outputs, AC Power. See page 2-7.
- 14 Point CPU Unit with DC Inputs / Relay Outputs, DC Power. See page 2-8.
- 14 Point CPU Unit with AC Inputs / AC Outputs, AC Power. See page 2-9.
- 16 Point CPU Unit with DC Inputs / Transistor Outputs, DC Power. See page 2-10.
- 28 Point CPU Unit with DC Inputs / Relay Outputs, DC Power. See page 2-11.
- 28 Point CPU Unit with DC Inputs / Relay Outputs, AC Power. See page 2-12.

General Description

LEDs on the front of the CPU unit indicate the state of each input and output. Additional LEDs indicate the presence of internal +5V power, as well as the PLC's operating mode and status.



OK LED

The OK LED on the CPU unit indicates the status of the PLC. If this LED is OFF, it indicates one of the following problems (usually related to programming):

PLC memory corrupted	Either the data memory or program memory in the PLC is corrupted.
Invalid program	The present program checksum does not match the checksum when the program was downloaded.
Invalid instruction in a program	Missing or incorrect instruction
Runtime register error	In the application program, a Move, Block Move or Indirect Move instruction has been made to an out-of-range register.

Expander Units

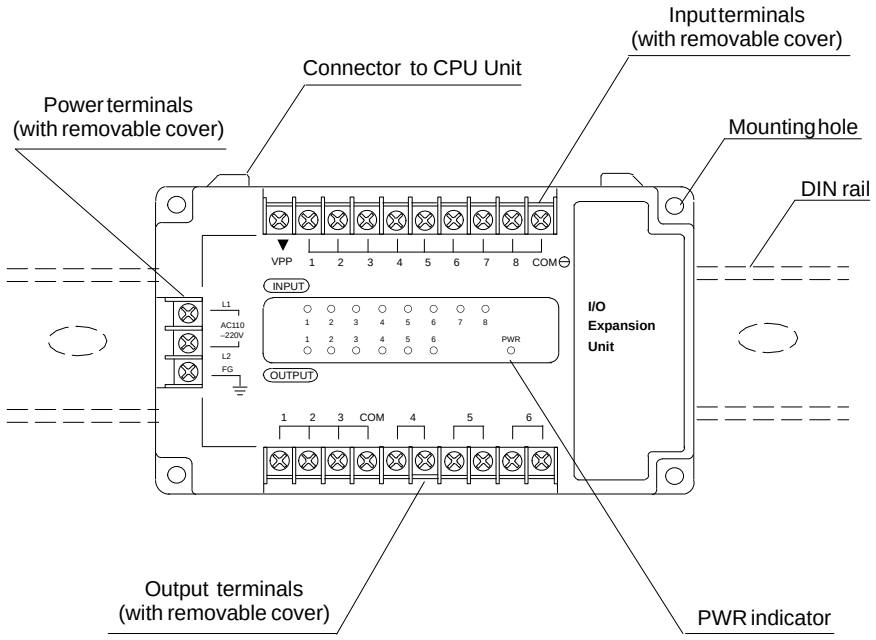
Optional Expander units can provide an additional 14 or 28 I/O points for the application. With a 14 point CPU unit, a 14 point Expander unit can be added. With a 28 point CPU unit, either a 14 point or 28 point Expander unit can be used.

The following types of Expander Units are available:

- 14 Point Expander Unit with DC Inputs/Relay Outputs, AC Power. See page 2-13.
- 14 Point Expander Unit with AC Inputs/AC Outputs, AC Power. See page 2-14.
- 28 Point Expander Unit with DC Inputs/Relay Outputs, DC Power. See page 2-15.
- 28 Point Expander Unit with DC Inputs/Relay Outputs, AC Power. See page 2-16.
- Analog Expander Unit. See page 2-17.

LEDs on the front of the Expander unit indicate the state of each input and output, and the presence of internal +5V power.

46013



General Specifications

Item	Specification
Operating temperature	0 to +55C (32 to +131F) ambient at the air inlets
Storage temperature	–20 to +70C (–4 to +158F)
Humidity	20% to 95% non-condensing
Vibration (1g equivalent)	10 – 58 Hz 0.075mm 58 – 150 Hz 9.8 m / s / s 20 cyc / axis (IEC68–2–6 / JIS C0911)
Shock (15g equivalent)	150 m / s / s, 11 mS, 3 axis pos and neg (IEC68–2–27 / JIS C0912)
Noise resistance	8kv electrostatic IEC801.2 10v / m radiated electromagnetic IEC 801.3 (future) 2kv burst IEC801.4 (NEMA ICS 3–304) 2kv IEC801.5 (IEEE 587)
Operating atmosphere	Free from corrosive gasses
Grounding	Grounding resistance (100Ω maximum)
Mounting style	Panel or 35mm DIN rail

Electrical Specifications

Item	Specification
Dielectric strength	AC – 220 VAC: Between power or I / O terminal and ground: 1500 VAC for 1 minute
Insulation resistance	Between power or I / O terminal and ground: 100MΩ (500 VDC megger)
Power and I / O terminals:	Maximum wire size: 1.25mm Maximum torque: 5kgf
FCC	Part 15, subpart J, class A

Function Specifications

Item	Specification
Programmingmethod	Instruction list via Hand-held Programmer Relay ladder logic via PC programmer
Programmerinterface	compatible with RS–232
Instruction words	24 basic instructions 19 advanced instructions
Programcapacity	2000 steps
Memory	EEPROM. Earlier CPU versions have RAM (built into CPU unit) or EPROM (replaces RAM)
EPROM (if used) requirements GE Fanuc part #44A725525–000	EPROM type must be 27C64, 200 nS access time or faster, 12.5 V programming voltage.
Microprocessorclockspeed	12 MHz
Scan time	.6mS overhead, plus 6 µsec per basic instruction. More complex functions such as math functions take longer to execute.
Internal relay	1024 (256 points can be retentive)
Timer	512 ON or OFF timers. (Uses internal registers)
Counter	512 UP or DOWN counters. Up to 128 counters can be retentive. (Uses internal registers.)
Internal register	16 bits each: 512 registers (128 can be retentive)
Self-diagnosticfunctions	Program checksum before and during program execution, check for illegal program before execution, check for communication error.
Automatic start function	Operation starts when power is turned on, with the CPU switch in the Run position.
External control	Start / stop via the Hand-held Programmer or PC programmer (with CPU switch in Run position)

Memory Map

Type	Total	Non Retentive	Retentive	Use for Timer or Counter Coil?	General Purpose Internal Coil?	Use as General Purpose Register?	Use as Indirect Register Reference?
I	256	1 – 256	none	no	yes	no	no
O	256	1 – 256	none	yes	yes	no	no
R	512	1 – 384	385 – 512*	no	notapplicable	yes	yes
IR	256	1 – 256	no	notapplicable	notapplicable	yes	no
OR	256	1 – 256	no	notapplicable	notapplicable	yes	no
C	1017	1 – 768	769 – 1017	yes	yes	no	no
C	1018		n/a	0.1 sec clock for use as input in application program (read only).			
C	1019		n/a	Startup scan coil for use as input in application program. (read only)			
C	1021		yes	Hold output coil for use in application program (read only).			

* Registers 501 to 512 are reserved for system use.

Relay Ratings and Lifetimes

The operating lifetime of a relay depends on its mechanical lifetime, its electrical rating, and the electrical operating environment.

The relays in the Micro PLC are rated at 20,000,000 operations mechanically (with no load), and 100,000 operations with full electrical load. Full electrical load is considered to be 5 Amps (full-resistive) at 240VAC, or 5 Amps (full-resistive) at 30VDC.

If a relay is driving a load that is less than the full electrical rating, its lifetime will increase beyond 100,000 operations. It will not exceed 20,000,000 operations. Typically, a relay might last for 500,000 operations.

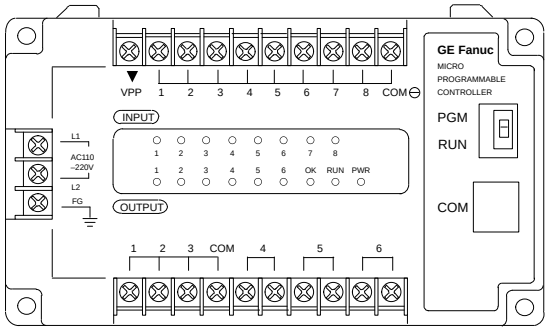
If a relay is driving a load that is not pure resistive, such as a lamp or solenoid, the relay lifetime is difficult to calculate in advance. As a rule, a lamp or solenoid steady-state load should be no more than 20% of the pure resistive load. Otherwise, the lamp or solenoid load will have “inrush” current that could exceed the maximum current rating.

Descriptions of CPU Units

14 Point CPU Unit with DC Inputs/Relay Outputs, AC Power

Catalog Number: IC620MDR014

46001



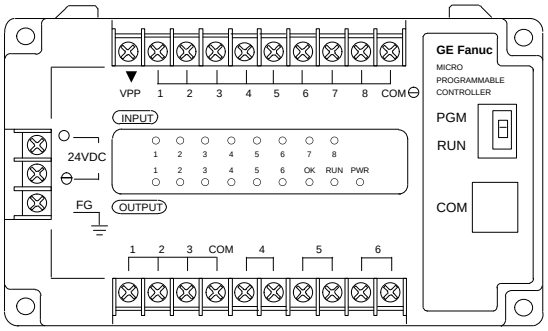
This CPU Unit provides 8 DC inputs and 6 relay outputs.

Specifications

Item	Specification
Dimensions (W x H x D)	5.5 in (140 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Weight (approximate)	490g (0.99 lb)
Voltage rating	110 to 220 VAC, 50 / 60 Hz wide range
Voltage range	85 to 265 VAC (47 to 63 Hz)
Power consumption	8.1 Volt amps
Power available from Vpp terminal	24 VDC, 75mA + 8.4mA per unused input. Unfused.
Voltage Drops and Interruptions	50 millisec at 85 VAC power input
Microprocessor clock speed	12 MHz
Scan time	.6mS overhead, plus 6 µsec per basic instruction. More complex functions such as math functions take longer to execute.
Inputs:	
Number of points	8 DC inputs, opto isolated from logic circuitry
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Input current	8.4milliamps
On level	10.8 VDC or lower
Off level	11.0 VDC or higher
Response time	Off to on = 7mS max. On to off = 11 mS max. Not adjustable.
Input impedance	3K ohms
Outputs:	
Type	Electromechanical relay contact
Number of points	6 relay outputs, normally open contacts,
Number of commons	3 points per common, also 3 individual points
Maximum voltage	On independent terminals: 250VAC @ 5A 30 VDC @ 5A On common terminals: 250VAC @ 5A per common 30 VDC @ 5A per common
Response time, off to on	10 mS maximum
Response time, on to off	10 mS maximum
Minimum applicable load	5 VDC @ 1mA
Contact resistance	30mΩ maximum (initial value)
Minimum load	5 VDC at 1mA
Relay life	20 million operations mechanical: 500,000 electrical operations, typical. 100,000 operations electrical at full rated load. See page 2-6 for more information about relay lifetimes.

14 Point CPU Unit with DC Inputs/Relay Outputs, DC Power

Catalog Number: IC620MDR114



This CPU Unit provides 8 AC inputs and 6 relay outputs.

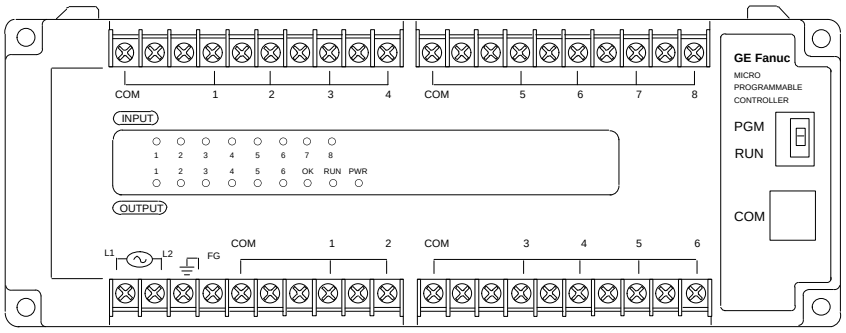
Specifications

Item	Specification
Dimensions (W x H x D)	5.5 in (140 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Weight (approximate)	490g (0.99 lb)
Power supply voltage	10 – 28 VDC, 12 – 24 VDC nominal
Power consumption	10 Watts at 24VDC
Power available from Vpp terminal	24VDC, 75mA plus 8.4mA per unused input. Unfused.
Voltage Drops and Interruptions	50 msec at 85 VAC power input
Microprocessor clock speed	12 MHz
Scan time	.6mS overhead, plus 6 µsec per basic instruction. More complex functions such as math functions take longer to execute.
Inputs:	
Number of points	8 DC inputs, opto isolated from logic circuitry
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Input current	8.4milliamps
On level	10.8 VDC or lower
Off level	11.0 VDC or higher
Response time	Off to on = 7mS max. On to off = 11 mS max. Not adjustable.
Input impedance	3K ohms
Outputs:	
Type	Electromechanical relay contact
Minimum applicable load	5 VDC @ 1mA
Contact resistance	30mΩ maximum (initial value)
Number of points	6 relay outputs, normally open contacts,
Number of commons	3 points per common, also 3 individual points
Maximum voltage	On independent terminals: 250VAC @ 5A 30 VDC @ 5A On common terminals: 250VAC @ 5A per common 30 VDC @ 5A per common
Response time, off to on	10 mS maximum
Response time, on to off	10 mS maximum
Minimum load	5 VDC at 1mA
Relay life	20 million operations mechanical: 500,000 operations typical. 100,000 operations electrical at full rated load. See page 2-6 for more information about relay lifetimes.

14 Point CPU Unit with AC Inputs/AC Outputs, AC Power

Catalog Number: IC620MAA014

46015



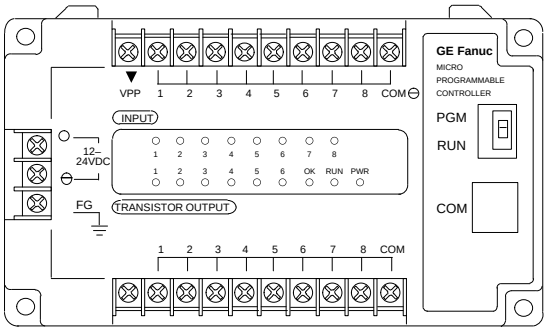
This CPU Unit provides 8 AC inputs and 6 AC outputs.

Specifications

Item	Specification
Dimensions (W x H x D)	8.6 in (218 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Weight (approximate)	490g (0.99 lb)
Power supply voltage	90 VAC to 260 VAC @ 47 – 63 Hz
Power consumption	11.0 Watts
Secondary power availability	75 mA @ 24VDC + /–3.6 VDC
Voltage Drops and Interruptions	20 mS dropout time
Microprocessor clock speed	12 MHz
Scan time	.6mS overhead, plus 6 µsec per basic instruction. More complex functions such as math functions take longer to execute.
Inputs:	
Number of points	8 AC inputs (2 groups of 4 each)
Rated voltage	90 to 260 VAC
Input current	10 mA at 120 VAC, 20 mA at 240 VAC
On level	60 to 270 VAC
Off level	0 to 60 VAC
Response time	25 mS (on to off or off to on)
Off state current	4.5 mA maximum
On state current	6 mA minimum
Outputs:	
Number of points	6 triac outputs
Number of commons	one group with 2 outputs and one group with 4 outputs
Rated voltage	90 – 260 VAC
Rated current	1 Amp maximum per point, 2 Amps per 2-output group, and 3 Amps maximum power 4-output group
Response time, off to on	1 / 2 cycle (10mS at 50 Hz, 8.3 mS at 60 Hz)
Response time, on to off	2 mS
Output leakage current	1 mA at 120 VAC
Output voltage drop	2 VAC maximum

16 Point CPU Unit with DC Inputs/Transistor Outputs, DC Power

Catalog Number: IC620MDD116



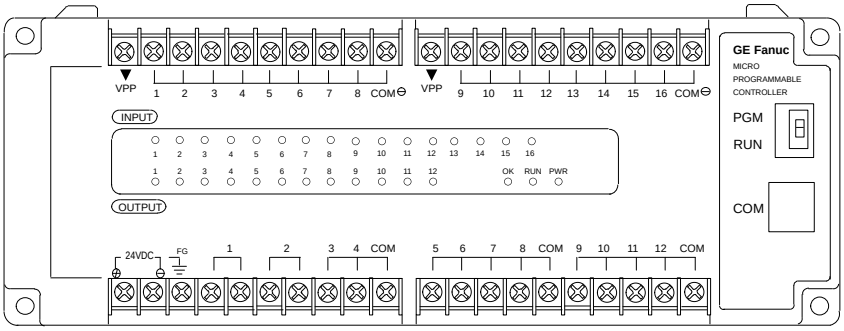
This CPU Unit provides 8 DC inputs and 8 Transistor outputs.

Specifications

Item	Specification
Dimensions (W x H x D)	5.5 in (140 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Weight (approximate)	490g (0.99 lb)
Power supply voltage	10 – 28 VDC, 12 – 24 VDC nominal
Power consumption	10 Watts at 24VDC
Power available from Vpp terminal	24VDC, 75mA plus 8.4mA per unused input. Unfused.
Microprocessor clock speed	12 MHz
Scan time	.6mS overhead, plus 6 µsec per basic instruction. More complex functions such as math functions take longer to execute.
Inputs:	
Number of points	8 DC inputs, opto isolated from logic circuitry
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Input current	4 milliamps / 12V, 8mA / 24V
Off-state current	1.5mA maximum
Response time	2 mS
Input impedance	3K ohms
Outputs:	
Number of points	8 Transistor outputs, .5 Amps max. per point.
Number of commons	All outputs attached to a single common point
Output voltage drop	1 volt maximum
Off state leakage	1mA maximum
Response time	2 mS
Isolation	1500 VRMS between field side and logic side

28 Point CPU Unit with DC Inputs/Relay Outputs, DC Power

Catalog Number: IC620MDR128



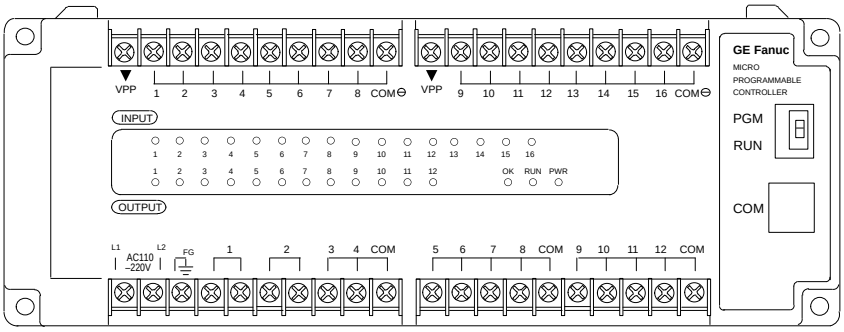
This CPU Unit provides 16 DC inputs and 12 relay outputs.

Specifications

Item	Specification
Dimensions (W x H x D)	8.6 in (218 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Weight (approximate)	490g (0.99 lb)
Power supply voltage	10 – 28 VDC, 12 – 24 VDC nominal
Power consumption	13.5 Watts at 24VDC
Power available from Vpp terminal	24VDC, 8.4mA per unused input. Unfused.
Voltage Drops and Interruptions	50 msec at 85 VAC power input
Microprocessor clock speed	12 MHz
Scan time	.6mS overhead, plus 6 µsec per basic instruction. More complex functions such as math functions take longer to execute.
Inputs:	
Number of points	16 DC inputs, opto isolated from logic circuitry
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Input current	8.4milliamps
On level	10.8 VDC or lower
Off level	11.0 VDC or higher
Response time	Off to on = 7mS max. On to off = 11 mS max. Not adjustable.
Input impedance	3K ohms
Outputs:	
Type	Electromechanical relay contact
Minimum applicable load	5 VDC @ 1mA
Contact resistance	30mΩ maximum (initial value)
Number of points	12 relay outputs, normally open contacts, grouped as 2 isolated, a group of 2 that shares a common, and two groups of 4 that share two commons.
Maximum voltage	On independent terminals: 250VAC @ 5A 30 VDC @ 5A On common terminals: 250VAC @ 5A per common 30 VDC @ 5A per common
Response time, off to on	10 mS maximum
Response time, on to off	10 mS maximum
Minimum load	5 VDC at 1mA
Relay life	20 million operations mechanical: 500,000 electrical operations, typical. 100,000 operations electrical at full rated load See page 2-6 for more information about relay lifetimes.

28 Point CPU Unit with DC Inputs/Relay Outputs, AC Power

Catalog Number: IC620MDR028



This CPU Unit provides 16 DC inputs and 12 relay outputs.

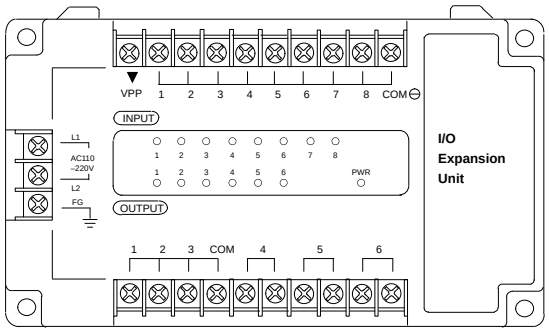
Specifications

Item	Specification
Dimensions (W x H x D)	8.6 in (218 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Power supply voltage	85 VAC to 264 VAC @ 47 – 63 Hz
Power consumption	15 Watts
Power available from Vpp terminal	24 VDC, 8.4mA per unused point. Unfused.
Microprocessor clock speed	12 MHz
Scan time	.6mS overhead, plus 6 µsec per basic instruction. More complex functions such as math functions take longer to execute.
Inputs:	
Number of points	16 DC inputs, opto isolated from logic circuitry
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Input current	8.4milliamps
On level	10.8 VDC or lower
Off level	11.0 VDC or higher
Response time	Off to on = 7mS max. On to off = 11 mS max. Not adjustable.
Input impedance	3K ohms
Outputs:	
Type	Electromechanical relay contact
Contact resistance	30mΩ maximum (initial value)
Minimum applicable load	5 VDC @ 1mA
Number of points	12 relay outputs, normally open contacts, grouped as 2 isolated, a group of 2 that shares a common, and two groups of 4 that share two commons.
Maximum voltage	On independent terminals: 250VAC @ 5A 30 VDC @ 5A On common terminals: 250VAC @ 5A per common 30 VDC @ 5A per common
Response time, off to on	10 mS maximum
Response time, on to off	10 mS maximum
Minimum load	5 VDC at 1mA
Relay life	20 million operations mechanical: 500,000 electrical operations, typical. 100,000 operations electrical at full rated load See page 2-6 for more information about relay lifetimes.

Descriptions of Expander Units

14 Point Expander Unit with DC Inputs/Relay Outputs, AC Power

Catalog Number: IC620EDR014



This Expander Unit provides 8 DC inputs and 6 relay outputs.

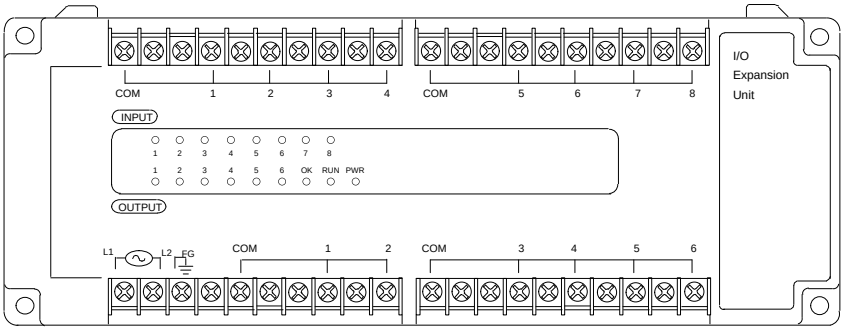
Specifications

Item	Specification
Dimensions(W x H x D)	5.5 in (140 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Power supply voltage	85 VC to 264 VAC @ 47 – 63 Hz
Power consumption	8.1 Volt amps
Power available from Vpp terminal	24 VDC, 75mA + 8.4mA per unused input. Unfused.
Voltage Drops and Interruptions	50 millisec at 85 VAC power input
Inputs:	
Number of points	8 DC inputs, opto isolated from logic circuitry
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Input current	8.4milliamps
On level	10.8 VDC or lower
Off level	11.0 VDC or higher
Response time	Off to on = 7mS max. On to off = 11 mS max. Not adjustable.
Input impedance	3K ohms
Outputs:	
Type	Electromechanical relay contact
Minimum applicable load	5 VDC @ 1mA
Contact resistance	30mΩ maximum (initial value)
Number of points	6 relay outputs, normally open contacts,
Number of commons	3 points per common, also 3 individual points
Maximum voltage	On independent terminals: 250VAC @ 5A 30 VDC @ 5A On common terminals: 250VAC @ 5A per common 30 VDC @ 5A per common
Response time, off to on	10 mS maximum
Response time, on to off	10 mS maximum
Minimum load	5 VDC at 1mA
Relay life	20 million operations mechanical: 500,000 electrical operations, typical. 100,000 operations electrical at full rated load See page 2-6 for more information about relay lifetimes.

14 Point Expander Unit with AC Inputs/AC Outputs, AC Power

Catalog Number: IC620EAA014

46096



This Expander Unit provides 8 AC inputs and 6 AC outputs.

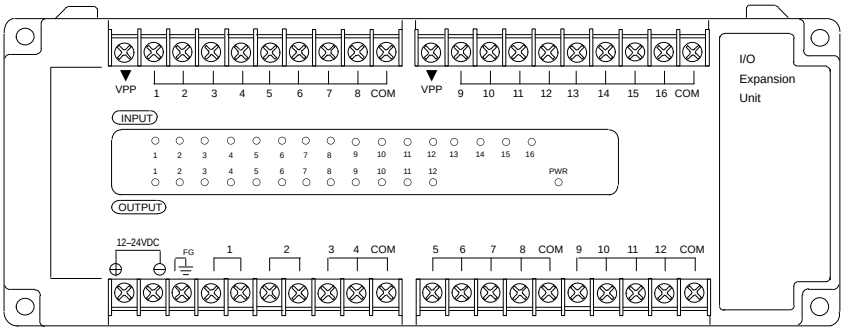
Specifications

Item	Specification
Dimensions (W x H x D)	8.6 in (218 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Power supply voltage	90 VAC to 260 VAC @ 47 – 63 Hz
Power consumption	11.0 Watts
Secondary Power Availability	75 mA at 24 VDC + / – 3.6 VDC
Voltage Drops and Interruptions	20 mS dropout time
Fuse	250V. 5 Amp, Normal–blow type
Inputs:	
Number of points	8 AC inputs, 2 groups of 4 each
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Input current	10 mA at 120 VAC, 20 mA at 240 VAC
On level	60 to 270 VAC
Off level	0 to 60 VAC
Response time	25 mS (on to off, or off to on)
On state current	4.5 mA maximum
Off state current	6 mA minimum
Outputs:	
Number of points	6 triac outputs
Number of commons	One group of 2 outputs and one group of 4 outputs
Rated current	1 Amp maximum per point, 2 Amps per 2 output group, and 3 Amps per 4 output group
Response time, off to on	1 / 2 cycle (10mS at 50 Hz, 8.3mS at 60 Hz)
Response time, on to off	2 mS
Output protection	Fuses are not required
Output leakage current	1 mA at 120 VAC
Output voltage drop	2 VAC maximum

28 Point Expander Unit with DC Inputs/Relay Outputs, DC Power

Catalog Number: IC620EDR128

46097



This Expander Unit provides 16 DC inputs and 12 relay outputs.

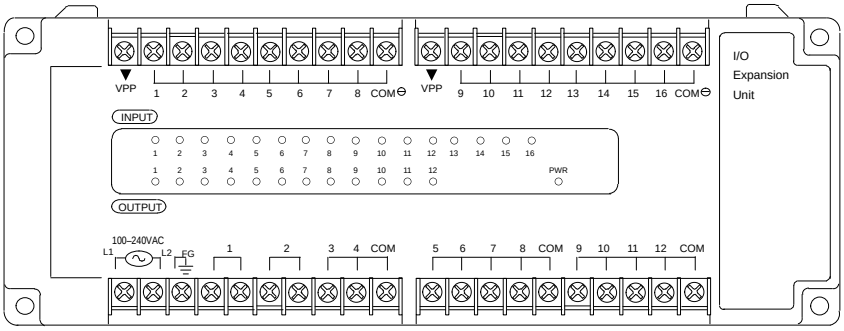
Specifications

Item	Specification
Dimensions (W x H x D)	8.6 in (218 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Power supply voltage	10 – 28 VDC, 12 – 24 VDC nominal
Power consumption	8.1 Watts at 24 VDC
Power available from Vpp terminal	24 VDC, 8.4mA per unused point. Unfused.
Inputs:	
Number of points	16 DC inputs, opto isolated from logic circuitry
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Input current	9.5mA at 24 VDC, 4.2mA at 12 VDC
On level	9.8 VDC or lower
Off level	10.0 VDC or higher
Response time	Off to on = 7mS max. On to off = 11 mS max. Not adjustable.
Input impedance	3K ohms
Outputs:	
Type	Electromechanical relay contact
Minimum applicable load	5 VDC @ 1mA
Contact resistance	30mΩ maximum (initial value)
Number of points	12 relay outputs, normally open contacts, grouped as 2 isolated, a group of 2 that shares a common, and two groups of 4 that share two commons.
Maximum voltage	On independent terminals: 250VAC @ 5A 30 VDC @ 5A On common terminals: 250VAC @ 5A per common 30 VDC @ 5A per common
Response time, off to on	10 mS maximum
Response time, on to off	10 mS maximum
Minimum load	5 VDC at 1mA
Relay life	20 million operations mechanical: 500,000 electrical operations, typical. 100,000 operations electrical at full rated load See page 2-6 for more information about relay lifetimes.

28 Point Expander Unit with DC Inputs/Relay Outputs, AC Power

Catalog Number: IC620EDR028

46020



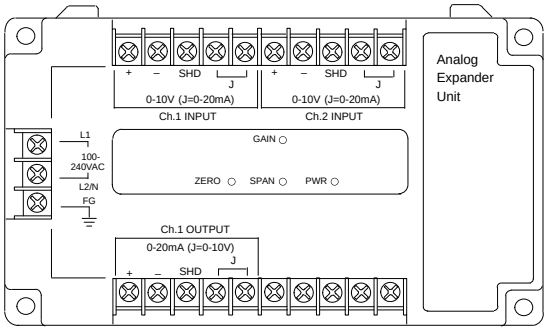
This Expander Unit provides 16 DC inputs and 12 relay outputs.

Specifications

Item	Specification
Dimensions (W x H x D)	8.6 in (218 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Power supply voltage	85 VAC to 264 VAC @ 47 – 63 Hz
Power consumption	8.1 Volt amps
Power available from Vpp terminal	8.4 mA per unused input @ 24VDC. Unfused.
Voltage drops and interruptions	50 millisec at 85 VAC power input
Inputs:	
Number of points	16 DC inputs, opto isolated from logic circuitry
Type	Pull up resistor to +V. The external device pulls the input point to ground to turn on the input.
Rated voltage	24VDC open circuit + / –3.6VDC
Input current	8.4 milliamps
On level	10.8 VDC or lower
Off level	11.0 VDC or higher
Response time	Off to on = 7mS max. On to off = 11 mS max. Not adjustable.
Input impedance	3K ohms
Outputs:	
Type	Electromechanical relay contact
Number of points	12 relay outputs, normally open contacts, grouped as 2 individual points, a group of 2 that shares a common, and two groups of 4 that share commons.
Maximum voltage	On independent terminals: 250VAC @ 5A 30 VDC @ 5A On common terminals: 250VAC @ 5A per common 30 VDC @ 5A per common
Response time, off to on	10 mS maximum
Response time, on to off	10 mS maximum
Contact resistance	30mΩ maximum (initial value)
Minimum load	5 VDC at 1mA
Relay life	20 million operations mechanical: 500,000 electrical operations, typical. 100,000 operations electrical at full rated load. See page 2-6 for more information about relay lifetimes.

Analog Expander Unit

Catalog Number: IC620ALG021



This Expander Unit provides two 8-bit analog inputs and one 8-bit analog output.

In a program, the analog inputs use references IR1 and IR2. The analog output uses reference OR1. Scaling is 0 volts = 0 mA = 0 bits; 10 volts = 20mA = 255 bits. For information about analog references and scaling, refer to the *Micro PLC Programmer's Guide*.

For PC-based programming, this module requires version 2.37 or later of the programming software. You can obtain this software with product manuals as part number IC620SWP020 rev B or later. You may also download the programming software files from the GE Fanuc computer bulletin board, or obtain the software from a GE Fanuc distributor.

The Analog Expander Unit has a switch that must be set to select operation with either a 14/16-point or 28-point CPU unit. It cannot be used with CPU units with catalog numbers IC620MRD014A or 114A. It can be used with later versions of those CPUs.

Adjustments for zero, gain, and span are made at the factory, and further adjustment is not recommended.

Be sure to refer to the wiring information on page 3-14 before using this unit. It must be wired as shown.

Specifications

Item	Specification
Dimensions (W x H x D)	5.5 in (140 mm) x 3.15 in (80 mm) x 3.0 in (76 mm)
Voltage rating	110 to 220 VAC, 50 / 60 Hz wide range
Power supply voltage	85 VAC to 264 VAC (47 to 63 Hz)
Power consumption	10 Watts
Inputs:	
Number of points	2 analog inputs
Type	8 bit, 0 to 10VDC, or 0 to 20mA
Calibration	Factory adjusted for zero, gain, and span. Adjusted for 40mV (or 79 micro-amps) per count.
Update rate	2 msec. in addition to PLC scan time
Absolute accuracy	+/– 80mV at 25C
Linearity	<1 LSB
Cross channel rejection	>60 db
Input impedance	>100K ohms (voltage mode); 500 ohms (current mode)
Outputs:	
Number of points	1 analog output
Type	8 bit, 0 to 10 VDC or 0 to 20 mA
Calibration	Factory calibrated to 40mV (or 79 micro-amps) per count.
Update rate	2 msec. in addition to PLC scan time
Absolute accuracy	+/–80 mV at 25C
User load	0 – 850 ohms (current mode); 100K ohms min. (voltage mode)

Chapter 3 Installation

This chapter explains how to situate, mount, and wire the GE Fanuc Micro PLC.

- Choosing a Location for the Micro PLC
  - Environmental Requirements
  - Other Considerations
- Mounting a Unit
- Connecting an Expander Unit
- Connecting AC or DC Power to a Unit
  - AC Power Connections
  - DC Power Connections
  - Grounding
- I/OWiring for 14-Point CPU or Expansion Units
- I/OWiring for 16-Point CPU Units
- I/OWiring for 28-Point CPU or Expansion Units
- I/OWiring for Units with AC Inputs and AC Outputs
- I/OWiring for an Analog Expander Unit
  - Selecting Operation with a 14 or 28 Point CPU
- Selecting the Operating Mode
  - Controlling the Operating Mode from the CPU Unit
  - Changing the Operating Mode from the Programmer

Choosing a Location for the Micro PLC

When selecting a location for the Micro PLC, follow these guidelines:

Environmental Requirements

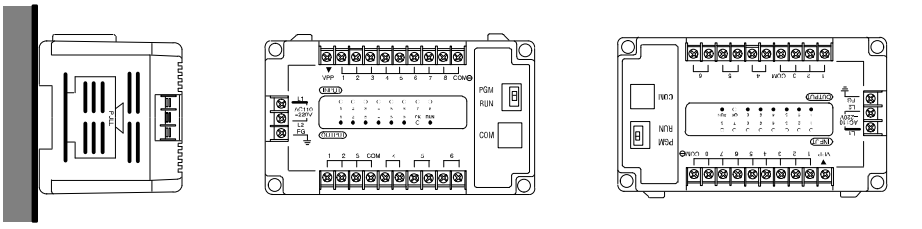
- Ambient temperature maintained between 0 and +55C (32 to 131F).
- Ambient humidity between 20% and 95% relative humidity, with no condensation.
- The temperature must not change so rapidly that condensation might form on or inside the Micro PLC.
- No corrosive, salty air or combustible gasses.
- No dust, salty air, conductive that may cause internal shorts, iron powder, etc...
- Vibration or shock must not exceed specified limits.

Other Considerations

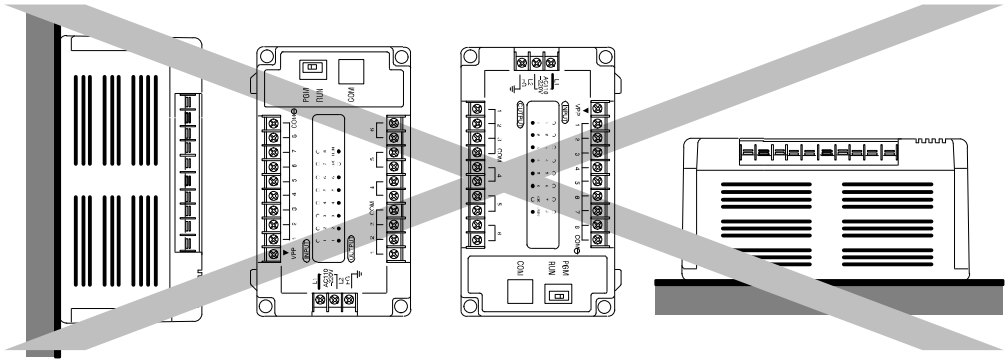
- If possible, do not install the Micro PLC where it will be exposed to direct sunlight.
- Provide adequate ventilation space. Recommended minimum space allowances are approximately: 75mm (3 inches) top and sides and 100mm (4 inches) bottom.
- Do not install the Micro PLC above equipment that generates a large amount of heat.
- If the ambient temperature exceeds 55C, provide a ventilation fan or air conditioner.
- Do not install the Micro PLC within a control panel that contains high-voltage (440V) or high-frequency equipment.
- Do not install the Micro PLC within 200mm (8 inches) of any high voltage (more than 100 volts) or high current (more than 1 Amp) line.
- For maintainability and safety, locate the Micro PLC as far from high voltage equipment and power generation equipment as possible.
- The Micro PLC must be mounted <u>on a vertical surface, in a horizontal position</u>. It must not be mounted vertically, and it must not be mounted on a horizontal surface.

Yes

46021



No



Mounting a Unit

The Micro PLC units can be installed on a DIN rail, or mounted on a wall or panel using screws. Dimensions and mounting footprints for CPU and Expander units are given on these pages.

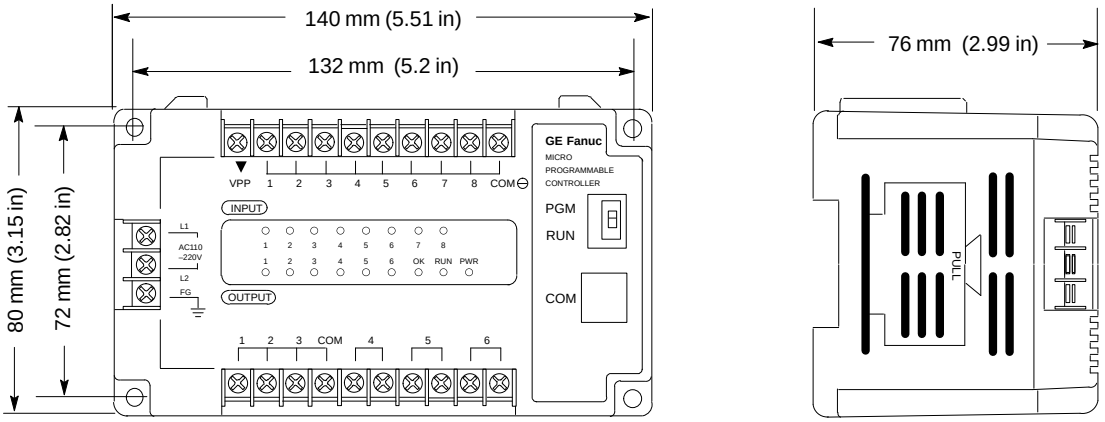
Unit Dimensions

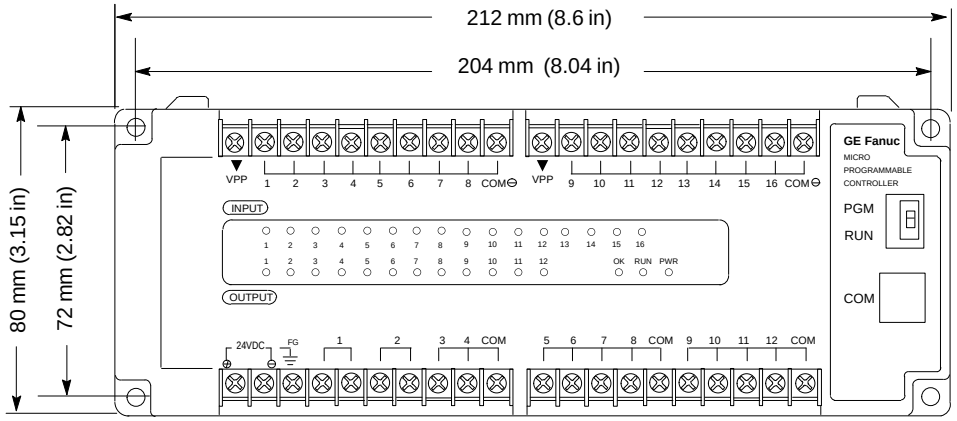
Dimensions of the Micro PLC units are shown below. All units are the same height and depth. 28-point units and 14-point AC / AC / AC units are wider.

46026

Height and Width

Depth (same for all units)



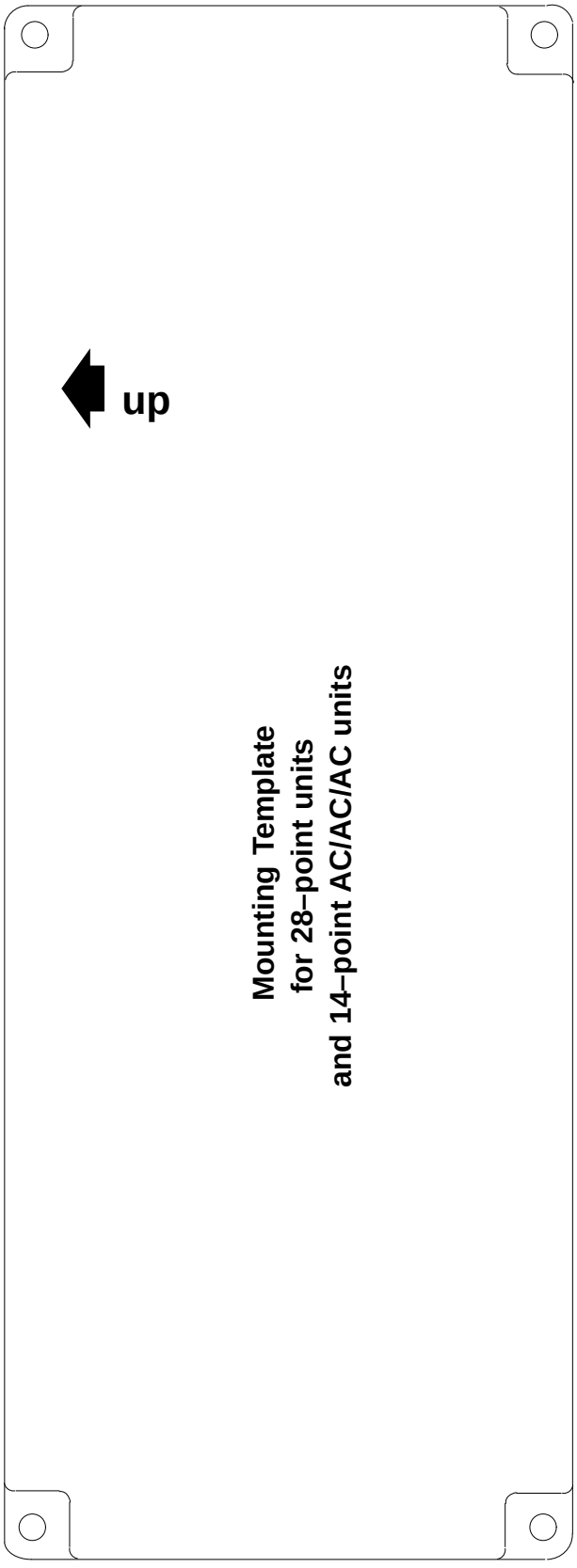


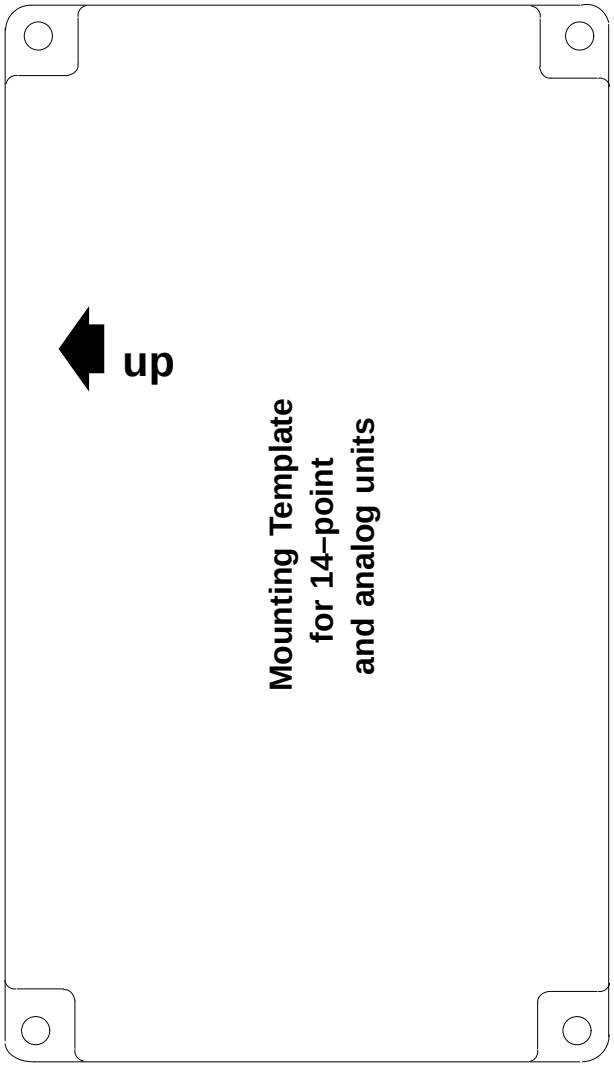
Mounting a Unit on a Panel

To mount the unit on a panel, use the appropriate mounting footprint on this page as a guide to drill the corner mounting holes.

Remember that Micro PLC units CANNOT be mounted on end, the way these illustrations appear on the page. See page 3-2 if you need more information about correct mounting position.

46027

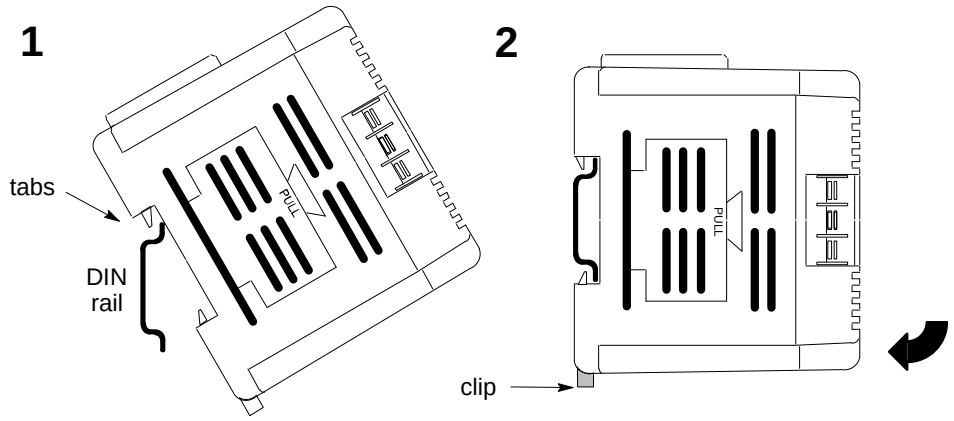




Mounting a Unit on a DIN Rail

The method of mounting a Micro PLC unit on a 35 mm DIN rail is shown below. A small, spring-loaded clip in the bottom of the unit holds it in place on the rail.

46028



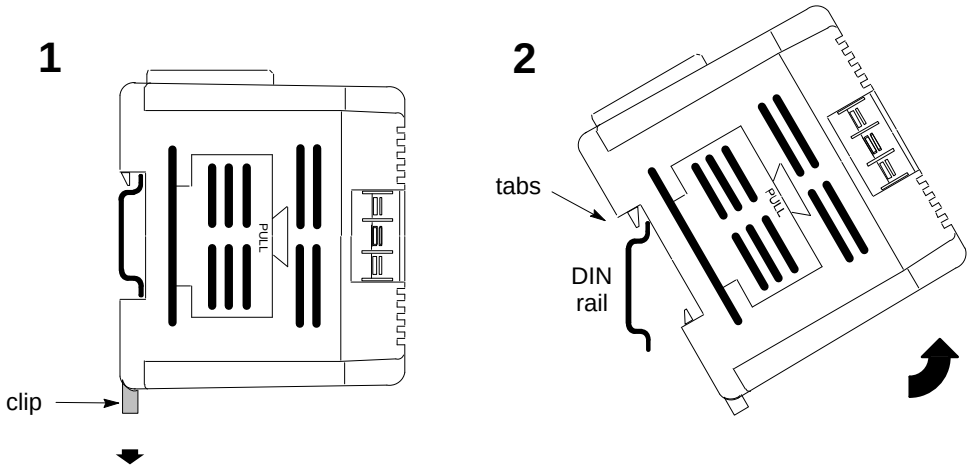
Position the upper edge of the unit over the DIN rail, so that the rail is behind the tabs as shown above.

Pivot the unit downward (for a unit being mounted right side up) until the spring-loaded clip in the bottom of the unit clicks firmly into place.

Removing a Unit From a DIN Rail

To remove a unit from a DIN rail, follow the procedure shown below.

46029



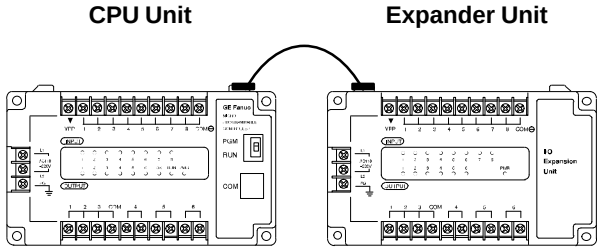
With a small flathead screwdriver or similar implement, pull down the spring-loaded clip at the bottom of the unit until the DIN rail is disengaged.

Pivot the unit upward (for a unit mounted right side up) to remove it from the rail.

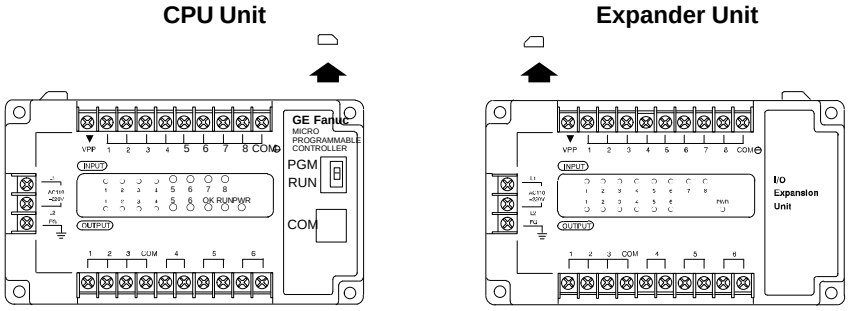
Connecting an Expander Unit

The ribbon cable supplied with an Expander unit allows it to be spaced approximately 250 mm (1 inch) from the CPU unit, as shown below. Optional ribbon cables in .5 meter (19 inch) and 1 meter (39 inch) lengths are available. It is not possible to use a cable longer than 1 meter (39 inches) to connect an expander unit.

1. **If you are using the short ribbon cable, locate the Expander units to the right of the CPU unit, as shown below.** If a longer cable is used, it is not necessary to locate the Expander unit to the right of the CPU unit.



2. **If you are using the short ribbon cables, mount the Expander unit first.** Complete its power wiring (see next page), then mount the CPU unit to its left (see above).
3. **Remove the protective covers from the Expander ports that will be used.** Do not remove the covers from unused ports.

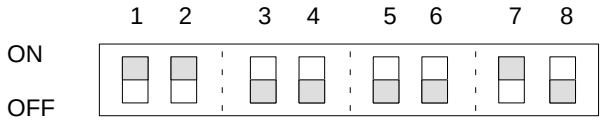


If it is necessary to use a screwdriver or other implement to pry up the covers, be very careful not to damage the connector pins.

4. **Attach the ribbon cables between the units.**

Note: If you are using an Expander unit with a CPU unit having catalog number IC620EDR014A, and experience problems such as incorrect addresses for the Expander unit, check the address-selection DIP switch in the CPU unit. This DIP switch is only present on IC620EDR014A. It is not present on later versions of the product. The DIP switch is located inside the right side door of the CPU unit. It must be set as shown below.

46032



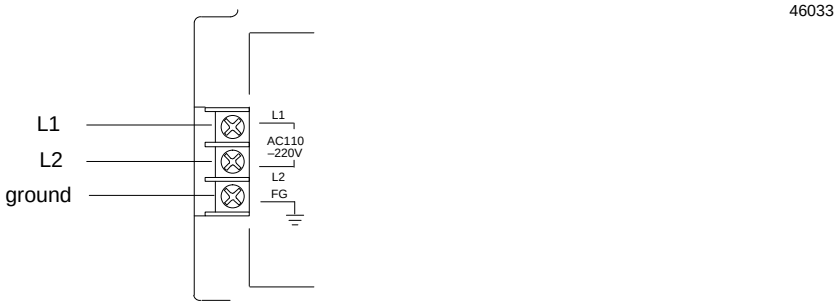
Connecting AC or DC Power to a Unit

Connect either AC or DC wiring, according to the unit type. Terminal assignments are printed on the front of the unit.

For many types of application, it is good practice to connect a switch in the power line to the unit, so that power can be removed if necessary without removing wiring from the power terminals.

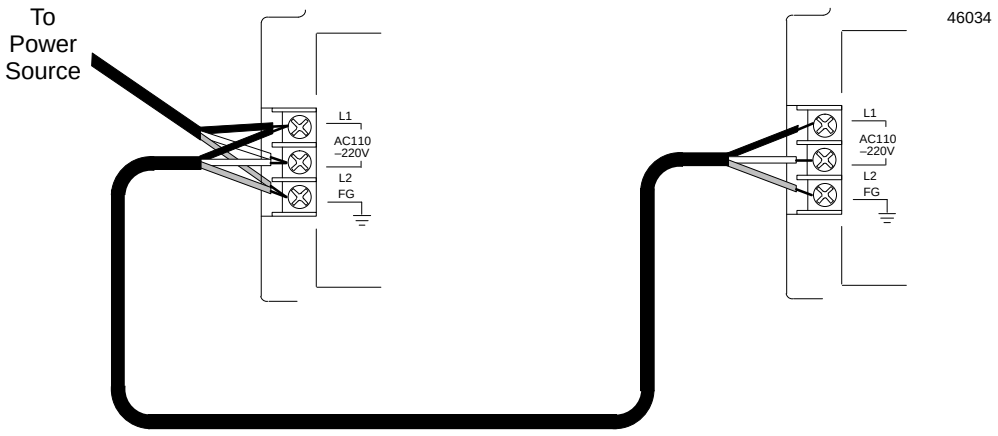
AC Power Connections

For AC-type units, connect L1 (hot) to the top power terminal, L2 (neutral) to the center power terminal, and ground to the bottom power terminal.



The ground wire must go to earth ground.

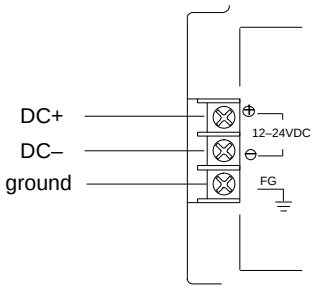
Power connections for an Expander unit are shown below. When an Expander unit is used, it is important to connect the FG terminal on the Expander unit to the FG terminal on the CPU unit only. Connect the FG terminal on the CPU unit to electrical ground.



DC Power Connections

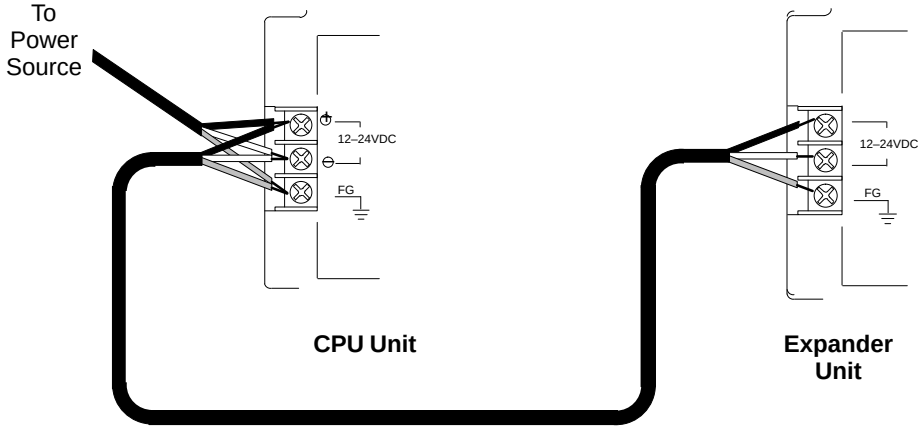
For DC-type units, connect DC +12 to +24 volts to the top power terminal, DC Ovolts to the center power terminal, and ground to the bottom power terminal.

46035



Power connections for an Expander unit are shown below.

46036

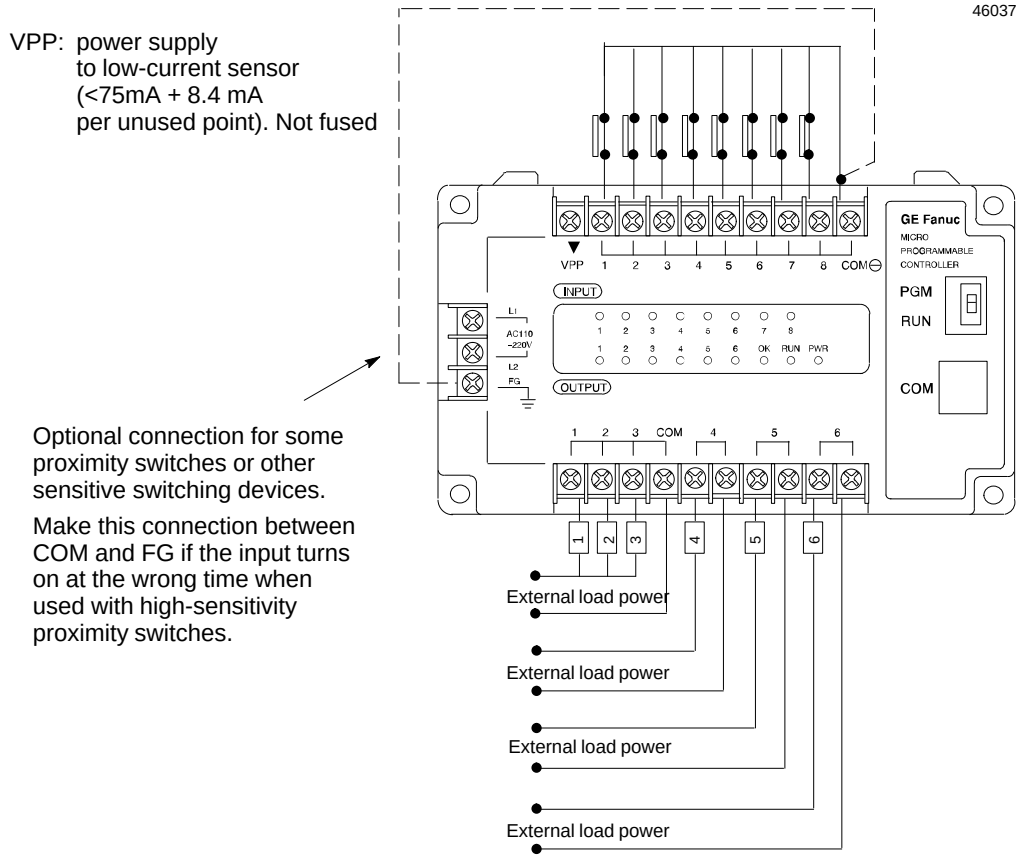


Grounding

System grounding must be consistent with local regulations.

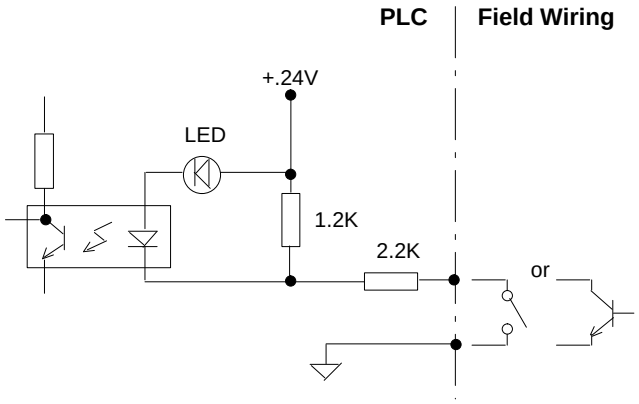
I/O Wiring for 14-Point CPU or Expansion Units

The diagrams below show I/O wiring for 14-point units with DC inputs and relay outputs.



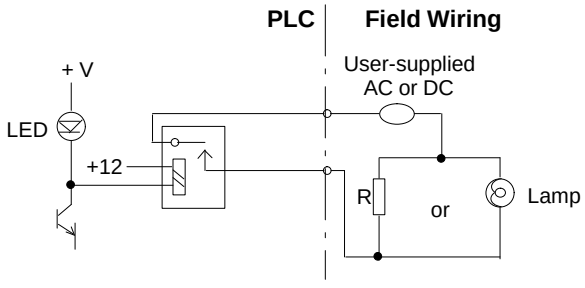
Note: For relays, solenoids, and other inductive loads, install an appropriate suppression device (such as an RC network) at the coil.

Typical DC Input Circuit



Typical Relay Output Circuit

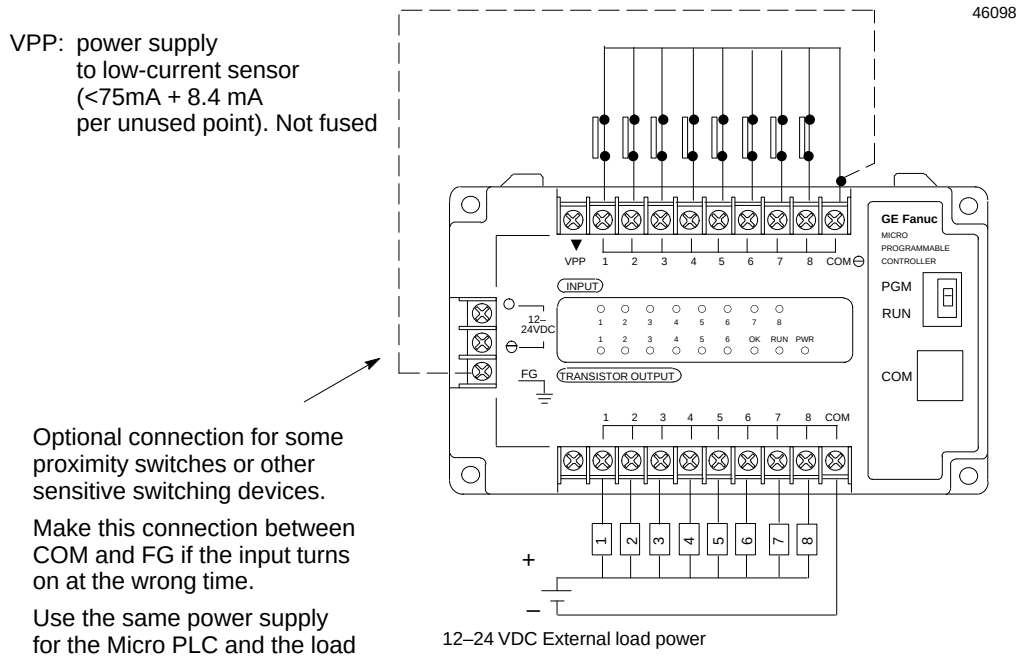
46038



The Micro PLC does not have internal fusing for outputs. If necessary, external fusing can be added. Be sure the type and size of fuse is appropriate for the load.

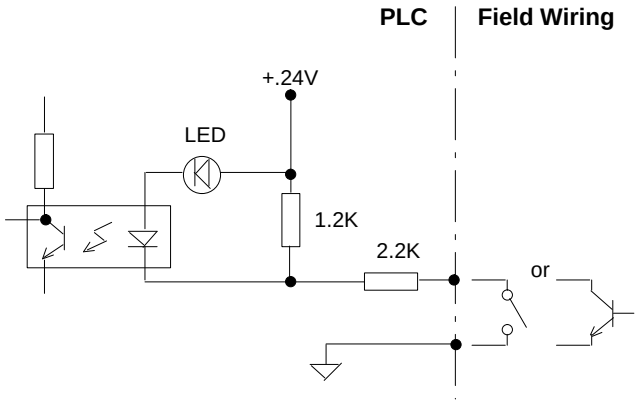
I/O Wiring for 16-Point DC/DC CPU Units

The diagrams below show I/O wiring for 16-point units with DC inputs and transistor outputs.

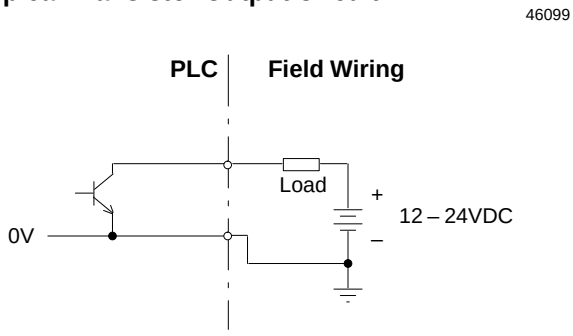


Note: For relays, solenoids, and other inductive loads, install an appropriate suppression device (such as an RC network) at the coil.

Typical DC Input Circuit

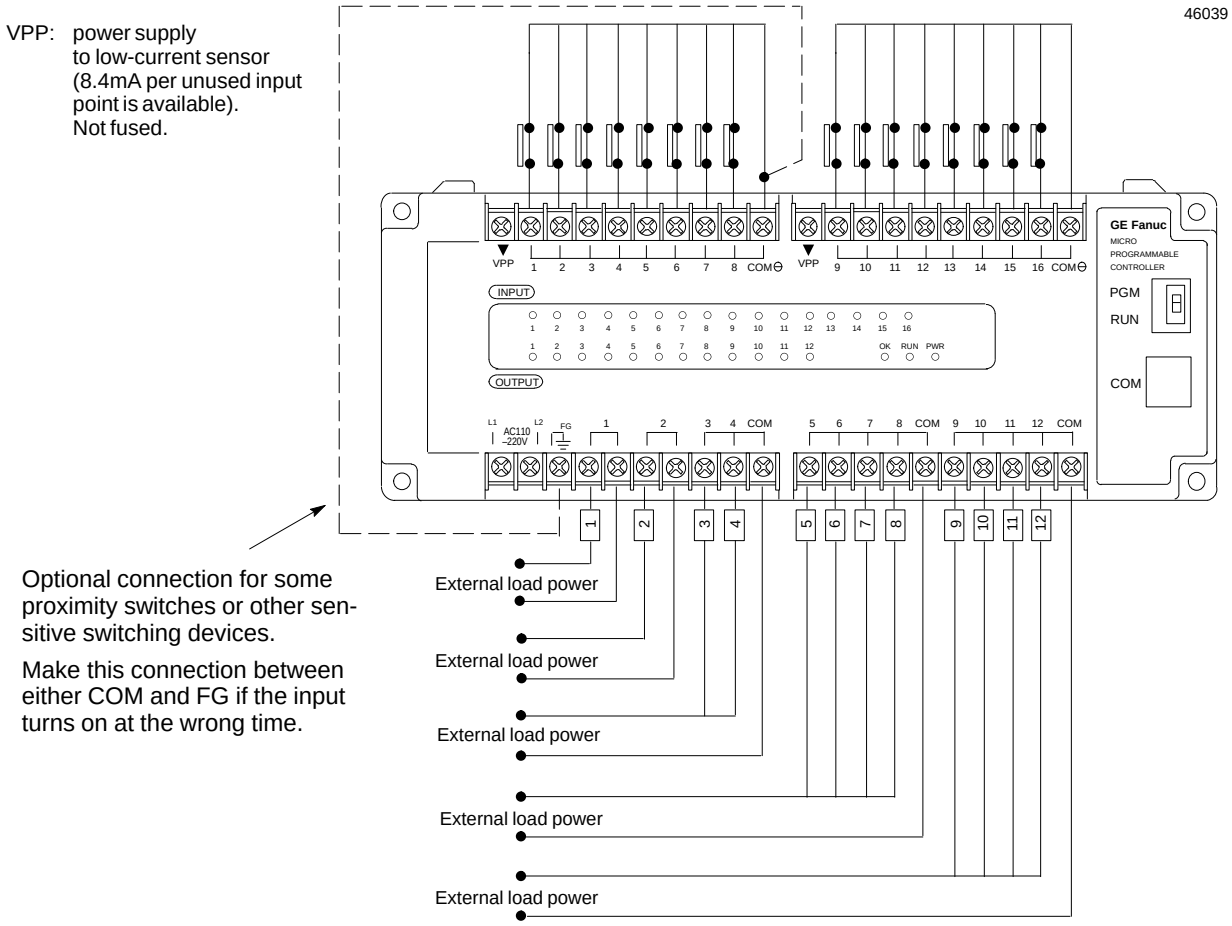


Typical Transistor Output Circuit



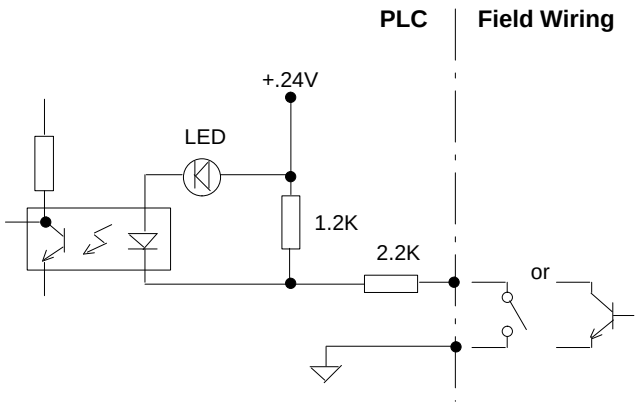
I/O Wiring for 28-Point CPU or Expansion Units

The diagrams below show I/O wiring for 28-point units with DC inputs and relay outputs.



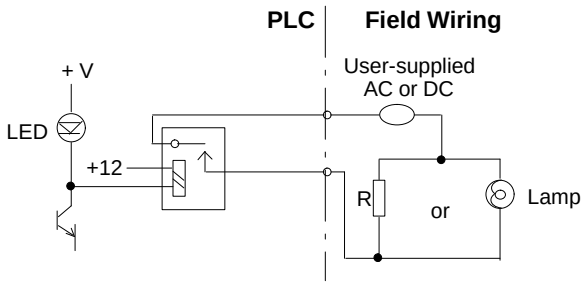
Note: For relays, solenoids, and other inductive loads, install an appropriate suppression device (such as an RC network) at the coil.

Typical DC Input Circuit



Typical Relay Output Circuit

46040



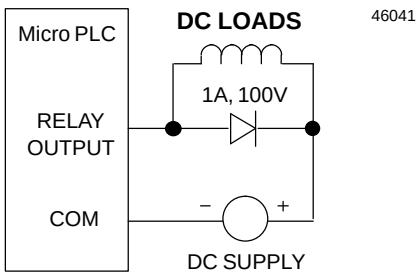
The Micro PLC does not have internal fusing for outputs. If necessary, external fusing can be added. Be sure the type and size of fuse is appropriate for the load.

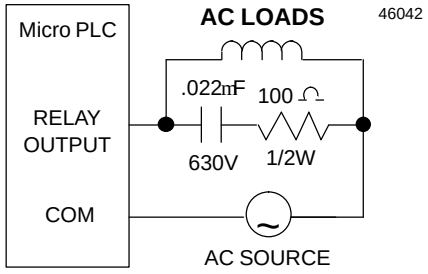
Adding Suppression

Suppression devices can be installed to help lengthen relay contact life, and to help eliminate electrical noise that can sometimes cause mis-operation of the Micro PLC system and / or other nearby sustems.

Relay contact life, when switching inductive loads, will approach resistive load contact life if suppression circuits are used.

The following figures are examples of typical suppression circuits for DC and AC loads. The 1A, 100V diode shown in the DC load typical suppression circuit is an industry standard 1N4934.

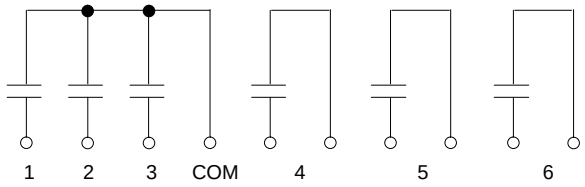




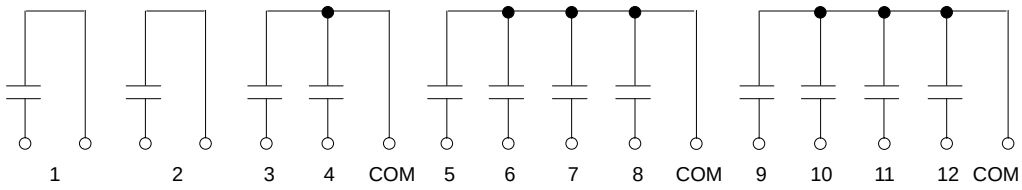
The diagrams below show COM terminal connections for 14-point and 28-point units. On 14-point units, either terminal of points 4, 5, and 6 can be used as the Common terminal. On 28-point units, either terminal of points 1 and 2 can be used as the Common terminal.

46043

Common Terminals for 14-point Units



Common Terminals for 28-point Units

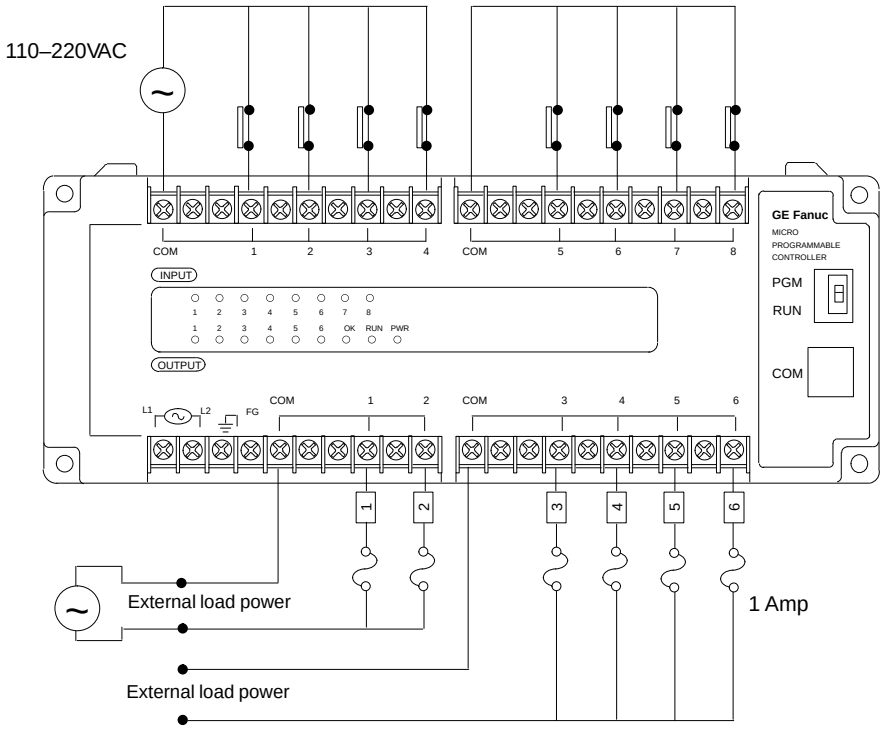


I/O Wiring for Units with AC Inputs and AC Outputs

The diagrams below show typical I/O wiring for 14-point CPU Units with AC inputs and AC outputs.

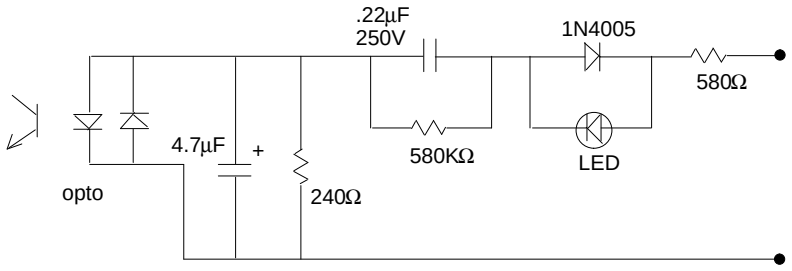
Note: The unit's internal 5 Amp fuse on output circuits is not intended to be replacable. To protect outputs, use of an external 1 Amp fuse is recommended.

46044



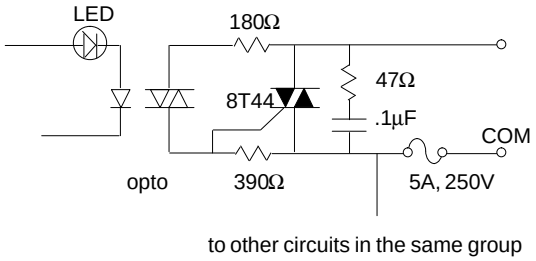
Typical AC Input Circuit

46045



Typical AC Output Circuit

46046

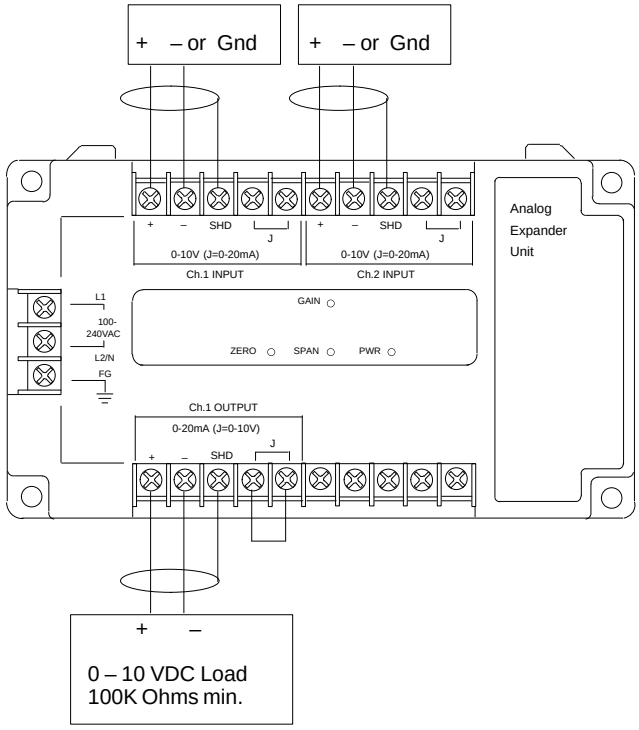


I/O Wiring for an Analog Expander Unit

The diagrams that follow show typical I/O wiring for Analog Expander Units.

Wiring for 0–10VDC Mode

46049



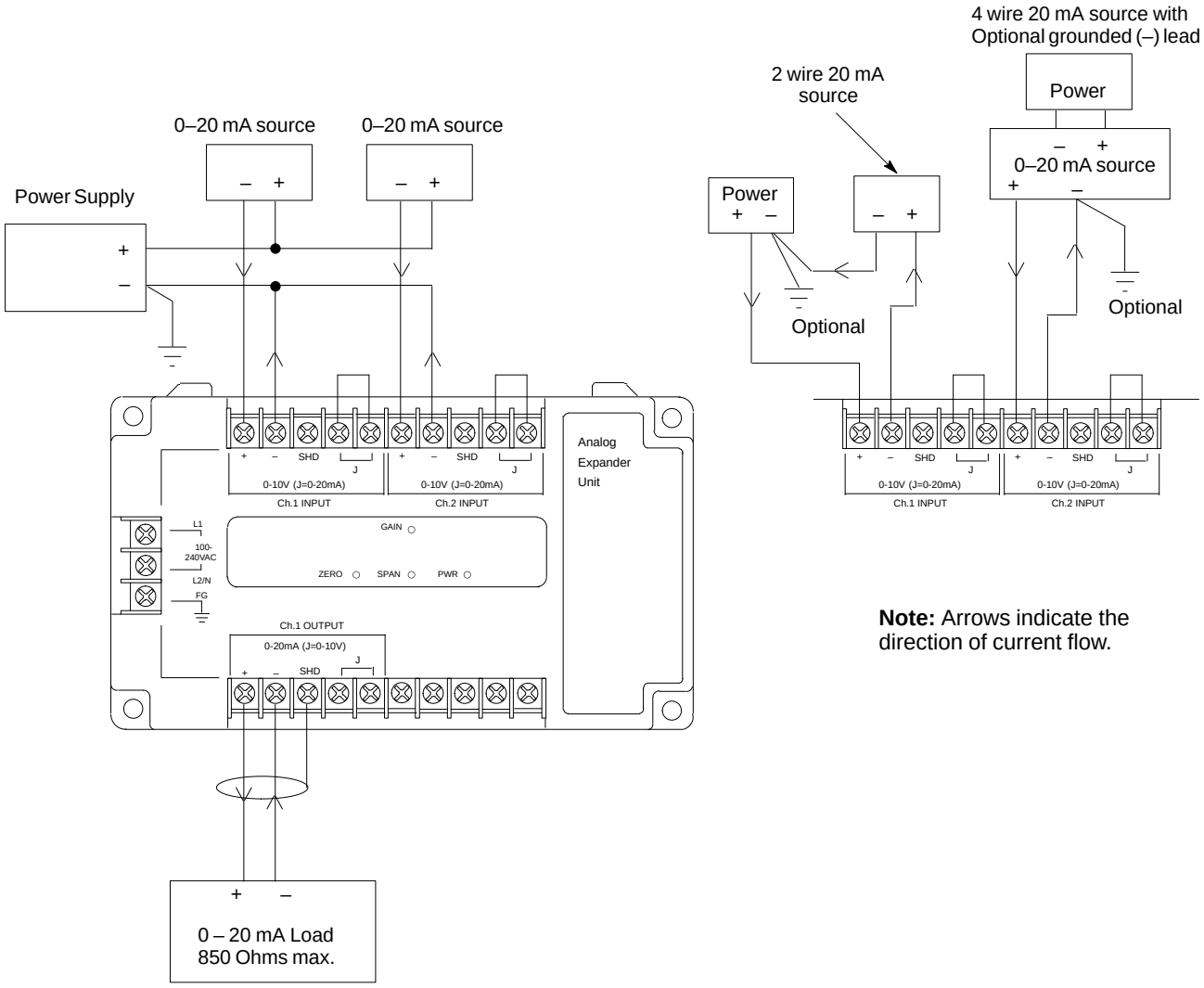
Caution

Do not connect the output (–) terminal to ground. Incorrect operation and/or damage to the unit may result.

Do not short the output (+) terminal to SHD or to the output (–) terminal. Incorrect operation and/or damage to the unit may result.

Wiring for 0–20mA Mode

46050



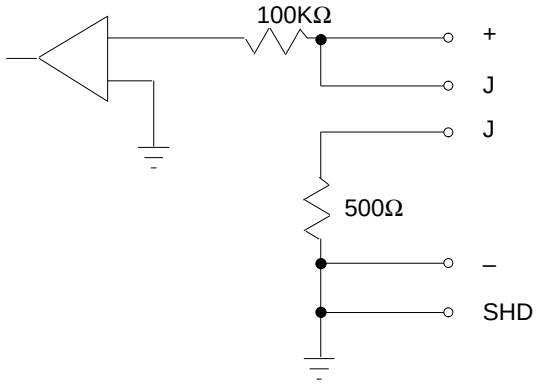
Note: Arrows indicate the direction of current flow.

Caution

Do not connect the output (–) terminal to SHD or any other ground. Incorrect operation in 0 – 20 mA mode will result, and the unit may be damaged.

Analog Input Circuit

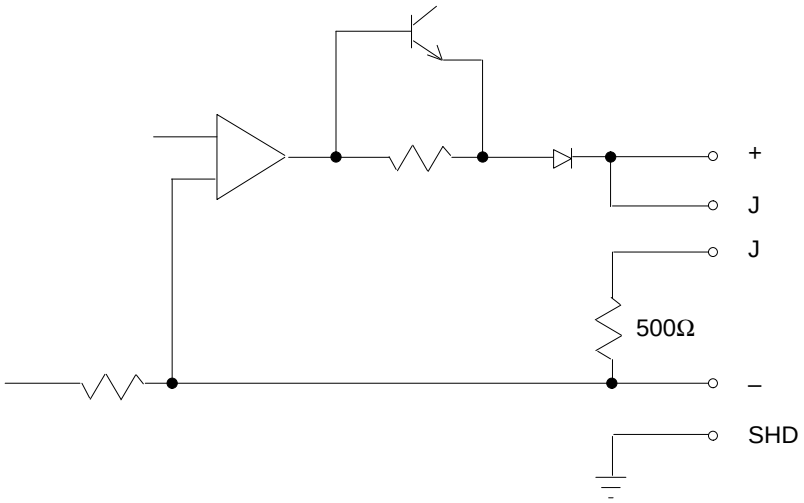
46047



Unused inputs must be grounded: connect + to – to SHD.

Analog Output Circuit

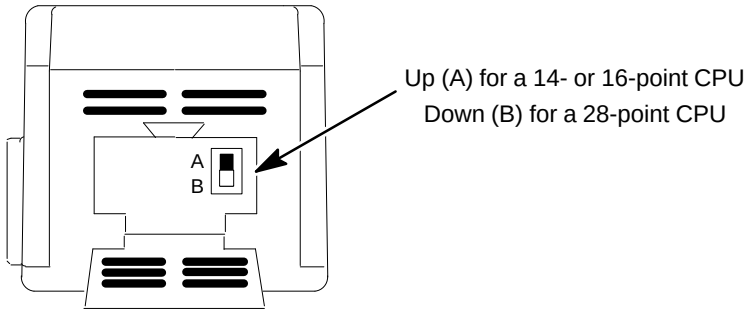
46048



Selecting Operation with a 14 or 28 Point CPU

Set the DIP switch inside the door on the left side of the Analog Expander Unit to select operation for a 14 / 16 or 28 Point CPU.

46199



Selecting the Operating Mode

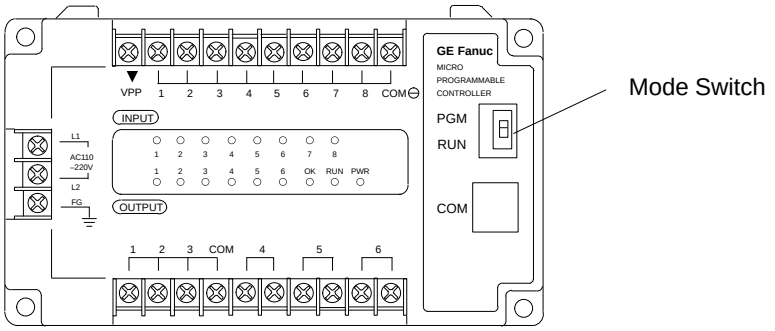
The PLC has two operating modes, Run and Stop. Stop mode is also referred to as Program mode. When the PLC is in Stop mode, the application program does not execute.

The PLC must be placed in Stop mode for program editing and transfer.

When the PLC is in Stop mode, outputs can either hold their last states, or be set to 0. By default, they are set to 0. However, there is a special program coil, described in the programming chapter, that can be used in the application program to cause outputs to hold their last states in Stop mode.

Controlling the Operating Mode from the CPU Unit

With power applied to the Micro PLC, use the switch on the front of the CPU unit to control its operating mode: Run or Program (stop).



If there is an Expander unit, its operation is also controlled by the switch on the CPU unit.

Changing the Operating Mode from the Programmer

The Hand-held Programmer or PC programmer can also be used to select the operating mode of the PLC. However, a stop setting of the mode selection switch on the CPU unit always takes precedence over a Run mode selection made from a programmer.

If the switch on the CPU unit is set to Run mode, the Hand-held Programmer or PC programmer can be used to select the operating mode If the switch is set to Stop mode, the PLC's operating mode cannot be changed from a programmer.

Similarly, if the PLC has been placed in Stop mode from a programmer (the CPU switch must be in Run mode to do that), you can place the PLC back in Run mode by changing the CPU switch setting to Program (stop) then back to Run mode. That will override the Stop mode commanded by the programmer.

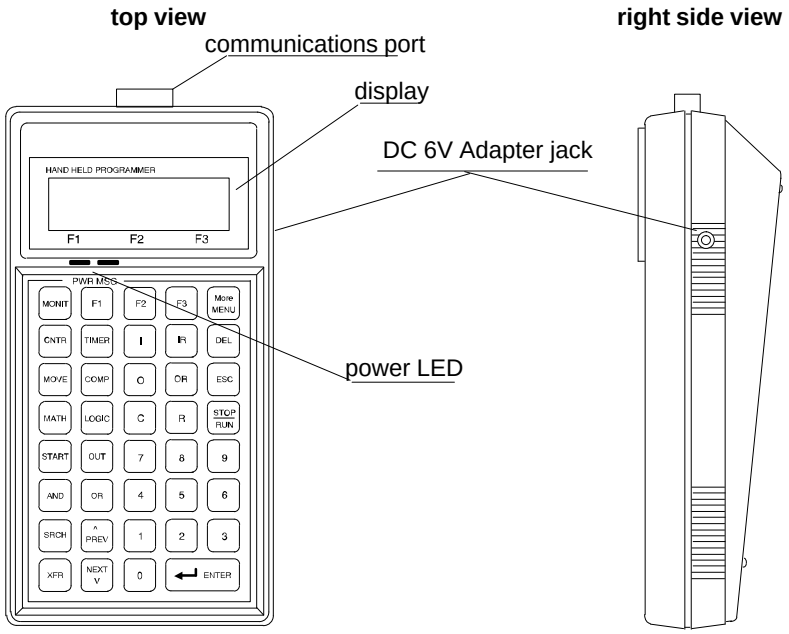
Chapter 4 The Hand-held Programmer

This chapter describes the Hand-held Programmer.

- Parts of the Hand-held Programmer
- Hand-held Programmer Specifications
- Getting the HHP Ready to Use
- Operating Power Supply
  - Online Mode
  - Offline Mode
  - Internal Battery Backup Operation
- Keypad Functions
- Powerup Displays
- Using the Online Functions of the HHP
  - Transferring a Program
  - Monitoring Program Data
  - Forcing I/O Bits
  - Modifying Word (Register) Data

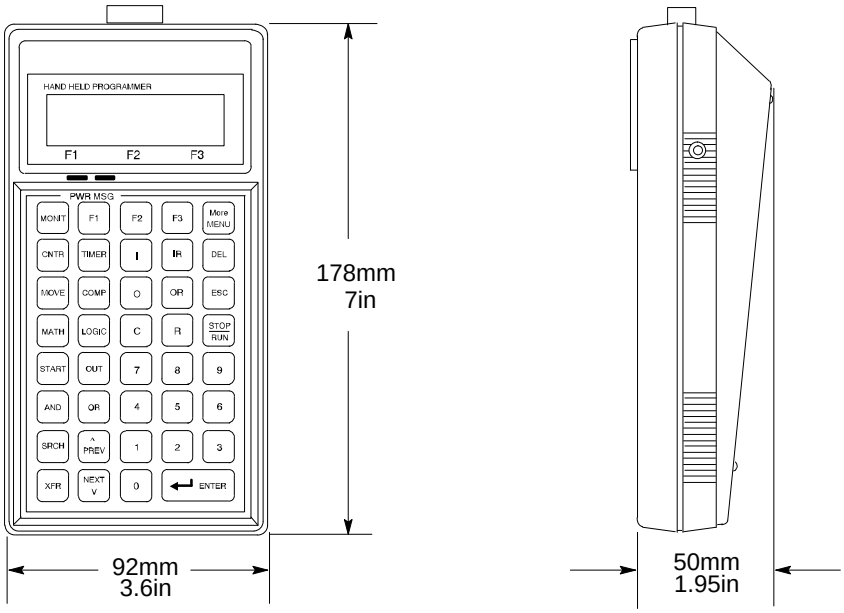
Parts of the Hand-held Programmer

46052



Dimensions

46053



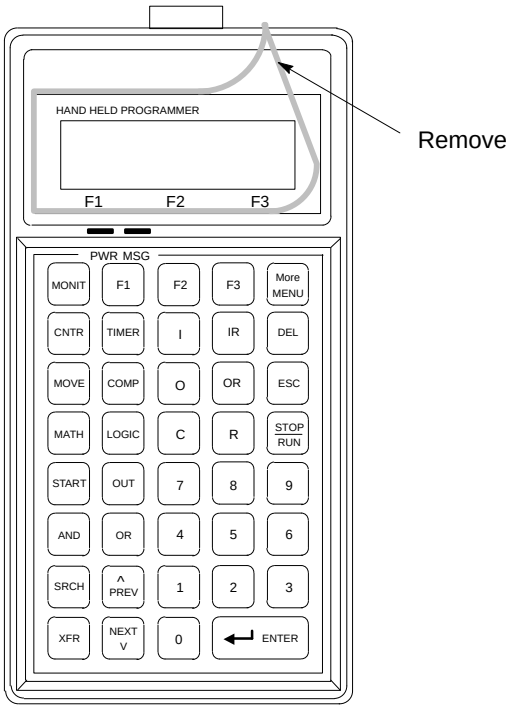
Hand-held Programmer Specifications

Item	Specification
Processor	Intel8031AH
Memory	RAM CMOS 16K words
Mode	Online / offline programming
Interface	RS–232C compatible 9-pin serial communications
Input voltage	From PLC, or from 6VDC, 400mA adapter
Power Consumption	1 Watt (200mA) @ 5VDC, ±.23V
Dimensions	178mm H x 92mm W x 50mm D 7" H x 3.6" W x 1.95" D
Weight	320g (0.7 lb)
Display	LCD with back-lighting 2 lines, 16 characters per line
Keypad	39-key soft-touch membrane contact keypad with beep
LEDs	Power and error LED indications

Getting the HHP Ready to Use

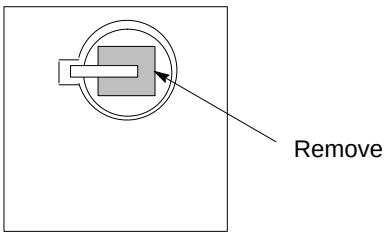
Removing the Protective Cover from the Display

A new Hand-held Programmer may have a removable protective plastic covering over the display window. It can be peeled off when the HHP is ready for use in an application.



Removing the Battery Insulator (for HHP version HHP01A only)

Hand-held Programmer IC620HHP001A is shipped with a plastic insulator over the battery, which is located inside the door on the back of the unit. It is not necessary to remove the protective cover to use the HHP. However, it is necessary to remove the cover to save program information when the HHP is disconnected from the PLC or other power source.

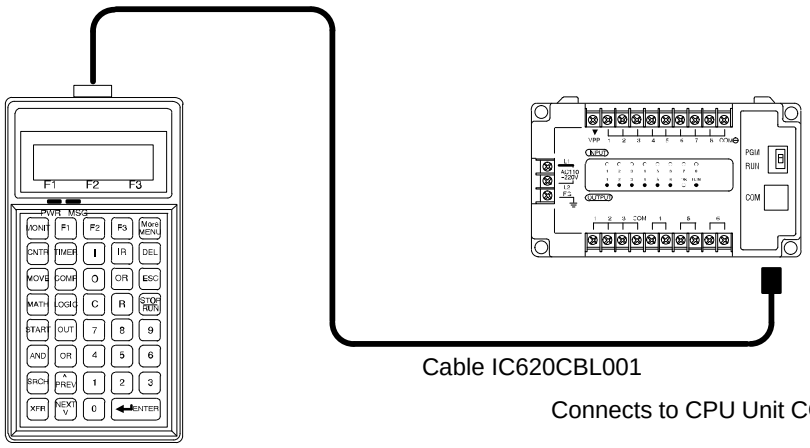


If you operate the HHP without removing the plastic insulator, the BATT LED on the front of the unit will stay lit.

Operating Power Supply

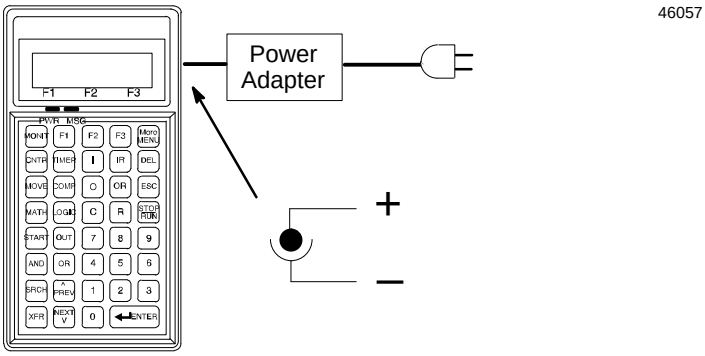
Online Mode

When you want to use the Hand-held Programmer in online or monitoring mode, use the HHP / PLC cable to connect the Hand-held Programmer to the micro PLC. The operating power for the Hand-held Programmer will come from the PLC.



Offline Mode

If you want to use the Hand-held Programmer in offline mode, connect it to a power source using a standard 6V DC adapter (400 mA).

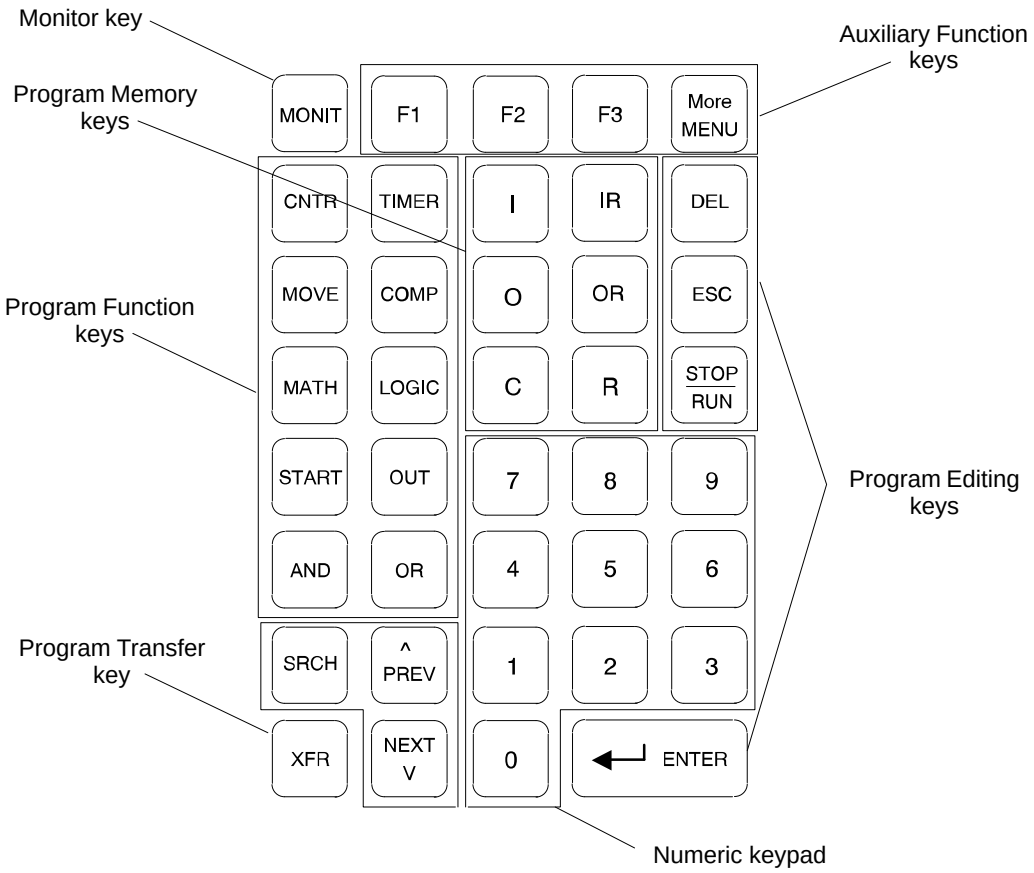


Keypad Functions

The keypad of the Hand-held Programmed is logically divided into groups:

- Program function keys
- Program memory keys
- Program editing keys
- Auxiliary function keys
- Numeric keypad
- Program transfer key
- Monitor key

46058



Key Definitions

Item	Key	Selection/Description
Program Function	START	START, START NOT
	.AND.	AND, AND NOT, CONNECTING AND
	.OR.	OR, OR NOT, CONNECTING OR
	OUT	OUT, DROP, SET, RESET, MCR, SKIP, END
	MATH	ADD, SUB, MUL, DIV (+, –, X, B)
	LOGIC	AND, IOR, XOR, NOT, SHR, SHL
	COMP	EQ, GT, LT, NE, GE, LE (=, >, <, 0, ≥, ≤)
	MOVE	MOVE, BLOCK MOVE, INDIRECT MOVE
	CNTR	UPCNT, DWNCNT (Upcounter, Downcounter)
	TIMER	OPTIM, OFFTIM (Ontimer, Offtimer)
Program Memory	I	Input
	O	Output
	C	Internal Relay
	R	Internal Register
	IR	Input Register
	OR	Output Register
Program Editing	ENT	ENTER (to accept command into memory)
	DEL	DELETE (element, rung, program)
	ESC	ESCAPE (abort operation)
	SRCH	SEARCH (operand, rung)
	PREV	PREVIOUS RUNG
	NEXT	NEXT RUNG
Auxiliary Functions	F1	PTRAN, DROP, MCR, ADD, DIV, AND, NOT, MOVE, EQ, NE, UPCNT
	F2	NTRAN, SET, SKIP, SUB, IOR, SHR, B–MOV, GT, GE, DWNCNT, OFFTIM
	F3	NOT, RST, END, MUL, XOR, SHL, I–MOV, LT, LE
	More MENU	MCR, SKIP, END, DIV, NOT, SHR, SHL, NE, GE, LE (*more MENU selection)
Other	0 – 9	0–9 (numeric data)
	XFER	Transfer Program (to from PLC/PC/EPROM writer)
	MONIT	Online one-point monitoring

Powerup Displays

Software Version

The HHP powerup screen shows the software version of the HHP. In online mode, it also shows the target software version:

Display in Online Mode

Display in Offline Mode

Using the Online Functions of the HHP

You can use the Hand-held Programmer for the following online functions:

- Placing the PLC in Program (Stop) or Run mode
- Transferring a Program
- Monitoring Program Data
- Forcing and unforcing I / O Bits
- Modifying Word (Register) Data

Placing the PLC in Program (Stop) or Run mode

If the mode selection switch on the front of the Micro PLC is presently set to Run mode, the HHP (or PC programmer) can be used to change the PLC operating mode.

Use the Stop / Run key to place the PLC in Program (Stop) mode or Run mode:

Key Operations	HHP Displays
STOP RUN F1 Run Stop F1 F2 Press F1 to place the PLC in Run mode.	FORCED _ RUN STOP
STOP RUN F2 Press F2 to place the PLC in Stop mode.	FORCED _ RUN STOP

It is necessary to press the Stop / Run key before each mode change.

If the mode selection switch on the front of the Micro PLC is presently set to Program (Stop) mode, it cannot be overridden by the HHP or PC programmer.

Transferring a Program

Transfer Instructions

After setting up the devices as described, use the XFER (F1) key to transfer a program between the HHP and another device.

Key Operations		HHP Displays
F1 XFER	PLC PROM PC F1 F2 F3	TRANSFER TO/FROM PLC PROM PC

Use the F1, F2, or F3 key to specify the other device involved in the program transfer.

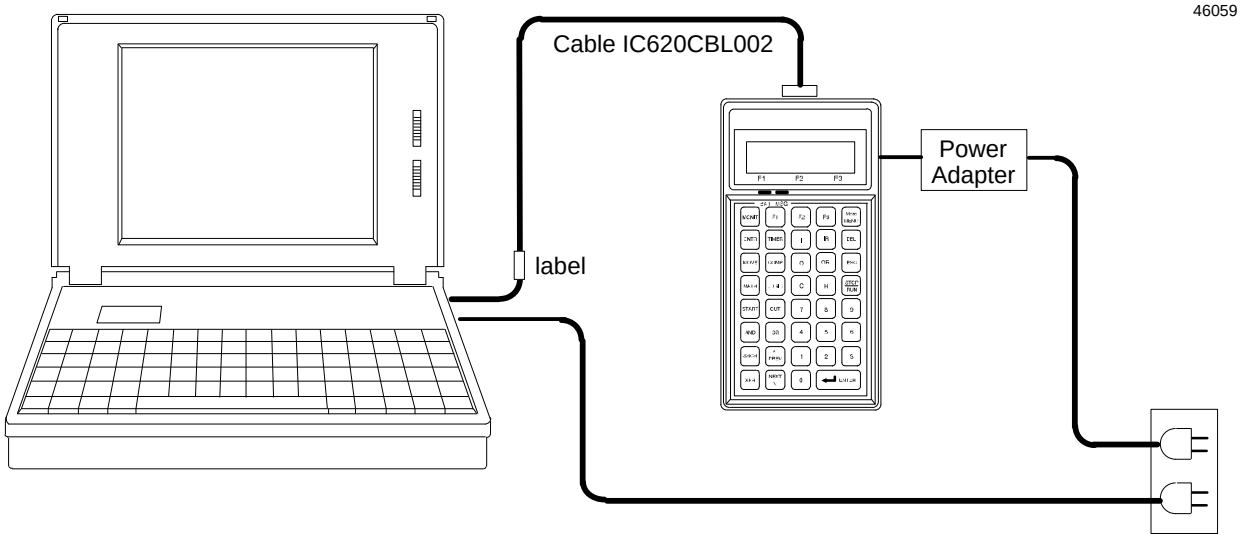
Transferring a Program to or from an EPROM Programmer

When transferring a program to or from an EPROM Programmer, follow the connection procedure and instructions on pages C-11 and C-17.

Transferring a Program to or from a Computer

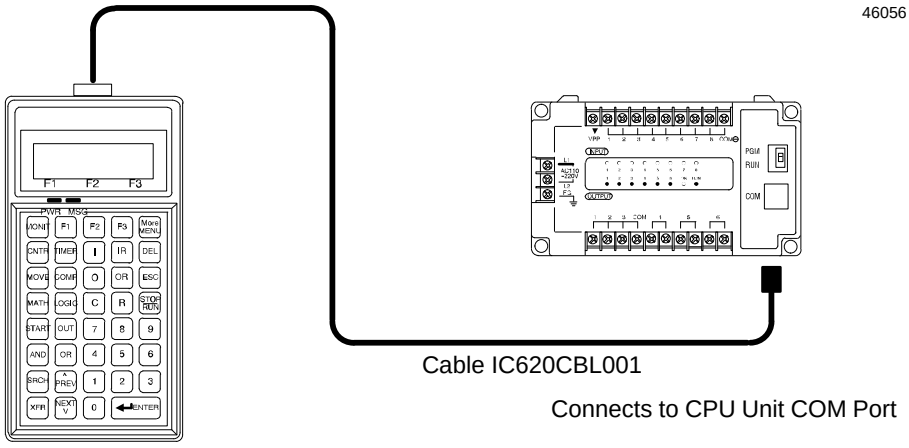
When transferring a program to or from a computer, set up the HHP and computer as shown below.

1. **Connect the HHP-EPW-PC cable (IC620CBL002) between the HHP and the computer.** Connect the end nearest the label to the computer.
2. **Connect the HHP and the computer to the same input power source.**



Transferring a Program to or from the Micro PLC

1. Connect the programming cable between the HHP and the computer.



2. To transfer a program to or from the PLC, first use the F1 key as instructed above. Then, use the F1 or F2 key to specify the direction of the program transfer.

To upload a program from the PLC to the HHP, the PLC must be in Program (Stop) mode.

Key Operations	HHP Displays
F1 (UPLD F1 DWNLD F2)	PLC TRANSFER UPLD DWNLD
F1 or F2	PROGRAM START STA I001 Dwnload Complete Press Any Key

Error Messages

If an error occurs during program transfer from the Hand-held Programmer to the PLC, the HHP displays an explanatory message:

PLC TRANSFER Open Rung	An open rung or other program error was encountered.
PLC TRANSFER PLC in RUN Mode	The PLC was in Run mode when the transfer was attempted.

Monitoring and Changing Program Data

Follow the steps below to monitor or change bit-type and word-type data.

After displaying an operand, you can use the NEXT and PREV keys to monitor other values of the same type.

- use the NEXT key to increment the display by one bit or word at a time.
- use the PREV key to decrement the display by one bit or word at a time.

Key Operations	HHP Displays
I/O enter number ENTER The operand may be an I, O, IR, OR, C, or R address.	MONITOR I1 Empty Location
Examples:	
I 1 ENTER This example selects input (I) 1. The HHP displays 8 bits of data: I001 to I008	I001 □ R MODIFY FON FOFF
O 1 5 ENTER This example selects output (O) 15. The HHP displays 8 bits of data: O015 to O022	O015 □ R MODIFY FON FOFF
C 5 0 ENTER This example selects relay operand C050. The HHP dusplays 8 bits of data: C050 to C057	C0050□ R MODIFY
R 8 ENTER This example selects register operand R8. The HHP displays the content of R8	R008: 0 R MODIFY
IR 3 ENTER This example selects input register IR3. The HHP displays the content of IR3	□003: 0 R MODIFY
OR 9 ENTER This example selects output register OR9. The HHP displays the content of OR9	■009: 0 R MODIFY

Solid Box = On
Underlined Box = Overridden (forced)

Forcing I/O Bits

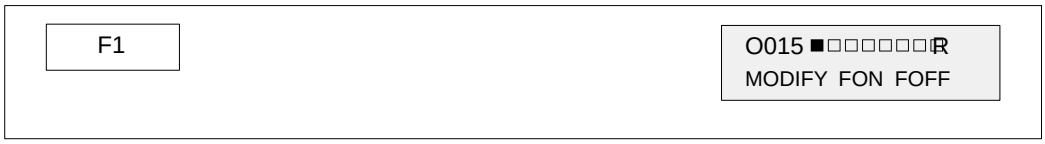
Sometimes it is desirable to temporarily change the state of a discrete point. This can be done from the Hand-held Programmer by toggling the point or overriding (forcing) it. Toggling will temporarily change the state of the point, but the logic program will have precedence if it refers to that point. If the point is overridden (forced), then the state of the point cannot be changed by the logic program.

When monitoring bit data with the HHP, you can use the F1 – F3 keys to change the state of the data. First display the data as described previously:

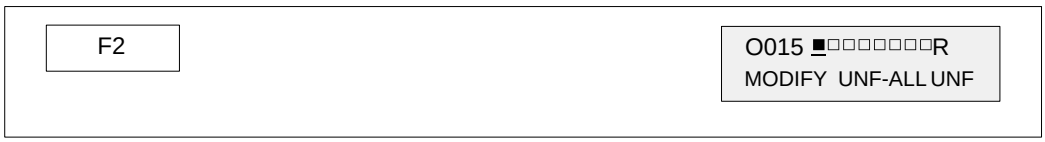
Key Operations	HHP Displays
O 1 5 ENTER This example selects output (O) 15. The HHP displays 8 bits of data: O015 to O022	O015 □ R MODIFY FON FOFF

Press the MODIFY (F1) key to change the data. Then:

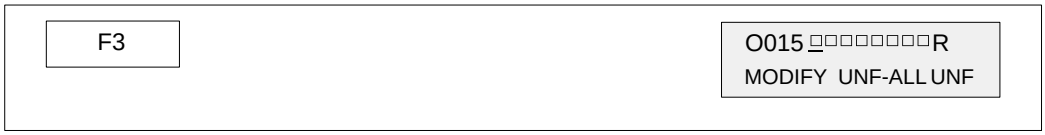
- use F1 to toggle the selected data bit on and off. In the illustration below, output bit O015 is selected. Pressing F1 would toggle the state of O015 on and off. A solid box means a bit is on. An underlined box means the bit is overridden (forced).



- use F2 to force the selected bit on. The HHP indicates that the bit is forced with an underscore on the display. The solid box means the bit is on. When a bit is forced, the functions of the F2 and F3 keys change to “unforce”.



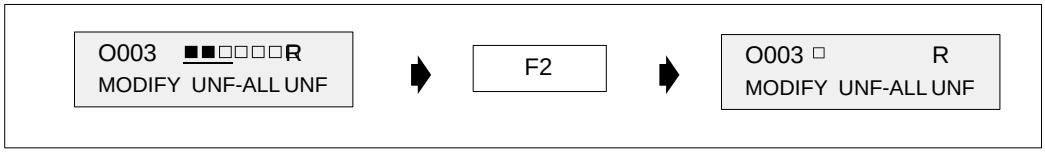
- use F3 to force the selected bit off. The HHP indicates that the bit is forced with an underscore on the display. The empty box means the bit is off. When a bit is forced, the functions of the F2 and F3 keys change to “unforce”.



Unforcing I/O Bits

You can unforce one bit at a time, or unforce all currently-forced bits at the same time. Use F3 to unforce one bit. Use F2 to unforce all bits that are currently forced.

In the following example, bits O003 and O004 are forced on. Bit O005 is forced off. Pressing F2 removes all the forces. In this example, the unforced state of O003, O004, and O005 is off.



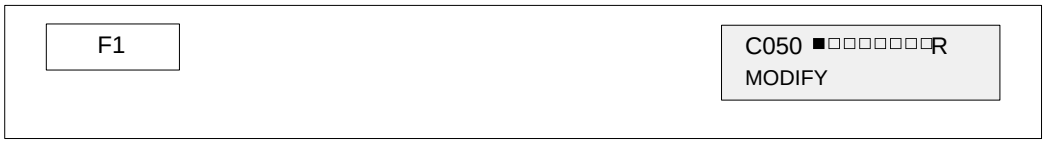
Forcing Internal Relay Bits

When monitoring internal relay bit (C) data with the HHP, you can use the F1 key to change the state of the data. First display the data as described previously:

Key Operations	HHP Displays
C 5 0 ENTER This example selects relay operand C050. The HHP displays 8 bits of data: C050 to C057	C0050 □□□□□□□□R MODIFY

Press the Modify (F1) key to change the data. Then:

- use F1 to toggle the selected data bit on and off. In the illustration below, internal bit C050 is selected. Pressing F1 would toggle the state of C050 on and off. A solid box means a bit is on. An underlined box means the bit is overridden (forced).



Modifying Word (Register) Data

When monitoring word (R, IR, or OR) data with the HHP, you can use the F1 key to change the value of the data. First display the data as described previously:

Key Operations	HHP Displays
R 8 ENTER This example selects register operand R8. The HHP displays the content of R8	R008: 0 R MODIFY

□ use F1 to modify the selected data word. Enter the new value for the data. Then press the ENTER key to accept the data.

Key Operations	HHP Displays
F1 Enter the new value. For example, 10. ENTER	R008: 10 R MODIFY

Chapter 5 The Operator Interface Unit

This chapter describes the Operator Interface Unit.

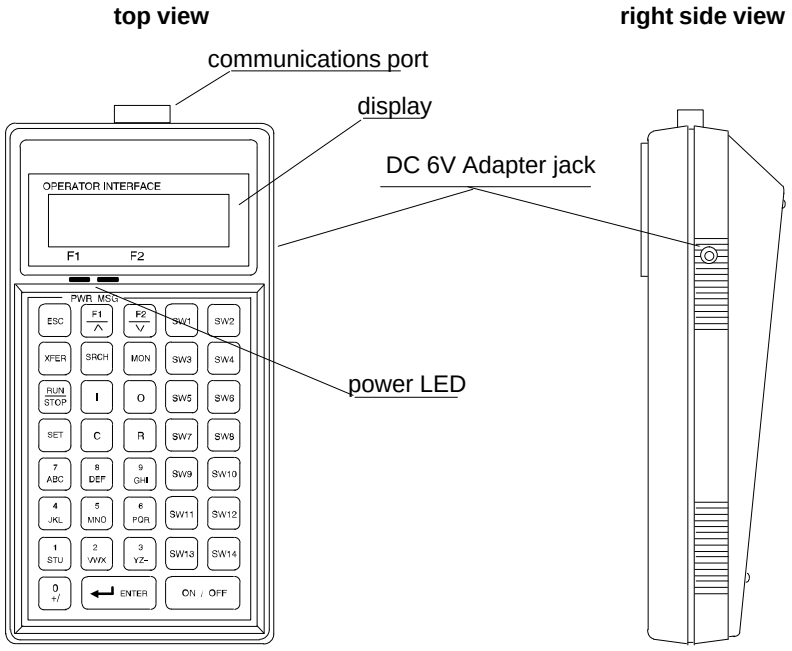
- Parts of the Operator Interface Unit
- Dimensions
- Operator Interface Unit Specifications
- Getting the OIU Ready to Use
- Operating Power Supply
- Keypad Functions
- Powerup Displays
- Changing the Operating Mode of the PLC
- Program Listing
- Program Transfer
- Program Searching
- Monitoring and Changing Program Data
- Setting the Operation Keys
- Using the Operation Keys
- Changing Data that is Associated with Operation Keys

The Operator Interface Unit (OIU) performs many of the same functions as a Hand-held Programmer. It can be used to monitor program data and I/O status and to change the operating mode of the PLC. It can display an application program, but it cannot be used to create or edit a program.

In addition to its basic features, the OIU has fourteen configurable software keys. These keys are easily set to display operator messages for up to 14 discrete and/or register data items. In addition, the OIU can be used to quickly change the state or value of any of the 14 data items that have been assigned to software keys.

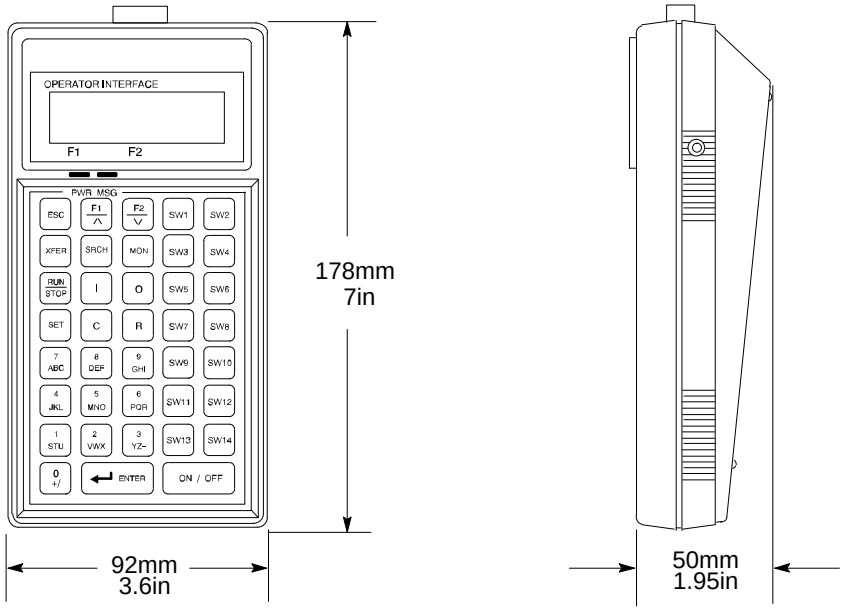
Parts of the Operator Interface Unit

46060



Dimensions

46061



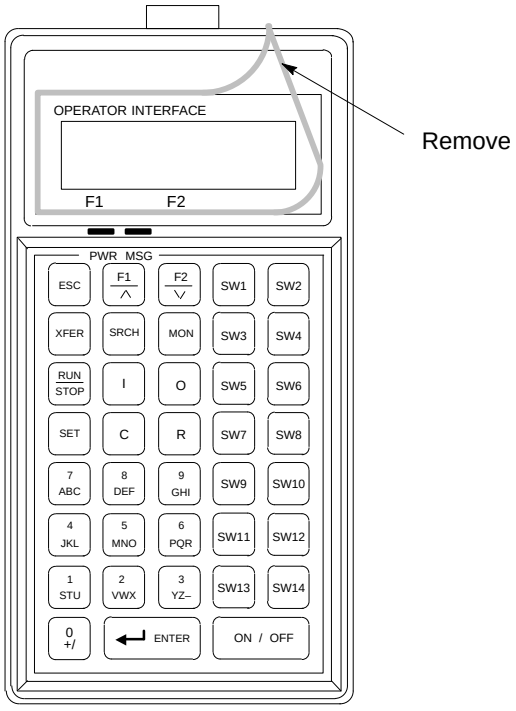
Operator Interface Unit Specifications

Item	Specification
Processor	Intel8031AH
Memory	RAM CMOS 16K words
Mode	Online / offline programming
Interface	RS–232C compatible 9-pin serial communications
Input voltage	From PLC, or from 6VDC, 400mA adapter
Power Consumption	1 Watt (200mA) @ 5VDC, ±.23V
Dimensions	178mm H x 92mm W x 50mm D 7” H x 3.6” W x 1.95” D
Weight	320g (0.7 lb)
Display	LCD with back-lighting 2 lines, 16 characters per line
Keypad	39-key soft-touch membrane contact keypad with beep
LEDs	Power and error LED indications

Getting the OIU Ready to Use

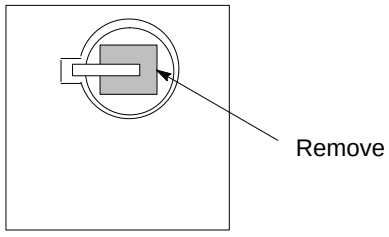
Removing the Protective Cover from the Display

A new Operator Interface Unit may have a removable protective plastic covering over the display window. It can be peeled off when the OIU is ready for use in an application.



Removing the Battery Insulator

The OIU is shipped with a plastic insulator over the battery, which is located inside the door on the back of the unit. It is not necessary to remove the protective cover to use the OIU. However, it is necessary to remove the cover to save operation key (SW1 to SW14) settings, or for storing program information when the OIU is disconnected from the PLC or other power source.

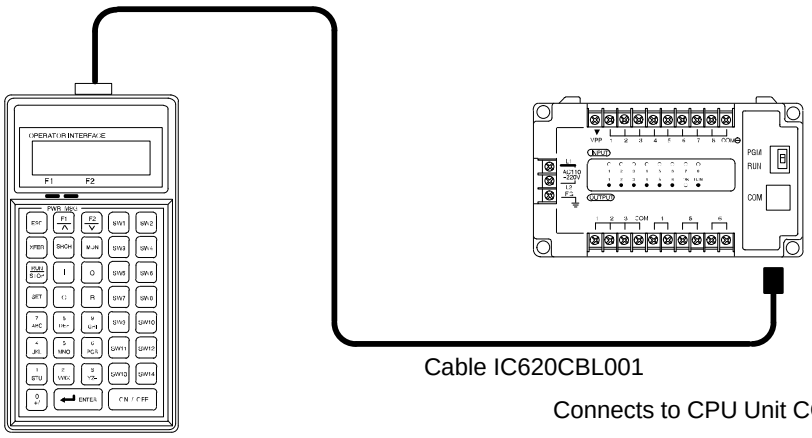


If you operate the OIU without removing the plastic insulator, the BATT LED on the front of the unit will stay lit.

Operating Power Supply

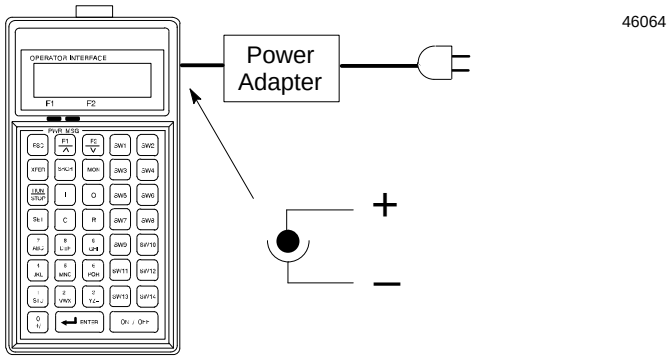
Online Mode

When you want to use the OIU in online or monitoring mode, use the OIU / PLC cable to connect the OIU to the micro PLC. The operating power for the Operator Interface Unit will come from the PLC.



Offline Mode

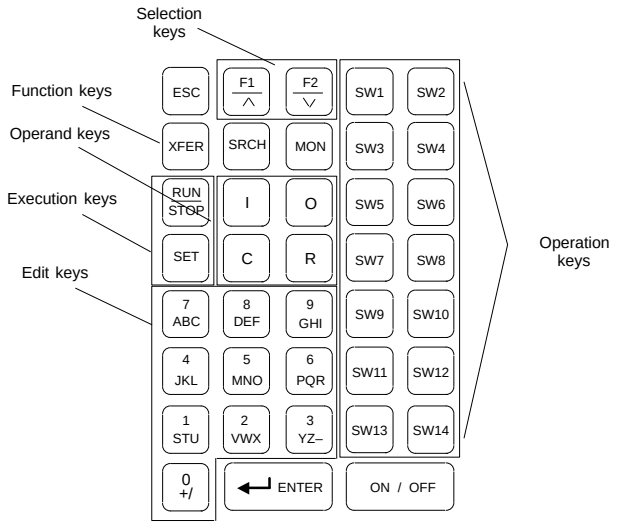
If you want to use the Operator Interface Unit in offline mode, connect it to a power source using a standard 6V DC adapter (400 mA).



Offline mode can be used to program the function messages without being connected to a CPU.

Keypad Functions

The keypad of the OIU is logically divided into groups:



Key Definitions

Item	Key	Selection/Description
Operand	**I** **O** **C** **R**	Set or select Input Set or select Output Set or select Internal Relay Set or select Internal Register
Edit	**0 +/** to **9 GHI**	Set Label, or select item to monitor
Function	**XFER** **SRCH** **MON**	Transfer program to/from PLC Search program Monitor operation status
Selection	**F1 /**	Select Upload (XFER) Run (Run/Stop) Search Previous Rung Move Cursor left to set label
	F2 \/	Select Download (XFER) Run (Run/Stop) Search Previous Rung Move Cursor right to set label
Operation	**SW1** to **SW14**	After functions are assigned: ON/OFF Function key for discrete control Change register data
Execution	**XFER** **RUN/STOP** **ESC**	Set of change operand key or label Select Run/Stop mode Escape

Powerup Displays

The OIT powerup screen shows the software version of the OIU.

```
Portable O. I. U
      VERS  1.15
```

Changing the Operating Mode of the PLC

If the mode selection switch on the front of the Micro PLC is presently set to Run mode, the OIU (or an HHP or PC programmer) can be used to change the PLC operating mode.

Use the RUN / STOP key, then the F1 or F2 key to place the PLC in Program (Stop) mode or Run mode:

Key Operations	OIU Displays
RUN STOP, F1 Run Stop F1 F2 Press F1 to place the PLC in Run mode. The LED on the CPU is ON.	FORCED _ RUN STOP
RUN STOP, F2 Press F2 to place the PLC in Stop mode. The LED on the CPU is OFF.	FORCED _ RUN STOP

Be sure to press RUN / STOP before pressing F1 or F2.

Note

If the mode selection switch on the front of the Micro PLC is presently set to Program (Stop) mode, it cannot be overridden by the HHP or PC programmer.

Program Listing

To display a program, press the ENTER key from the powerup screen.

Program Transfer

Use the XFER (F1) key to transfer a program between the OIU and the PLC.

Key Operations	OIU Display
XFER	PLC TRANSFER UPLD DWNLD

To download a program from the OIU to the PLC, the PLC must be in Program (Stop) mode.

Key Operations	OIU Displays
F1 (UPLD F1 DWNLD F2)	PLC TRANSFER UPLD DWNLD
F1 or F2	PROGRAM START STA I001 Dwnload Complete Press Any Key

Error Messages

If an error occurs during program transfer from the Hand-held Programmer to the PLC, the HHP displays an explanatory message:

PLC TRANSFER Open Rung	An open rung or other program error was encountered.
PLC TRANSFER PLC in RUN Mode	The PLC was in Run mode when the transfer was attempted.

Program Searching

Use the SRCH key to locate a program rung. The steps below show how to search for an operand, element, or rung number, or the start or end of the program.

Key Operations	OIU Displays
SRCH I/O enter number ENTER The search operand may be I, O, C, or R.	AND I001 OUT O017
SRCH 1 0 ENTER This example searches for rung number 10.	OUT O040 Empty location
SRCH 0 To locate the start of the program, search for rung 0.	PROGRAM START STA I001
SRCH ENTER To locate the end of the program, search with no rung number.	OUT O040 Empty location

Monitoring and Changing Program Data

Follow the steps below to monitor or change bit-type and word-type data.

Key Operations	OIU Displays
I/O enter number ENTER The operand may be an I, O, IR, OR, C, or R address.	MONITOR I1 Empty Location
Examples:	
I 1 ENTER This example selects input (I) 1. The HHP displays 8 bits of data: I001 to I008	I001 □ R MODIFY
O 1 5 ENTER This example selects output (O) 15. The HHP displays 8 bits of data: O015 to O022	O015 □ R MODIFY

Changing Discrete Data

With the PLC in Program mode, you can change the state of the data. First display the data as described above.

Then, use F1 to toggle the selected data bit on and off. In the illustration below, output bit O015 is selected. Pressing F1 would toggle the state of O015 on and off. A solid box means a bit is on. The bit being monitored is always in the leftmost position on the display.

Key Operations	OIU Displays
O 1 5 ENTER This example selects output (O) 15. The HHP displays 8 bits of data: O015 to O022	O015 □□□□□□□□R MODIFY
F1	O015 ■□□□□□□□R MODIFY FON FOFF

Modifying Word (Register) Data

When monitoring word (R) data with the OIU, you can use the F1 key to change the value of the data. First display the data as described previously:

Key Operations	OIU Display
R 8 ENTER This example selects register operand R8. The HHP displays the content of R8	R008: 0 R MODIFY

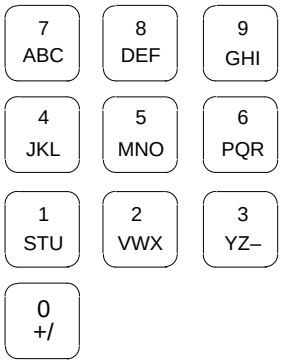
Use F1 to modify the selected data word. Enter the new value for the data. Then press the ENTER key to accept the data:

Key Operations	OIU Display
F1 Enter the new value. For example, 10. ENTER	R008: 10 R MODIFY

Setting the Operation Keys

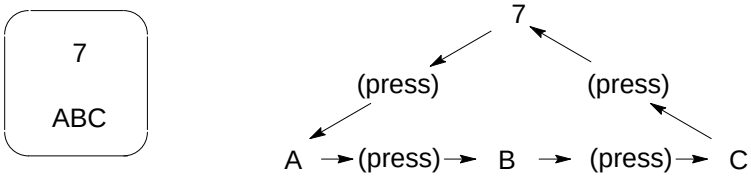
Keys SW1 to SW14 on the Operator Interface Unit can be programmed to display custom operator messages for selected discrete points or registers. When the keys have been set up for a specific application, information on their use should be provided for persons operating the equipment.

1. To save messages, the plastic insulator on the battery must be removed. If the BATT LED on the front of the unit is lit, check open the back of the unit and check the battery.
2. Press the Set key to begin setting the Operation keys.
3. Press an Operation key to be set up. For example, SW1.
4. Specify the I/O point or register you want to associate with that key. For example, input 1 (I1). Press the Enter key when you have completed the entry.
5. Press the F1 key to begin entering text. The cursor moves to the top line.
6. Use the Edit keys (in the gray area of the keypad) to enter the text.



46066

7. Each Edit key has four functions, which are accessed in sequence. For example:



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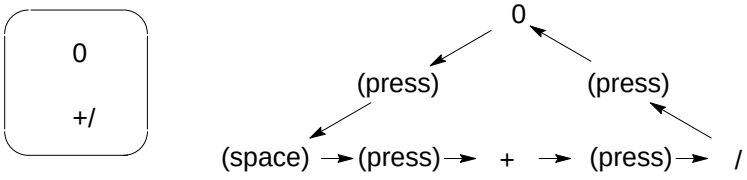
The space (blank) is the first keypress on the 0 key:



46068

Press another Edit key or the F2 key to move the cursor to the right. Press the F1 key if you want to move the cursor left. If you move the cursor to a position that already has content, pressing an Edit key will change the content. When the entry is correct, press the Enter key to save it.

Example:

Key Operations	OIU Displays
SET	SETTING SW ? ? = ? ? ? ?
SW1	SW01 = ? ? ? ?
I 1 ENTER	SW01 = I 1 SW01 = I 001
F1	SW01 = I 001
1 F2 1 1 5 5 5 6 0 1 2 2 9 1 7 9 ENTER	S S ST STO STOP STOP STOP S STOP SW STOP SWI STOP SWIT STOP SWITC STOP SWITCH

Using the Operation Keys

After OIU keys SW1 to SW14 have been programmed, when pressed they will display the selected message, and the present on / off state or register values of the associated points.

For example, when you press the SW1 key, for the example message created on the previous page, the display would be:

```
STOP  SWITCH
I 0 01      OFF
```

Changing Data that is Associated with Operation Keys

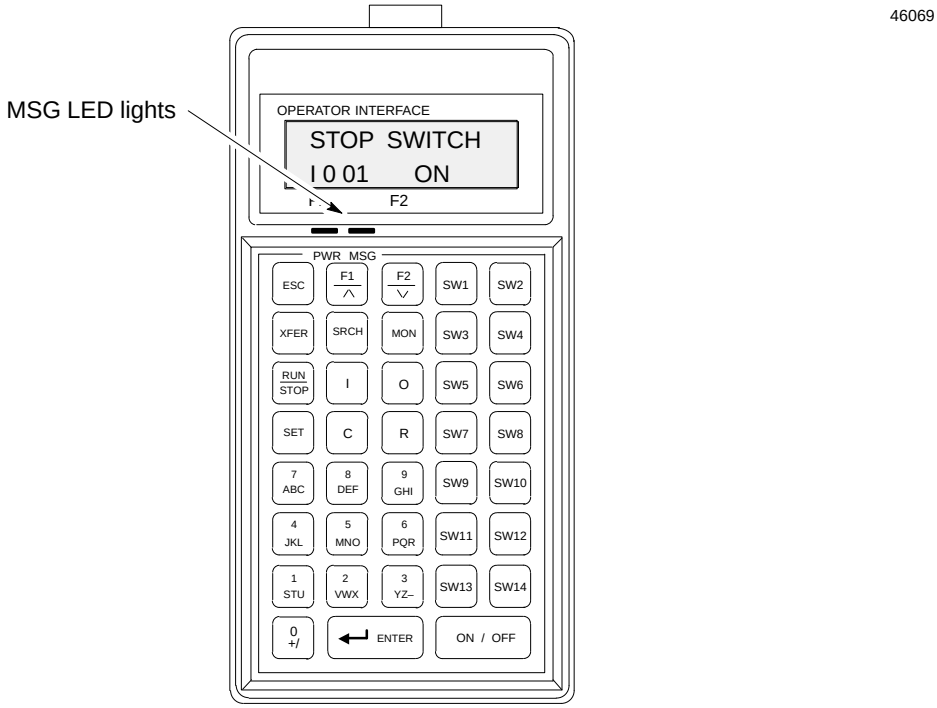
Data associated with Operation keys SW1 to SW14 can be changed from the Operator Interface Unit.

The data is displayed by pressing the associated Operation key, as explained above.

Changing Discrete Data

With the data displayed, press the ON / OFF key on the OIU to change the data's state.

The message LED on the OIU lights to show that the data is forced from its actual state.



Changing Register Data

With the register data displayed, you can change its value from the OIU keypad. Press Enter.

Chapter 6 The Programming Software

This chapter explains the basics of using the Micro PLC programming software. For detailed programming information, refer to the *Micro PLC Programmer's Guide* (GFK–0804).

- Files Provided on the Diskette
- Setup Instructions
  - Hardware Setup
  - Installing the Programming Software
- Automatic Installation on a Hard Disk
- The Programming Software Main Menu
- Software Functions
- Configuring the Programmer
  - Setup Parameters
- Using the File-Handling Functions
  - Loading a Program File
  - Saving a Program File
  - Changing to Another Directory
  - Accessing the DOS Utilities
  - Clearing a Program from Memory
- Using the Online Functions of the Programming Software
  - Connecting the Computer to a Micro PLC
  - Map of the Online Functions
  - Placing the PLC in Stop or Run Mode
  - Transferring a Program
  - Monitoring an Application Program
  - Monitoring and Changing Program Data
- Using the Offline (Programming) Functions
- Programming Operations
- Printing an Application Program
- Exiting the Programming Software

Serial Port Setup

The serial port in the programming computer must be set up for RS-232.

The programming software can use COM1, COM2, COM3, or COM4 as the communications port. Be sure your computer has a serial port available.

Programming Software Files

The programming software is available with product manuals as part number IC620SWP020.

It can also be obtained from a GE Fanuc distributor, or downloaded from the GE Fanuc computer bulletin board (see below).

Installing the Programming Software from the Bulletin Board

If you want to download the latest version of the programming software from the GE Fanuc bulletin board, follow the steps below. (Files from the bulletin board need to be "unzipped" before you can use them).

1. You will probably want to create a new subdirectory on your hard disk. For example:

```
C:> MC MICRO242
C:> CD MICRO242
C:\MICRO242>
```

2. Download the file **VER242.ZIP** from the bulletin board to the **C:\MICRO242>** directory.

3. Use **PKUNZIP** with the **–d** switch to unzip the files:

```
C:\MICRO242> PKUNZIP –d MICRO242
```

4. This creates a subdirectory structure and copies all the files to the appropriate subdirectory under the **\MICRO242**directory.

5. Use an editor (such as DOS EDIT) to append the statement **C:\MICRO242**to the end of your PATH statement. For example:

```
PATH=C:\;C:\DOS;C:\MICRO242;
```

The text files listed below provide on-line information about the software. (Nearly all of the same information is included in these manuals).

README.1ST	contains the most recent notes and comments.
STARTUP.TXT	summarizes startup steps.
DDE.TXT	describes the demo Windows DDE communications driver.
CHANGES.TXT	lists all PLC and software changes that have been made.
COMM.TXT	describes C files that can be used for communications.
DISPLAY.TXT	describes the Display software program.
README.TXT	describes the RTU communications files.

Installing the Programming Software from Diskette

The programming software can be installed on the hard disk of an IBM PC-compatible computer, or run directly from diskette. Before using the programming software, make a backup diskette.

Software installation on a hard disk can be done either automatically or manually. Both methods are explained below.

Automatic Installation

Automatic installation will create the following directory structure on your hard disk (for example, C:>):

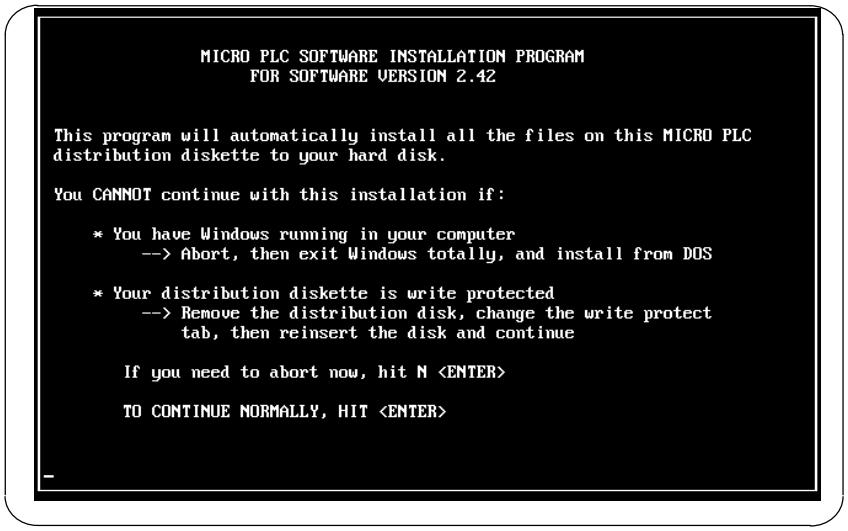
```
C:>
    \MICRO
        MICRO.EXE
        MICRO.CFG
        README.1ST
        etc
        \COMM
            communications driver and sample files
        \DDE
```

To use this method, you must have an AUTOEXEC.BAT file (most computers are shipped with a default AUTOEXEC.BAT file). In addition, you will need about 1 megabyte of available space on the hard disk for all the files listed above. (After installation, you may prefer to delete the documentation, communications drivers and product demonstration files).

If you want to go ahead with automatic installation now, place the software diskette in your computer. Assuming the diskette is now in Drive A and you want to install the software on Drive C, type:

C:> **MODE CO80** (press Enter)
C:> **A:INSTALL** (press Enter)

The following screen appears:



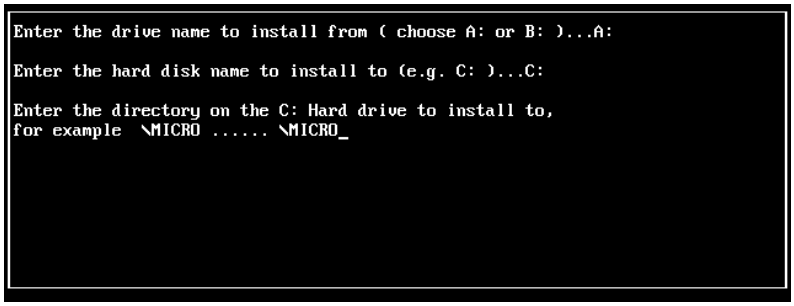
If you press Enter to continue, the next screen appears:

Press Enter to continue. Then, provide the information requested in response to the prompts, as shown on the next page. (If you are not sure of the correct response, press Enter for a default value that is suitable for most applications).

Type in the following information:

- the letter of the drive containing the programming software diskette (A: for example).
- the letter of the hard drive where you want to install the programming software (C: for example).
- the directory on the hard drive where you want the software located (\MICRO for example).

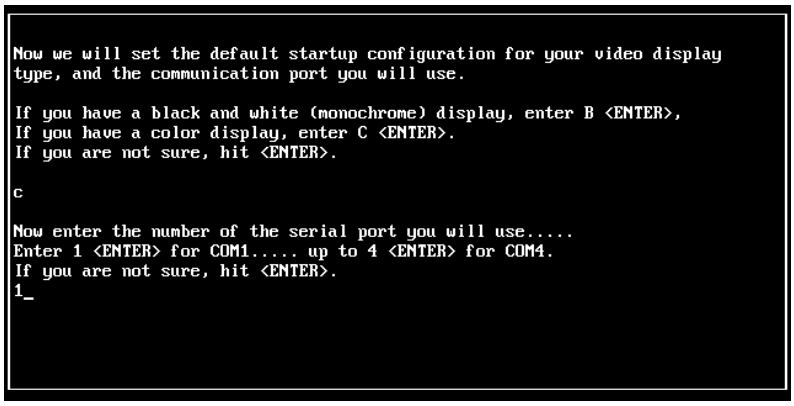
Press the Enter key to continue.

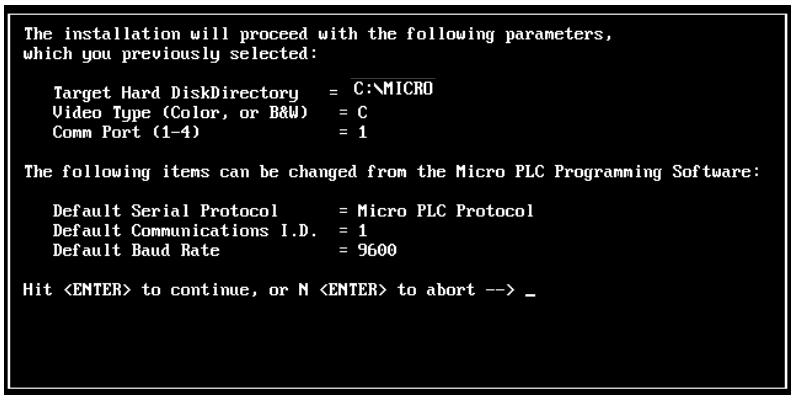


Provide the following information about your computer:

- the display type.
- the serial port.

Press the Enter key to continue.

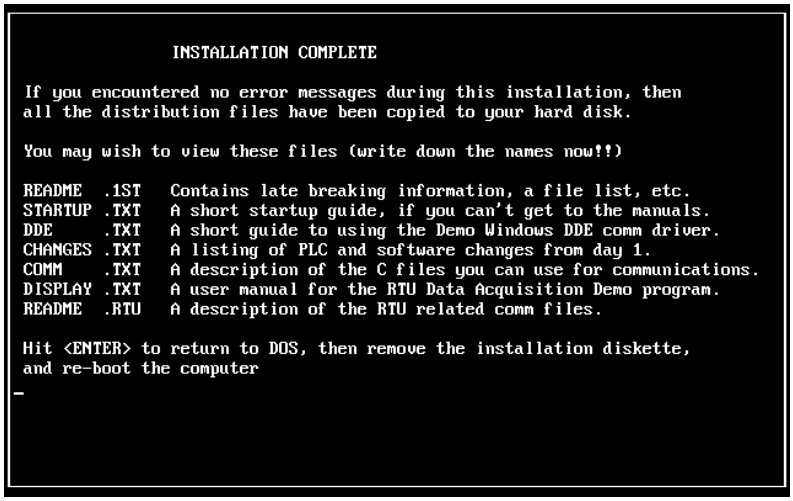




After verifying that your entries are correct, press Enter twice to install the software. You will be asked whether you want to append your AUTOEXEC.BAT file. Read the message and follow the instructions

After installation, a final screen appears instructing that you reboot your computer. To reboot the computer,pressCTRL / ALT / DEL at the same time.

The following screen appears:



Manual Installation:

If you prefer not to use the automatic installation method for example, if you have limited space on your hard disk or if the automatic installation has failed for some reason, follow the steps below to install the software. Otherwise, skip this section.

1. **Go to the DOS prompt if it is not already displayed:**

   C:>

2. **Make a directory on the hard disk for the programming software.** For example:

   C:>MD MICRO (Press the Enter key)

3. **Place the diskette containing the programming software into the appropriate diskette drive.**

4. **Copy the contents of the diskette into the new directory on the hard disk**. For example:

   C:>COPY A:*.* C:\MICRO*.* (Press the Enter key) If you want to have all the files, in the same \MICRO subdirectory.

   It is not necessary to copy the communications drivers, demonstration files, or document files of you don't want to install them on your hard disk.

   The only file that is absolutely essential is "MICRO.EXE". If you wish, you can copy only this file. If you choose this approach, you need to use the Setup function from the main menu immediately after running the Programming software to set up the correct video display type and serial port.

5. **Append the following to the path statement of your AUTOEXEC.BAT file:**

   C:\MICRO

   For example:

Before:	**C:\BAT;C:\DOS;C:\EXCEL**
After:	**C:\BAT;C:\DOS;C:\EXCEL;C:\MICRO**

   This can be done using a text editor.

Running the Programming Software from a Hard Disk

1. **Go to the directory where you placed the MICRO.EXE file.** For example:

   C:>CD MICRO (Press the Enter key)

2. **To run the programming software, type:**

   C:\MICRO>**MICRO** (Press the Enter key)

Using the Programming Software Directly from a Diskette

(Operation from a hard disk is preferred, if one is available.)

1. **Go to the DOS prompt if it is not already displayed:**

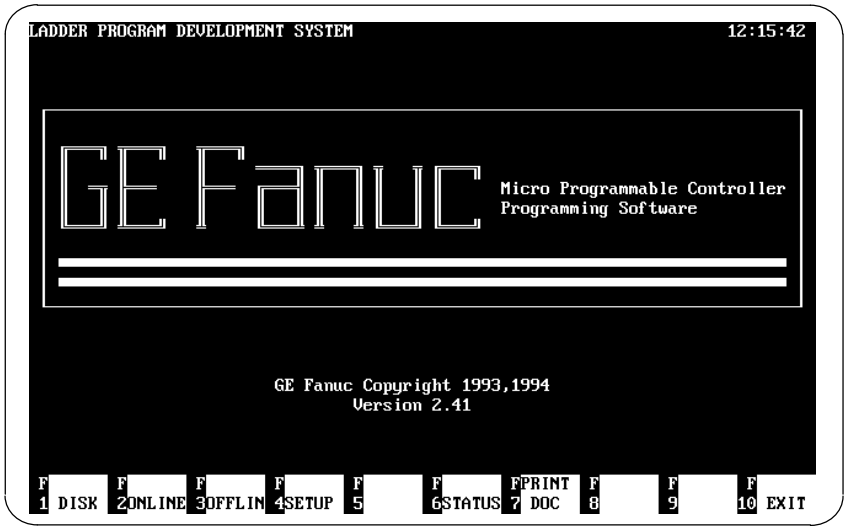
   A:>

2. **Place the diskette containing the programming software into the appropriate diskette drive (for example, drive A).** To run the programming software, type:

   A:> **MICRO** (Press the Enter key)

The Programming Software Main Menu

After you start up the programming software as described on the previous page, the startup screen appears:



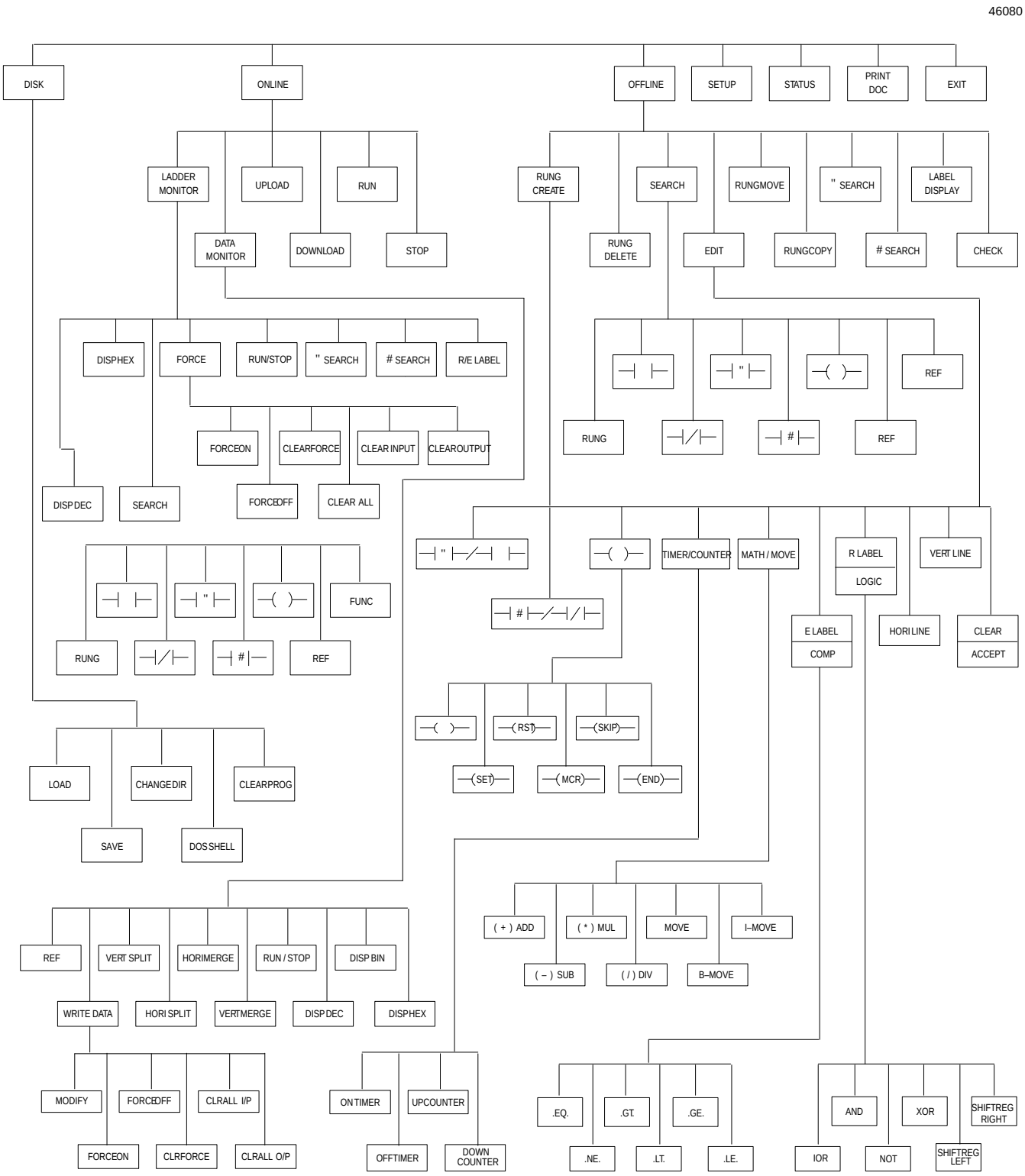
This screen shows the version of the programming software, and provides the following basic functions:

DISK (F1)	The disk utilities.
ONLINE (F2)	Program and data monitoring functions.
OFFLINE (F3)	To create and edit programs.
SETUP (F4)	To configure the programmer.
STATUS (F6)	To show the status of the PLC when the computer is communicating with the Micro PLC.
PRINT DOC (F7)	To print the program currently in the computer's RAM memory.
COMMS (F9)	The F9 key (which isn't labelled on this screen) can be used to set up point-to-point communications between the computer and a Micro PLC on a multidrop network. This function requires optional hardware modules and software which are described in the appendix *Related Products*.
EXIT (F10)	To exit from the programming software to DOS.

Function key assignments for the entire programming software package are described on the following pages.

Software Functions

The following diagram shows the primary functions of the programming software.



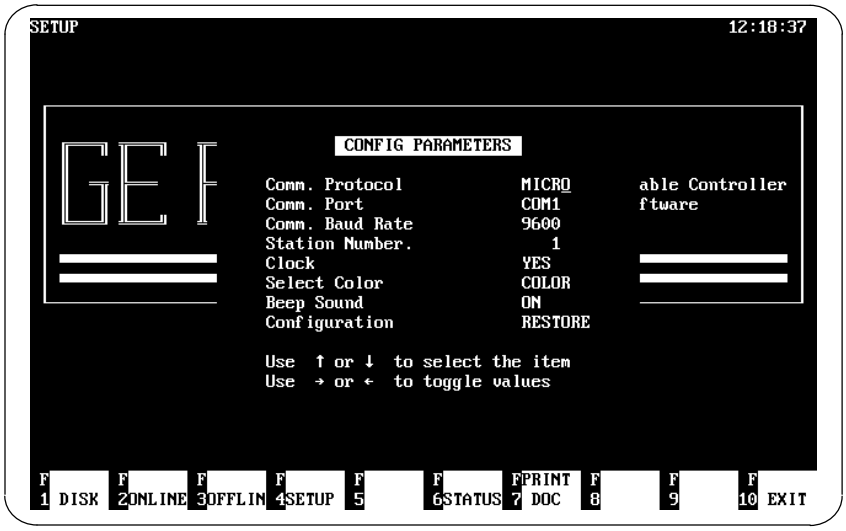
1st Selection	2nd Selection	3rd Selection	Description
Disk	Load		Select and load a file (.PLC) from the available directory
	Save		Save a file to the available disk (A, B, C, or D) directory)
	Change Dir		Change to another disk directory
	DOS Shell Clear Program		Exit to the DOS prompt. To return from DOS to the programming software, enter <EXIT>
	Clear Program		Delete the current program from RAM memory
Online	Ladder Monitor	Display decimal	Register values written / displayed in decimal
		Display hexadecimal	Register values written / displayed in hexadecimal
		Search for:	RUNG : Rung number –| |– : Normally-open contact –| /|– : Normally-closed contact –| "|– : Positive transition contact –| #|– : Negative transition contact –( )– : Output Ref : Types of operand Func : Logical, math, move functions etc..
		Force	Force a program reference ON Force a program reference OFF Clear a force Clear all forces Clear all input forces Clear all output forces
		Run / Stop	Place the PLC CPU in Run or Stop mode
		R / ELabel	Display Rung Labels or Element Labels
	Data Monitor	Reference	References such as I, O, C, R, etc..
		Write data	Modify : update current values Force On : force input or output ON Force Off : force input or output OFF Clear Force : turn forcing on or off Clear All Inputs : remove all input forces Clear All Outputs : Remove all output forces
		Vertical split	Create vertical window
		Horizontal split	Create horizontal window
		Horizontal merge	Merge horizontal window
		Vertical merge	Merge vertical window
		Run / Stop	Change PLC mode
		Display decimal	Display format in decimal
		Display binary	Display format in binary
		Display hexadecimal	Display format in hexadecimal
	Upload		Copy a program from the Micro PLC
	Download		Copy a program to the Micro PLC
	Run		Place the PLC CPU in Run mode
	Stop		Place the PLC CPU in Program (Stop) mode

1st Selection	2nd Selection	3rd Selection	Description
Offline	Rung Create	–|"|– / –| |–	Positive transition and normally-open contacts
		–|#|– / –|/|–	Negative transition and normally-closed contacts
		–( )–	–( )– : Output –(SET)– : Set output –(RST)– : Reset output –(MCR)– : Master Control Relay –(SKIP)– : Skip –(END)– : End
		Timer / Counter	On Timer : Start Timer Off Timer : Stop Timer Up Counter : Count up Down Counter : Count down
		Math / Move	Add : Addition Sub : Subtraction Mul : Multiplication Div : Division Move : Direct Move B–Move : Block Move I–Move : Indirect Move
		Compare	.EQ. : Equal (=) .NE. : Not Equal (0) .GT. : Greater Than (>) .LT. : Less Than (<) .GE. : Greater or Equal To (≥) .LE. : Less than or Equal To (≤)
		Logic	AND : Logical AND IOR : Logical Inclusive OR XOR : Logical Exclusive OR NOT : Negation SH–REG: Shift Register (right or left)
		Hori Line	Add horizontal line in rung
		Vert Line	Add vertical line in rung
		Accept	Accept (save) a rung
		Clear	Delete rung element
		R Label	Create text for a rung element
		E Label	Create text for a rung
	Rung Delete		Remove a program rung
	Search	Rung	Rung number
		– | |–	Normally-open contact
		– |/|–	Normally-closed contact
		– |"|–	Positive transition one-shot contact
		– |#|–	Negative transition one-shot contact
		–( )–	Output
		Reference	Reference types of operand
		Function	Math functions, Logical functions, Move functions, etc..
	Edit		See “Rung Create”
	Rung Move		Move a program rung
	Rung Copy		Copy a program rung
	" Search		Search backward
	# Search		Search forward
	Label Display		Display ladder logic elements
	Check		Convert program logic to machine-executable code
Setup			Set up the characteristics of the programmer
Status			Online between PLC and programmer to monitor software and hardware configuration
Print Doc			Print the program
Exit			Exit the programming software

Configuring the Programmer

To change the programmer screen color, clock display, or communications port, select Setup (F4) from the Main menu.

The Configuration Parameters window appears:



Use the arrow keys to select an item, and to display the choices. To quit the window, use the ESC key.

Setup Parameters

Comm. Protocol	Specify whether your computer will communicate using Micro PLC protocol or RTU protocol. Most applications use Micro PLC protocol.
Comm Port	Specify whether your computer will communicate with the Micro PLC through its COM1, COM2, COM3, or COM4 port.
Comm Baud Rate	Select the baud rate that will be used for communications: 9600, 4800, 2400, 1200, 600, or 300 baud. 9600 is the usual selection.
Station Number	Specify the station number if the system uses RTU protocol. Type in the station number from 1 to 247.
Clock	Specify whether to display a real-time clock while programming.
Select Color	Select either color or black and white.
Beep Sound	Specify whether to use the programmer's audible beep if an error is encountered.
Configuration	If you want to save the configuration from this screen, select Save. In addition to the selections made in this window, the Screen format set up for online monitoring, including multiple windows and data types, is also saved. If you don't save the configuration, your changes will be lost when you exit. If you want to reset to the setup of a previously-saved configuration, MOVE to the SUBDIRECTORY where the configuration was saved and select Restore.

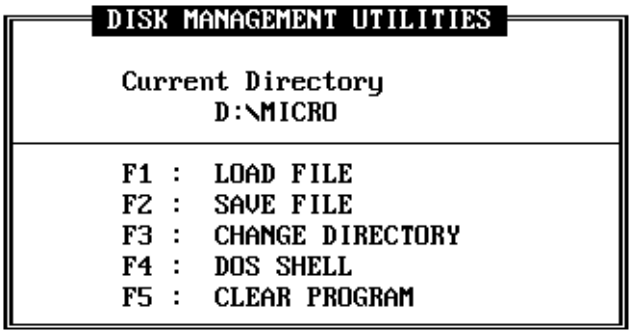
Using the File-Handling Functions

You can use the file utilities of the programming software to:

- Load and store program files
- Access DOS without exiting the programming environment
- Clear a program from the computer's RAM memory

To use the file utilities, select Disk (F1) from the Main menu.

The Disk Management Utilities window appears:



In the Disk Management Utilities window, use the function keys to select a utility. To quit the Setup window, use the ESC key.

Disk Management Utilities

The window shows the currently-selected directory. Use the function keys to access the file utilities:

Load File (F1)	to load an application program file from the currently-selected directory. See page 6-15.
Save File (F2)	to save the application program file currently located in the computer's RAM memory to the selected directory. See page 6-16.
Change Directory (F3)	to change to another directory for loading or saving a file. See page 6-17.
DOS Shell (F4)	to access the DOS utilities without quitting the programming software. See page 6-18.
Clear Program (F5)	to clear the program currently stored in the computer's RAM memory. See page 6-19.

Loading a Program File

Select **Load File (F1)** from the Disk Utilities menu when you want to load a program that is currently stored on a diskette or hard disk, into the computer's RAM memory (for editing, transfer, etc).

If the file is located on a different (drive and) directory than the one shown, first change the directory as described on page 6-17.

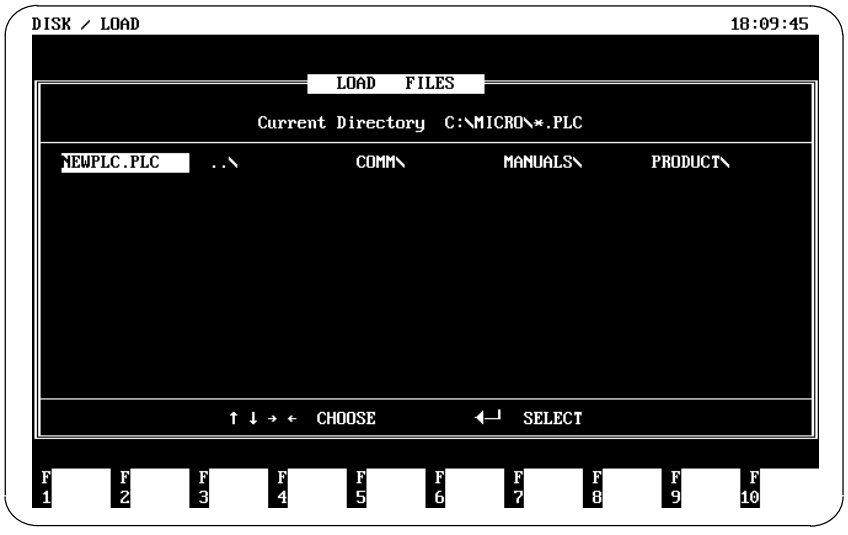
When you select **Load File (F1)** from the Disk Utilities menu, the software prompts:

```
Enter file name to load
*.PLC
```

If you know the name of the file you want to load, type it in. Press the Enter key. Or you can select the file from a list of program files as explained below.

Displaying a List of Program Files

If you want to see a list of the program files in the currently-selected directory, press Enter without entering a filename:



To load a program from the list:

1. **Use the arrow keys to highlight the name of the program.**
2. **Press Enter to load the program file.**

Viewing the File After Loading

If you want to read or edit the program, return to the main menu then select **Offline (F3)**.

Saving a Program File

Select **Save File (F2)** from the Disk Utilities menu when you want to save a program currently in the computer's RAM memory.

If you want to save the file to a different (drive and) directory location than the one shown, either type in the entire path and filename, or change the directory as described on the next page.

When you select **Save File**, the software prompts:

If the program was named previously, its name appears.

From this prompt, you can:

- Enter a name for a new program. The programming software automatically adds the .PLC filename extension; you don't need to enter it.
- Enter a new name for an existing program. This will create a new program file without deleting the original file.
- Save the program with the same name. This will write over the previous version of the file that is stored in the selected directory.

With the correct program name shown, press the Enter key. After saving the file, the programming software re-displays the Main menu.

Working on Another Program

Saving a file does not delete it from the computer's RAM memory. If you return to the Offline functions, the program will still be there for viewing or editing.

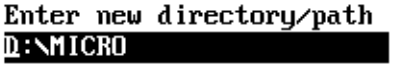
If you want to start a new program, you must clear the computer's RAM memory first. See "Clearing a Program from Memory" on page 6-19.

If you want to load a different program from memory, see "Loading a Program File", on the previous page.

Changing to Another Directory

Select **Change Directory (F3)** from the Disk Utilities menu to select another directory before Loading or Storing a file. The directory may be on the same drive or on another drive. For example, you might change the directory if the programming software is installed on a hard disk, and you want to store a backup copy of a program on a diskette.

When you select **Change Directory**, the software prompts with the name of the currently-selected directory:



In the example above, the currently-selected directory is MICRO, on drive D.

Enter the name of the (drive and) directory. For example:

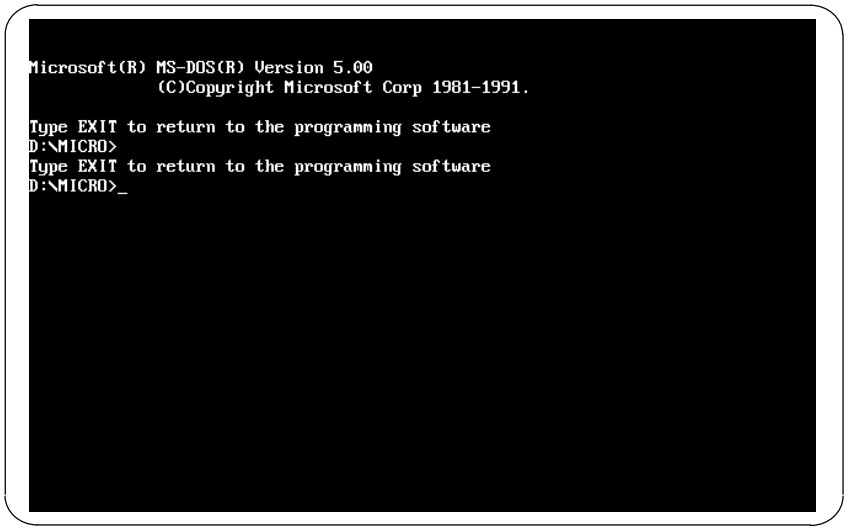
D:\MICRO\RIVET (Press the Enter key)

Loading or Saving a File After Changing the Directory

After changing the directory, you can Load or Store a file as described previously. You can also save the current configuration in a MICRO.CFG file in this directory from the setup menu. This may be useful if you have a unique I/O table display related to the logic program you are saving.

Accessing the DOS Utilities

Select **DOS Shell (F1)** from the Disk Utilities menu to access the DOS functions. The screen returns to your DOS location. For example:



Type **EXIT** when you want to return to the programming software.

Note: If you get an error message and are unable to access the DOS utilities, it means the DOS version in the computer is not the same as the one expected by the software.

Clearing a Program from PLC Memory

If you want to create a completely new program and there is already a program in the computer's RAM memory, you need to clear memory first. If you want to save the current program to a diskette or hard disk before clearing memory, see "Saving a Program" on page 6-17.

When you select **Clear Program (F5)**, the software prompts:

```
Program in memory will be lost,
    hit Enter to continue_
```

Only the program in RAM memory will be cleared; if there is a copy of the program on diskette or on the hard disk, it will not be affected.

To clear RAM memory, press the Enter key. If you want to quit without clearing the program, press ESC.

Loading or Creating a Program After Clearing Memory

After clearing memory, you can:

- Load an existing program. See page 6-15.
- Create a new program. See page 6-36.

Using the Online Functions of the Programming Software

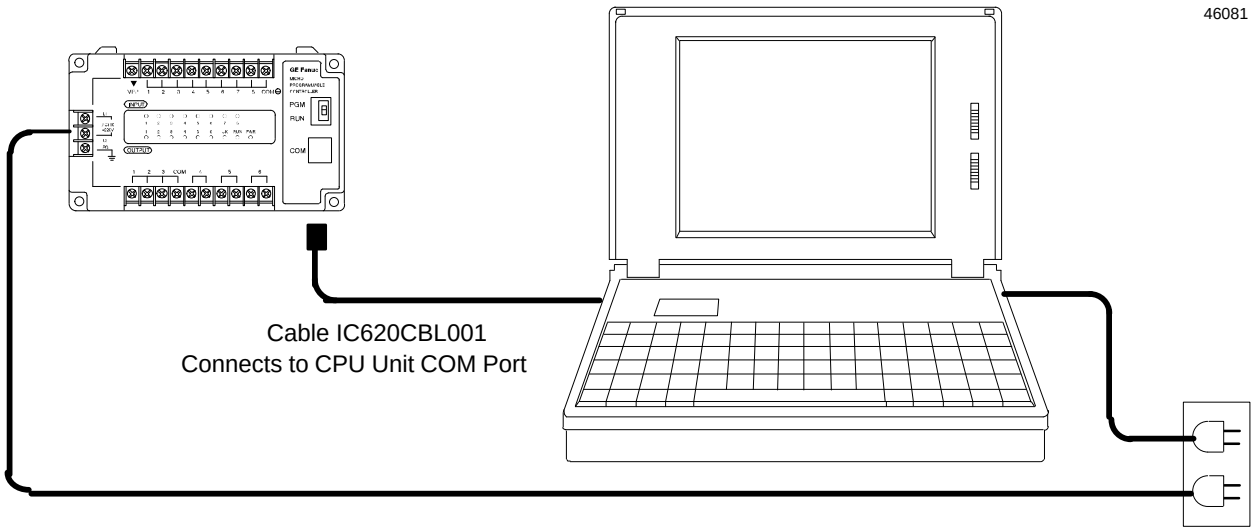
You can use the programming software for the following online functions:

- Placing the PLC in Program (Stop) or Run mode
- Transferring a program to or from the Micro PLC
- Monitoring program operation
- Monitoring system and program data
- Changing discrete and word data
- Forcing and unforcing discrete data

Connecting the Computer to a Micro PLC

Connect the communications cable between the EPROM Programmer and the Micro PLC:

The Micro PLC and the computer ***must*** be connected to a common ground. If the CPU unit is AC-powered, connect it to the same power source as the computer.



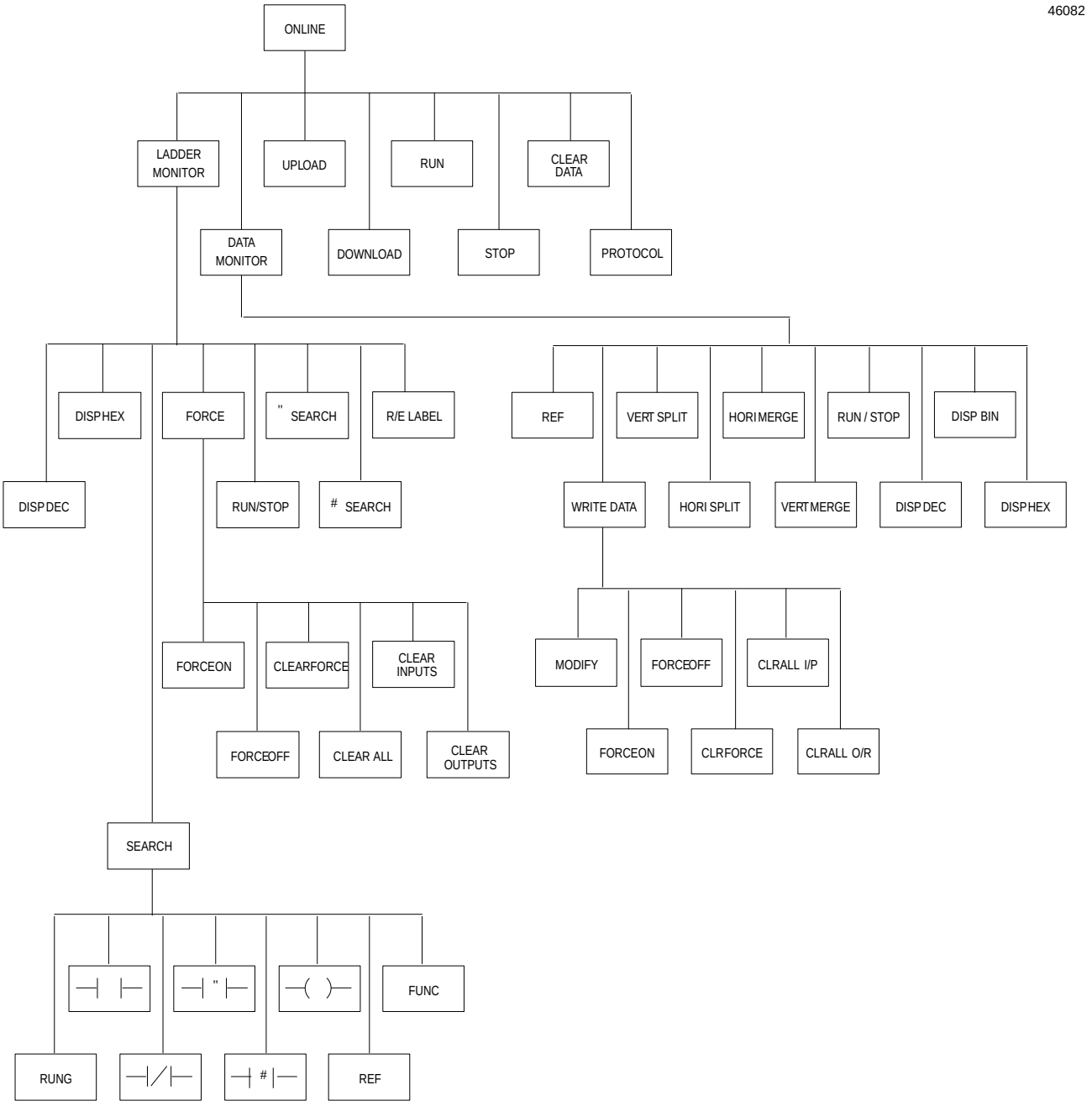
If the CPU unit is DC-powered, connect the ground of the DC power supply to the same ground as the computer.

Caution

The computer and Micro PLC must be connected to the same ground point, or damage to both units may result.

Map of the Online Functions

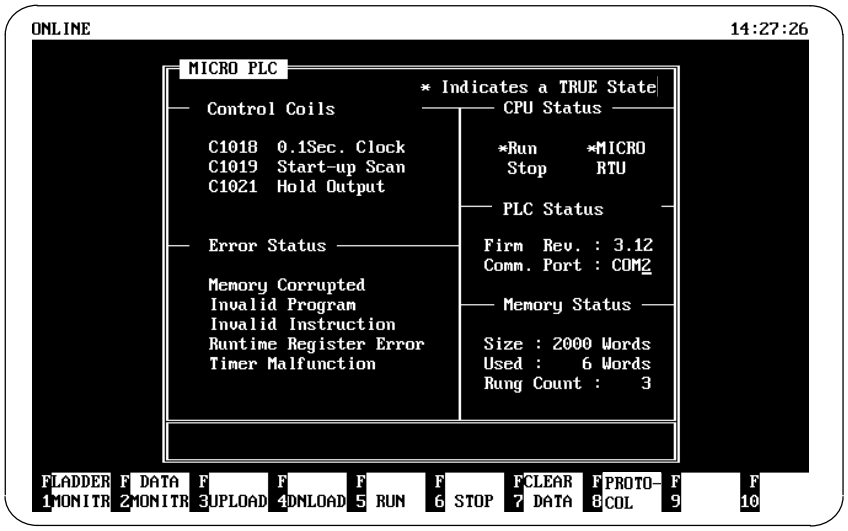
Select **Online (F2)** to link the computer to the Micro PLC for monitoring and control functions.



Online Function Menus

When you select **Online**, the programming software automatically downloads the application program currently running in the PLC.

This status screen appears:



The screen displays the current function assigned to the function keys on your keyboard. These basic functions are available from the Status screen:

Ladder Monitor (F1)	to monitor the program in the PLC. See page 6-25.
Data Monitor (F2)	to monitor, change, or force data in the PLC. See page 6-27.
Upload (F3)	to transfer a program from the PLC to the computer. See page 6-23.
Download (F4)	to transfer a program from the computer to the PLC. See page 6-23.
Run (F5)	to place the PLC in Run mode.
Stop (F6)	to place the PLC in Program (Stop) mode.
Clear Data (F7)	to clear register data, coil data, or both to zero.
Protocol (F8)	to toggle the protocol mode of BOTH the Micro PLC and the programming software. See page 6-24.

Placing the PLC in Program (Stop) or Run Mode

With the mode selection switch on the front of the Micro PLC set to Run mode, the programming software (or a Hand-held Programmer) can be used to change the PLC operating mode. (The operating mode of the PLC can also be changed while monitoring program data, as described on page 6-27.)

Note: If the switch on the front of the Micro PLC is presently set to Program (Stop) mode, it cannot be overridden by the programming software or a Hand-held Programmer. To change the PLC operating mode, select **Online (F2)**, then **Run (F5)** or **Stop (F6)**.

For software version 2.37 and later, a blinking ♠ character appears in the upper right corner of the screen when the PLC is in Run mode. If the character is not there, the PLC is in Stop mode. (In software version 2.35, this character indicated "online" mode).

Transferring a Program

Use the Online functions to transfer a program between the computer and another device.

- For information about transferring a program to or from a Hand-held Programmer, see page 4-11.
- For information about transferring a program to or from an EPROM Programmer, see pages C-15 and C-17.

Copying a Program to the Computer from a Micro PLC

A program can be transferred from a Micro PLC when the Micro PLC is in either Stop mode or Run mode.

To transfer a program, select **Upload (F3)** from the Online status screen.

If there is presently a program in the computer's RAM memory, the software prompts:

Program in PC will be lost. Continue (Y/N)?

When a transfer has been completed, the software displays:

Program has been uploaded from PLC

Copying a Program to the Micro PLC from a Computer

To transfer a program to a Micro PLC from the computer, the Micro PLC must be in Stop mode (see page 6-28 for instructions). If you try to upload a program while the PLC is in Run mode, an error message will appear.

To transfer a program, select **Download (F4)** from the Online status screen.

If there is presently a program in the PLC, the software prompts:

Program in PLC will be lost. Continue (Y/N)?

When a transfer has been completed, the software displays:

Program has been downloaded to PLC

Clearing Coils and Retentive Registers

To clear coils or retentive registers, select **Clear Data (F7)** from the Online Status screen. Then:

- Select **Clear Reg (F2)** to clear all *retentive* registers to zero. This function does not clear non-retentive registers. Non-retentive registers are cleared on every power cycle and on every transition from Stop mode to Run mode.
- Select **Clear Coil (F3)** to clear all coils.
- Select **Clear All (F1)** to clear both coils and retentive registers.

Changing the Communications Protocol

The Micro PLC can communicate using either its own Micro PLC protocol, or RTU protocol. Micro PLC protocol is used for programming. In addition, most applications use Micro PLC protocol.

The programming software provides two tools for changing protocol if necessary:

- From the Main menu, you can select Setup. From the Setup screen, you can change the protocol mode of the programming software (only). This does not change the protocol mode of the Micro PLC.
- From the Online screen, you can select Protocol (F8), as shown on page 6-22. This toggles the protocol of BOTH the software and the Micro PLC. This step is necessary to actually begin communicating using RTU protocol.

The method to use depends on the type of activity you are working on.

When developing and debugging a program, always use Micro PLC protocol. Micro PLC protocol is used for most applications.

On the Setup screen, select Micro.
On the Online screen, select Micro.

If the application will use RTU protocol, it is necessary to switch to RTU before communicating with the RTU device.

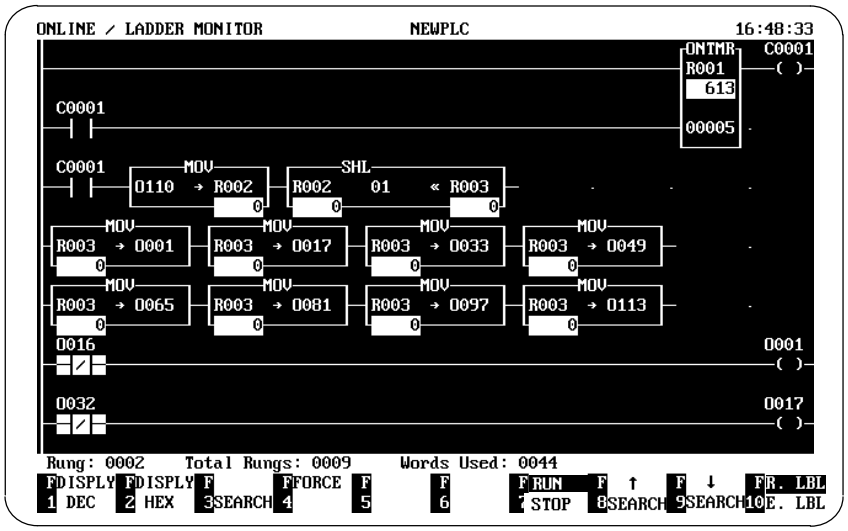
1. When the Micro is ready to begin operating in the application, go to the Online screen and use the F8 key to change to RTU protocol.
2. Connect the Micro PLC to the RTU master device.
3. If program changes are needed:
   A. Connect the Micro PLC to a computer running the programming software.
   B. Go to the Setup screen and select RTU protocol.
   C. Go to the Online screen and select Micro protocol.
   D. Develop and debug your program changes.
   E. After changing the program, go back to the Online screen and again select RTU protocol.
   F. Disconnect the computer and reconnect the RTU master device.

Note

The protocol selections on the Setup screen and Online screen must match for communications to begin. Selections that do not match will cause a Communications Error message.

Monitoring an Application Program

To monitor the application program that is currently running in the PLC, select **Online (F2)** then **Ladder Monitor (F1)**. The application program appears:



Highlighted areas show the presence of power flow through a rung, as well as current register values. To scroll the program display, use the Page Up and Page Down keys.

While monitoring a program, you can locate a specific rung or other program element, force and unforce discrete data. You can also change the display format or search for a specific rung,:

Display Decimal (F1)	to display data in decimal format.
Display Hex (F2)	to display data in hexadecimal format.
Search (F3)	to search for a specific program element. See page 6-26.
Force (F4)	to force a program reference or clear force. See page 6-27.
Run/Stop (F7)	to toggle between Run and Stop mode.
" **Search (F8)**	to specify a backward search for the specified program element.
# **Search (F9)**	to specify a forward search for the specified program element.
R/E Label (F10)	to display Rung Labels (shift / F10) or Element Labels.

If you want to exit the Ladder Monitor function, use the ESC key.

Searching for a Program Element

After selecting **Search (F3)** from the Monitor Program function, use the function keys to specify the program element you want to locate. Then respond to the prompt that appears to provide additional information for the search.

Search For:	Function Keys:	Respond to Prompt by Entering:
RUNG : Rung number	F1	a rung number
–| |– : Normally-open contact	F2	the reference (eg: I001) for the contact
–|/|– : Normally-closed contact	F3	"
–|"|– : Positive transition contact	F4	"
–|#|– : Negative transition contact	F5	"
–( )– : Output	F6	the reference (eg: O001) for the output
Ref : Types of operand	F7	a reference (eg: I001)
Func : Program function	F10	a number representing the function type (see below)

Specifying a Function Type

To search for a function type, enter one of the following numbers in response to the prompt:

1	UPCTR	8	AND	15	ADD	22	NE
2	DNCTR	9	IOR	16	SUB	32	GT
3	ONTMR	10	XOR	17	MUL	24	LT
4	OFTMR	11	NOT	18	DIV	25	GE
5	MOVE	12	MCR	19	SET	26	LE
6	B–MOVE	13	SKIP	20	RST	27	SHF–R
7	I–MOVE	14	END	21	EQ	28	SHF–L

Specifying the Search Direction

Use the function keys **F7** and **F8** to locate the instances of the specified element.

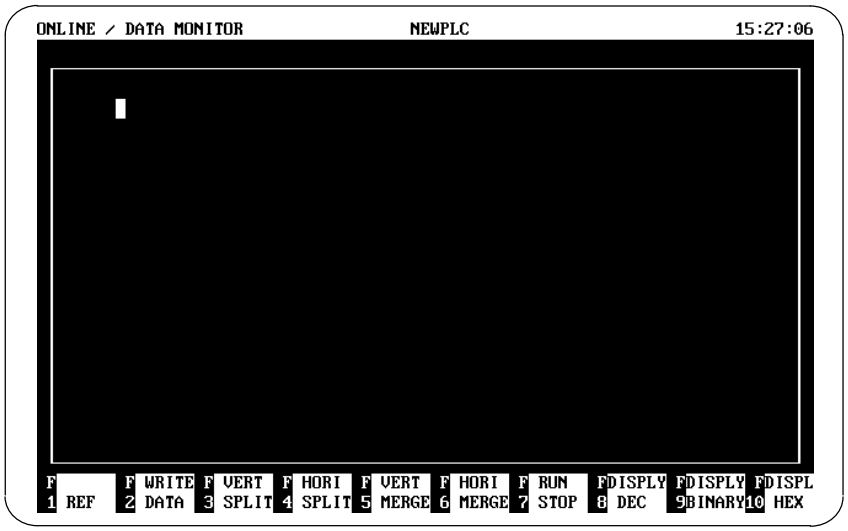
Forcing and Clearing Forces

Use the **Force (F4)** key to display the Force / Clear Force function keys. From there:

- To force an element on, press **Force On (F1)**. Enter the element (for example, **i1**). Press the Enter key.
- To force an element off, press **Force Off (F2)**. Enter the element (for example, **i1**). Press the Enter key.
- To clear one forced element, press **Clear Force (F3)**. Enter the element (for example, **i1**). Press the Enter key.
- To clear all forces, press **Clear All (F4)**.
- To clear all input forces, press **Clear Input (F5)**.
- To clear all output forces, press **Clear Output (F6)**.

Monitoring and Changing Program Data

To display or change data values, select **Data Monitor (F1)** from the Status screen. The Data Monitor screen appears. For a new configuration, this screen has no initial content:



Use the function keys to select a reference, change data, and change the display format:

Reference (F1)	to specify a reference. See page 6-28.
Write Data (F2)	to change discrete or word data, or to force and unforce discrete data. See page 6-33.
Vertical Split (F3)	to divide the current window vertically. See page 6-30.
Horizontal Split (F4)	to divide the current window horizontally. See page 6-31.
Vertical Merge (F5)	to merge a vertical window. See page 6-30.
Horizontal Merge (F6)	to remove a horizontal window. See page 6-31.
Run / Stop (F7)	to change the PLC operating mode. See page 6-28.
Display Decimal (F8)	to display word data (R, IR, or OR) in decimal format. See page 6-32.
Display Binary (F9)	to display word data in binary format. See page 6-32.
Display Hex (F10)	to display word data in hexadecimal format. See page 6-32.

Selecting a Reference Type

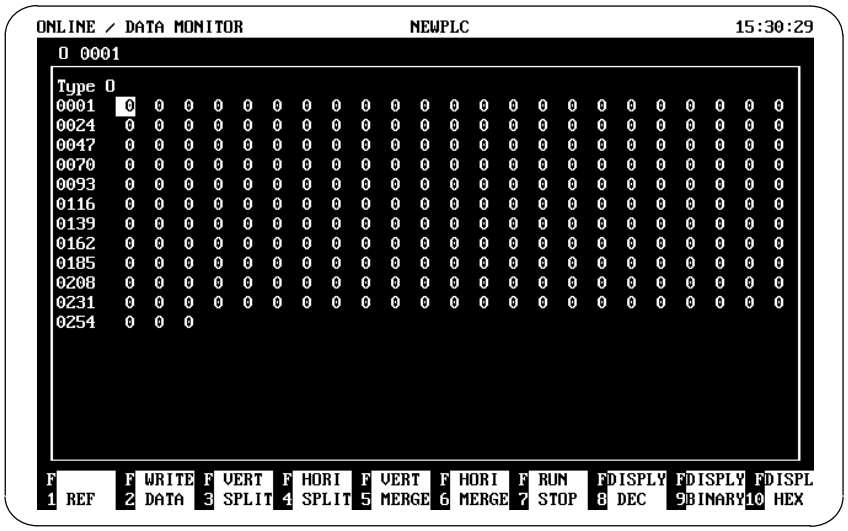
To display a data table, specify a reference to be monitored.

1. **Select Reference (F1) from the Data Monitor screen.**
2. **Enter a reference type** (I, O, C, R, IR, or OR).
3. **Enter a numerical address.**

For example:

```
Type O
0001
```

4. **Press the Enter key.** The selected data table appears:



Displaying a Different Data Table

To display a different data table, repeat the steps above.

Placing the PLC in Stop or Run Mode

With the mode selection switch on the front of the Micro PLC set to Run mode, the programming software (or a Hand-held Programmer) can be used to change the PLC operating mode.

Note: If the mode selection switch on the front of the Micro PLC is presently set to Stop mode, it cannot be overridden by the programming software or a Hand-held Programmer.

To change the PLC operating mode while monitoring program data, select **Run / Stop (F7)**.

Changing the Format of the Data Monitor Screens

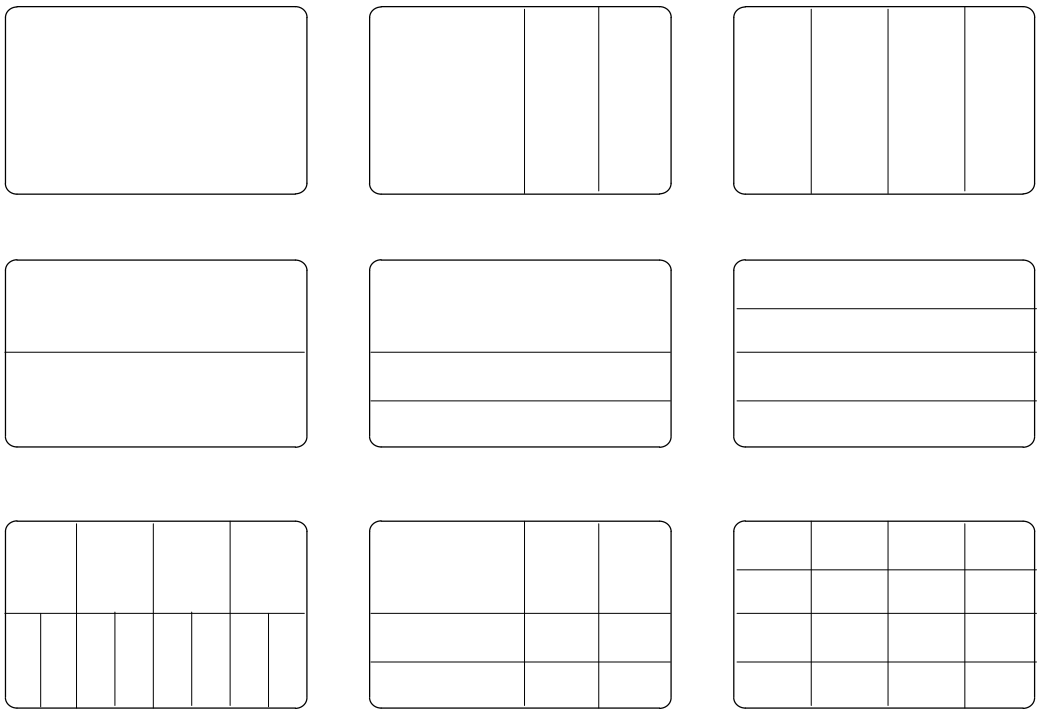
You can display multiple windows on the Data Monitor screen, and change the data type for word data in individual windows. Instructions follow.

After customizing the Data Monitor screen, you can save your format by returning to the Configuration Parameters screen and doing a Save. See page 6-13. You may want to SAVE the configuration in the same subdirectory or the Program file. You can then reload the configuration in the future.

Creating Multiple Windows in the Data Display

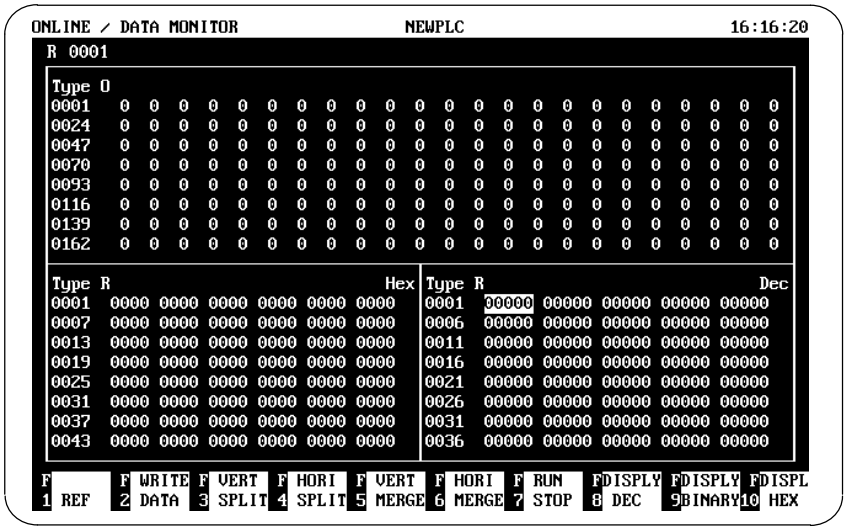
You can divide the data display screen into as many as 16 windows. Some possible screen formats are shown below.

46083



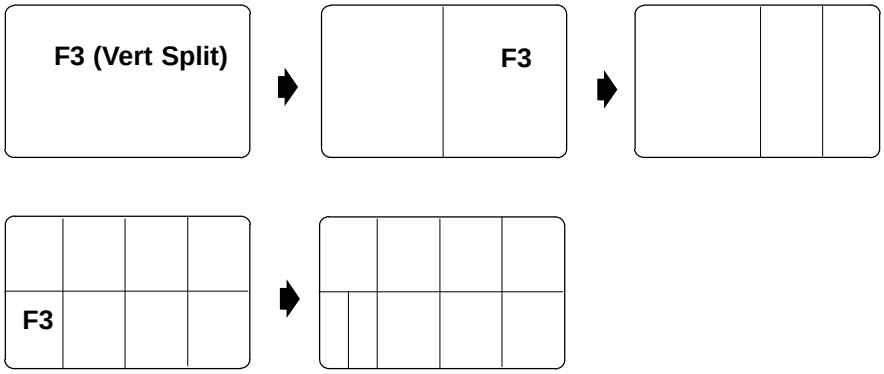
Vertical Split Screen

Select **Vertical Split (F3)** to vertically divide the window where the cursor is located.



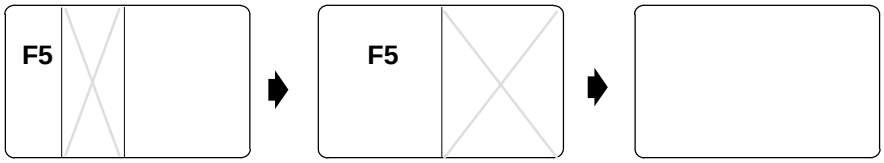
Examples:

46084



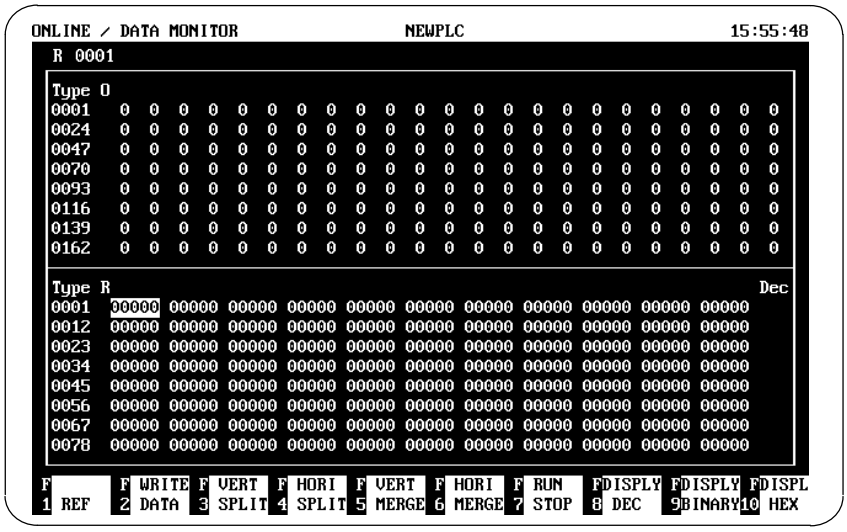
To delete the right window of a vertically–split pair (as shown with an X below) select **Vertical Merge (F5).**

46085



Horizontal Split Screen

Select **Horizontal Split (F4)** to horizontally divide the window where the cursor is located.

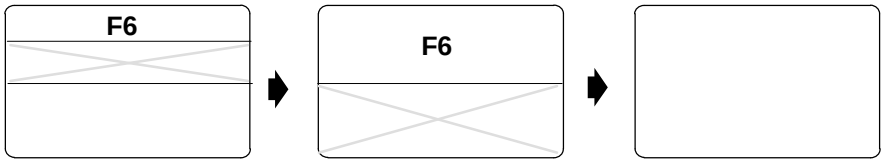


Examples:

46086

To delete the bottom window of a horizontally–split pair (as shown with an X below) select **Horizontal Merge (F6).**

46087

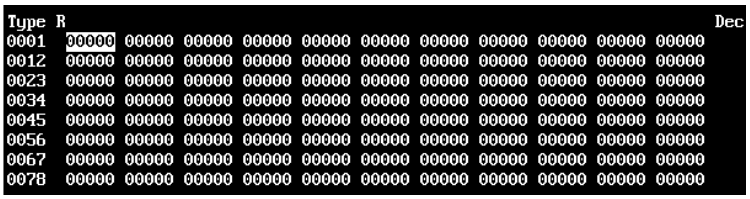


Selecting the Data Type for a Window

To create a display for the new window, move the cursor into the new window, and select **Ref (F1)**. Enter the reference type and address for the data area you want to display.

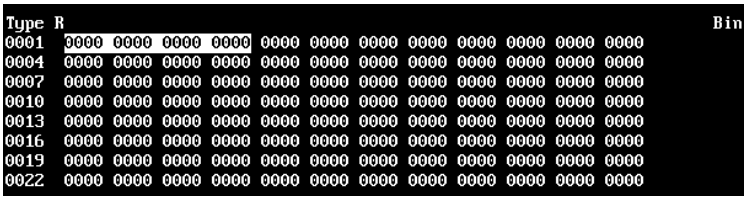
- **Decimal Format**

  Select **Display Decimal (F8)** to display word data in the window where the cursor is located in decimal format:



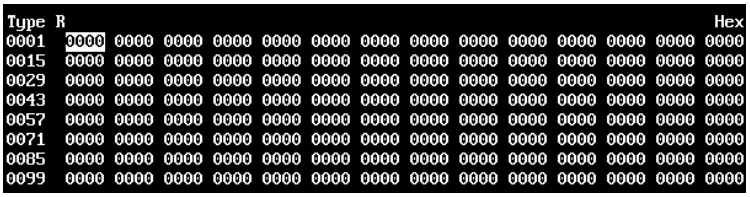
- **Binary Format**

  Select **Display Binary (F9)** to display word data in the window where the cursor is located in binary format:



- **Hexadecimal Format**

  Select **Display Hex (F10)** to display word data in the window where the cursor is located in hexadecimal format:



Changing and Forcing Data

Sometimes it is desirable to temporarily change the state of a discrete point. This can be done from by modifying the point or overriding (forcing) it. Modifying will temporarily change the state of the point, but the logic program will have precedence if it refers to that point. If the point is overridden (forced), then the state of the point cannot be changed by the logic program.

Register data can also be changed as described below.

To modify or force data or clear a force, select **Write Data (F2)** from the Data Monitor screen.

Use the function keys to modify the highlighted data, as described below

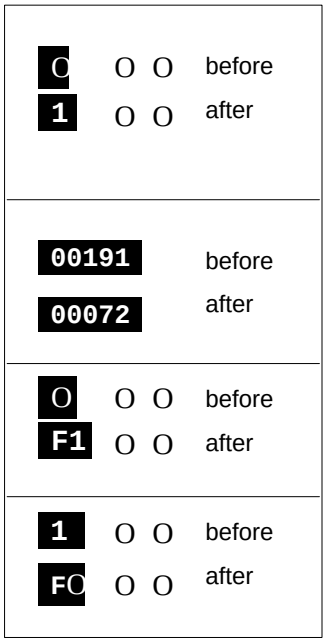
Modify (F1) to change the state or value of discrete or word data:

Discrete (I, O, C) Data

The status of the highlighted discrete data item changes as soon as the **Modify (F1)** key is pressed. You will not see a change if the reference is being overwritten by the logic program.

Word (R, IR, OR) Data

After pressing the **Modify (F1)** key, type in the new value for the data. Press Enter.



Force On (F2) to force a discrete data item ON. When discrete data is forced ON, it is displayed as **F1.**

Force Off (F3) to force a discrete data item OFF. When discrete data is forced OFF, it is displayed as **F0**

Clear Force (F4) to clear a forced discrete data item

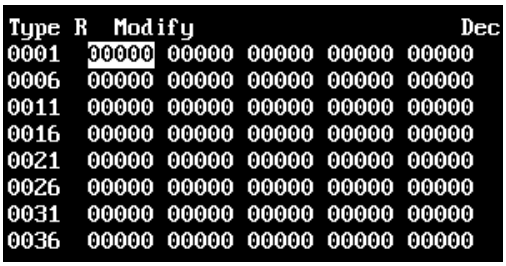
Clrall Input (F5) to clear **all** discrete input forces

Clrall Output (F6) to clear **all** discrete output forces

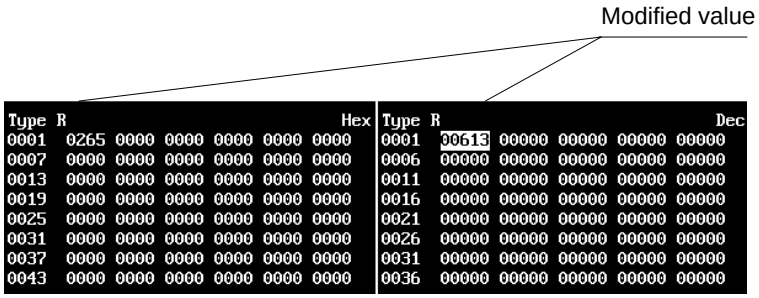
Use the ESC key to return to the previous menu.

Example:

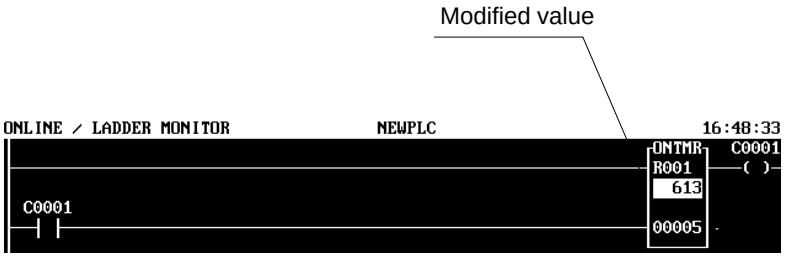
To modify the currently-selected word value, select **Modify (F1)**.



Enter the new value and press the Enter key. In the following example, the value 613 has been entered for register R001 in the decimal format window. Notice that the hexadecimal equivalent of the 613 appears in the hex format window for register R001.



The changed data is also displayed in Ladder Monitor mode:

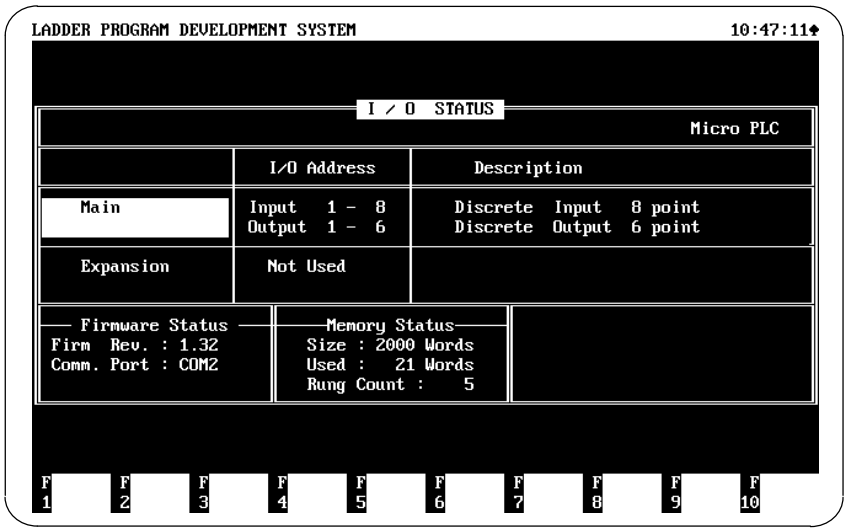


Status Information

When you select **Status (F6)** from the main menu, the software displays the following status information:

- The hardware configuration of the system.
- The firmware status.
- The selected communications port.
- The amount of memory available and the amount used.
- The number of rungs in the application program.

The Status screen looks like this:



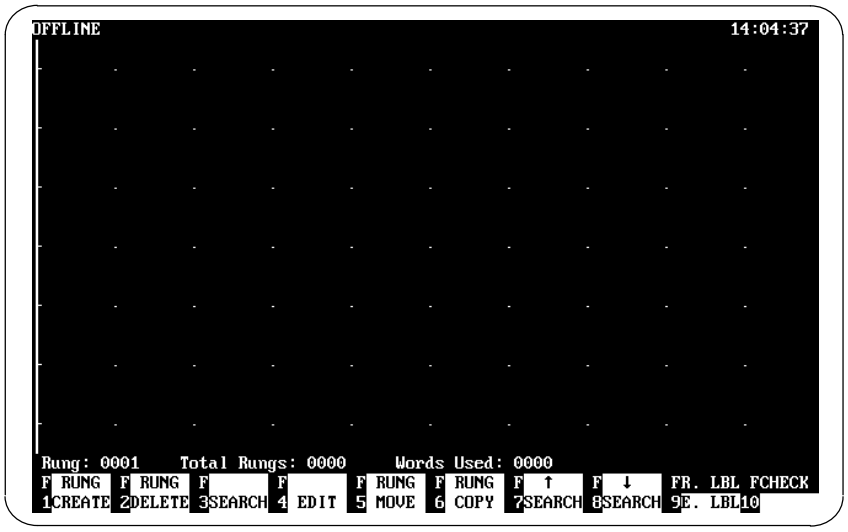
For software version 2.37 and later, a blinking ♠ character appears in the upper right corner of the screen when the PLC is in Run mode. If the character is not there, the PLC is in Stop mode.

Use the ESC key to return to the main menu.

Using the Offline (Programming) Functions

When you select **Offline (F3)** from the Main menu, the application program currently in the computer's RAM memory appears.

If there is no program currently in RAM memory, the program has no content. The screen looks like this:



The window shows the current rung, total number of rungs in the program, and program size in words. If you want to quit the Programming window, use the ESC key.

Programming Operations

In the Offline window, use the function keys to select a programming operation.

Rung Create (F1)	to create a new program rung
Rung Delete (F2)	to delete a program rung
Search (F3)	to search for a type of function or operand
Edit (F4)	to edit the program
Rung Move (F5)	to move a program rung
Rung Copy (F6)	to duplicate a program rung
" **Search (F7)**	to search previous rungs (search backward)
# **Search (F8)**	to search next program rungs (search forward)
R/E Label (F9)	to display element labels or rung labels
Check (F10)	to check program syntax.

Use of the programming features is explained in the *Micro PLC Programming Guide* (GFK-0804).

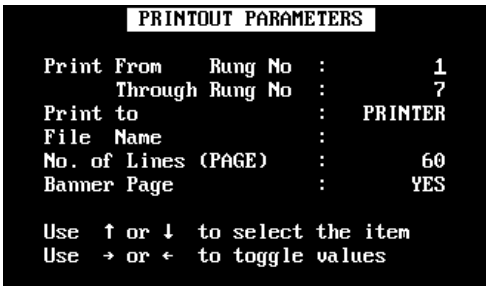
Printing an Application Program

To print out a hard copy of an application program, select **Print Doc (F7)** from the Main menu.

This utility prints the program currently in the computer's RAM memory. If you want to print a program that is located on the hard disk or on a diskette, use the Disk Utilities to Load that program into RAM memory first.

If there is already another program in RAM memory, you will need to Save it, then Load the program you want to print.

When you select **Print (F7)**, this window appears:



You can specify the rungs to be printed, the printout destination (PRINTER or FILE), and the number of lines to be printed on a page. You can also specify whether or not the printout should start with a banner page.

If you print the program to a file, it will produce a text file that can be viewed or edited using a text editor. When you select FILE, enter a filename (up to 8 characters). The software will automatically add the appropriate extension (see examples) to the filename.

If you are printing the program directly to a printer, the printer should be set up to 80 or 132 columns, and for standard ASCII text input.

Use the function keys to print:

F1: a ladder diagram
F2: a statement list (which is useful for comparing Hand-held Programmer screens).
F3: a cross-reference listing of contacts and registers used.

See the examples on the next 2 pages.

Note: In a ladder diagram printout, Timer and Counter functions appear as separate lines of logic. There are not boxes around these functions as there are when the functions are displayed with the programming software.

Printout Styles

The following examples show the same information printed in the three available styles.

Ladder Logic Style (.LAD file)

```
Rung 0001
| I001
+--|/|--+[R001  + 00001 = R001 ]
|

Rung 0002
|
+[R001  > 10000]+[00001 M R001 ]
|

Rung 0003
|
+[R001  - 00001 = R002 ]
|

Rung 0004
| I001                                                                  O001
+--||--+-------+-------+-------+-------+-------+-------+-------+-------+--()--
|

Rung 0005
|                                                                ONTMR   C0001
+-------+-------+-------+-------+-------+-------+-------+-------+[R010]+--()--
|
|
|
|
| C0001
+--||--+-------+-------+-------+-------+-------+-------+--------[00020]
|

Rung 0006
| C0001
+--| |--+[R020  + 00001 = R020 ]+[R020  M O001 ]
|

Rung 0007
|
+[R020  > 00064]+[00000 M R020 ]
|
```

Statement List Style (.MNE file)

```
0001:  START NOT I001 .
0002:  MATH R001 = R001 + 1 .
0003:  DROP .
0004:  START .
0005:  COMPARE R001.GT.10000 .
0006:  MOVE R001 = 1 .
0007:  DROP .
0008:  START .
0009:  MATH R002 = R001 – 1 .
0010:  DROP .
0011:  START I001 .
0012:  OUT O001 .
0013:  START .
0014:  START C0001 .
0015:  ON TIMER     R010 – 20 .
0016:  OUT C0001 .
0017:  START C0001 .
0018:  MATH R020 = R020 + 1 .
0019:  MOVE O001 = R020 .
0020:  DROP .
0021:  START .
0022:  COMPARE R020.GT.64 .
0023:  MOVE R020 = 0 .
0024:  DROP .
```

Cross Reference Style (.LST file)

```
Cross Reference      Rung No./ Element type      PAGE    1.

   – INTERNAL COIL STATUS TABLE –
C0001
      5–( )–    5–| |–    6–| |–

   – DISCRETE INPUT STATUS TABLE –
I001
      1–|/|–    4–| |–

   – DISCRETE OUTPUT STATUS TABLE –
O001
      4–( )–    6(MOVE)

   – INTERNAL REGISTER STATUS TABLE –
R001
      1(ADD)    2(.GT.)   2(MOVE)   3(SUB)
R002
      3(SUB)
R010
      5(ONTMR)
R020
      6(ADD)    6(MOVE)   7(.GT.)   7(MOVE)
```

Exiting the Programming Software

If you want to terminate the programming software, select **Exit (F10)** from the Main menu. This will return you to DOS. The program currently in RAM memory will be cleared. If there is a program in RAM memory that you want to keep, be sure to Save it before exiting the programming software.

(If you only want to exit to DOS temporarily, select **Disk Utilities (F1)** then **DOS Shell (F4)** instead). If you exit temporarily, the programming software and the program in RAM memory are *not* cleared.

Appendix A Cable Pin Assignments

This appendix shows cable pin assignments for:

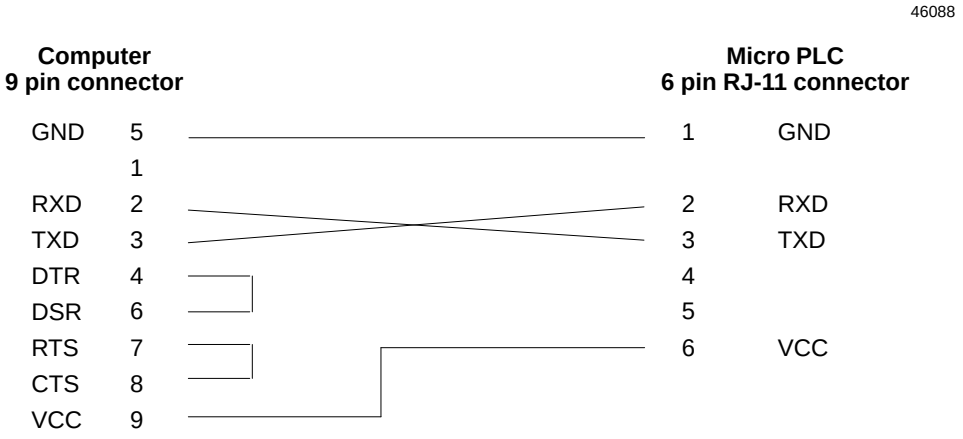
- Computer or HHP to Micro PLC Cable
- Computer or Hand-held Programmer to EPROM Writer Cable

Cable Length

The maximum recommended cable length is approximately 2 meters (6 feet).

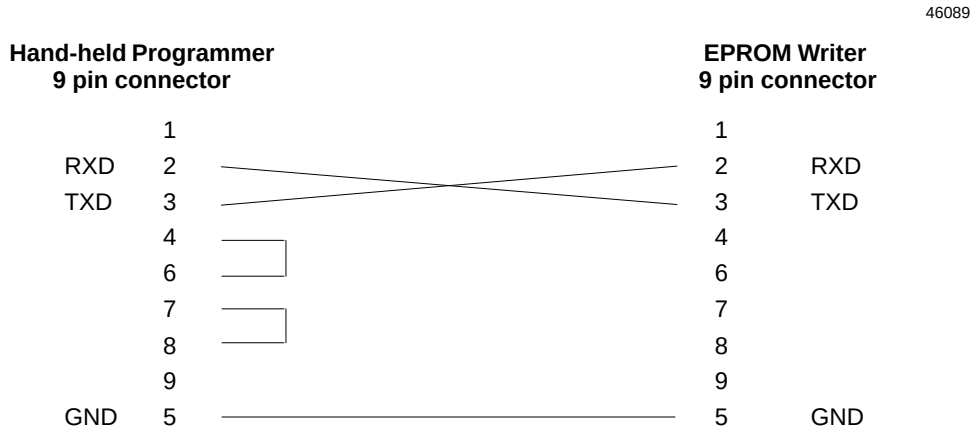
Nine-pin computer port to Micro PLC Cable
Hand-held Programmer to Micro PLC Cable

IC620CBL001



Hand-held Programmer to EPROM Writer Cable
Computer to EPROM Writer Cable

IC620CBL002



Cables for 25-Pin Computer Ports

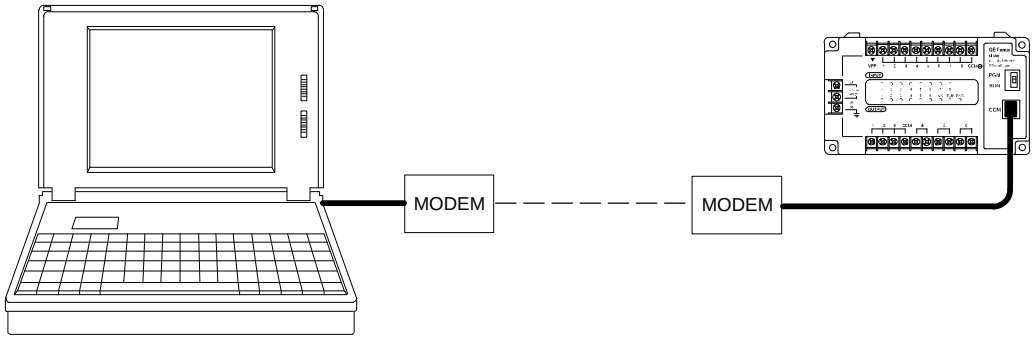
The cables represented above can also be used with a 25-pin computer port by adding a 25 pin/9 pin adapter.

Appendix B Using a Modem

A modem can be used for remote communications between a computer (running the programming software) and the GE Fanuc Micro PLC.

The modem must operate at 9600 baud.

46090



Modem Setup

Set up the modems to match the serial port characteristics of the Micro PLC:

9600 baud (fixed)
8 data bits
no parity
1 stop bit
disable error checking
disable compression

Recommended Modems

- Hayes OPTIMA 144

  Program the following commands, and use the new settings as the powerup defaults.

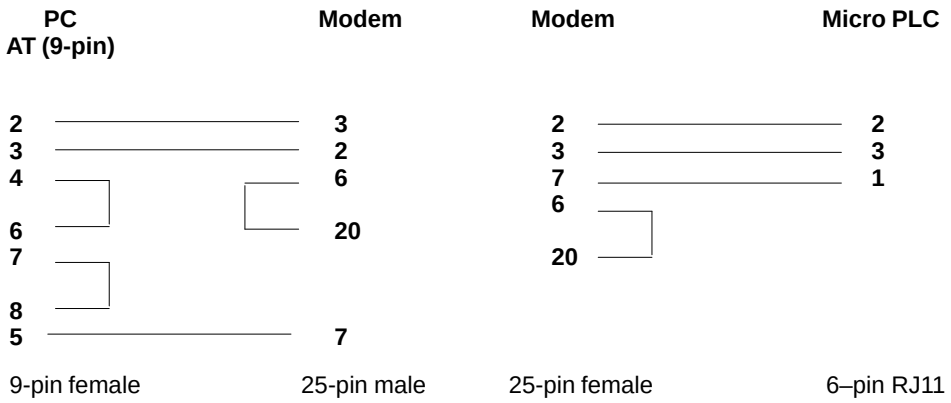
AT&Q0	Use asynchronous mode
ATS36=1	Attempt standard asynchronous connection on retry
ATS48=128	Attempt S36 configuration on 1st try, not on retry
AT&W0	Save setup as user profile 0, used on powerup

  For the modem that will be connected to the Micro PLC, add the following command before saving the user profile:

ATS0=2	Auto answer on 2nd ring

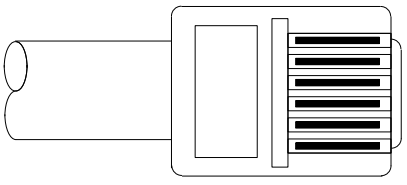
Cables

46091



Pin Assignments on the RJ11 Connector

46092



Pins	
6	blue
5	yellow
4	green
3	red
2	black
1	white

Appendix C

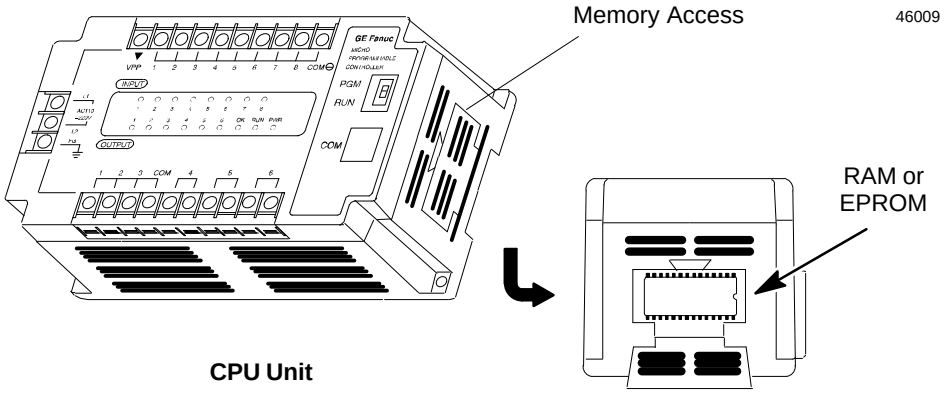
Using EPROMs or Battery-backed RAM

This appendix describes the EPROM Programmer that may be used with some versions of the Micro PLC CPU.

- Program Storage in the Micro PLC
  - Battery-backed RAM
- Memory Charging / Discharging Characteristics of Older CPUs
  - Charging Characteristics
  - Discharging Characteristics
- Installing an EPROM or Battery-Backed RAM
  - Charging the CPU Unit's Program Backup Memory
- The EPROM Programmer
  - Dimensions
  - EPROM Programmer Specifications
  - Keypad Functions
  - EPROM Programmer Menus
- Transferring a Program TO the EPROM Programmer
- Transferring a Program FROM a Micro PLC
- Transferring a Program FROM a Hand-held Programmer
- Transferring a Program FROM a Computer
- Transferring a Program FROM the EPROM Programmer
- Transferring a Program TO a Hand-held Programmer
- Transferring a Program TO a Computer

Program Storage in the Micro PLC

For some Micro PLC CPU versions, an application program created on an HHP or computer is transferred to the Micro PLC, where it is stored in either RAM or EPROM memory (as in later versions). The unit is shipped from the factory with RAM memory installed. EPROMs or Battery-Backed RAM chips can be purchased separately.



The Micro PLC stores its application program as long as it is connected to its normal power source. If power is removed, the length of time a program can be retained in memory depends on environmental conditions and other factors.

If power to the Micro PLC is turned off or lost, programs stored in RAM are typically retained for approximately 6 weeks. Under worst-case environmental conditions, which are not found in typical industrial situations, programs are retained for 1 week without external power to the Micro PLC. To attain a full charge, the unit must be powered up one time for at least 30 minutes.

EPROMs or Battery-Backed RAM, which are optional, can be used for program storage in applications where the PLC may be powered down for extended periods. EPROMS also provide added program security and ease of distribution for OEM logic programs. If you have an early Micro PLC version and do not want to use EPROM, but need a longer guaranteed retention time, Battery-Backed RAM chips are commercially available.

Battery-backed RAM

Battery-Backed RAM chip must operate at 150nS or faster. Voltage tolerance should be $\pm$5%. Examples of possible Battery-Backed RAM chips that might be used include:

Benchmarq	bq4010–150 (commercial)
Benchmarq	bq4010Y–150N (industrial)
SGS Thompson	MK48Z08–150
Dallas	DS1225
KOA KAOSIUM	MK48Z08

Note that these chips have not been tested by GE Fanuc, and none is explicitly recommended for use. Note also that it may be necessary to permanently remove the door that covers the memory area of the Micro PLC CPU to install one of these chips, and that would expose the inside of the CPU unit to greater risk from environmental contamination.

Memory Charging/Discharging Characteristics of Older CPUs

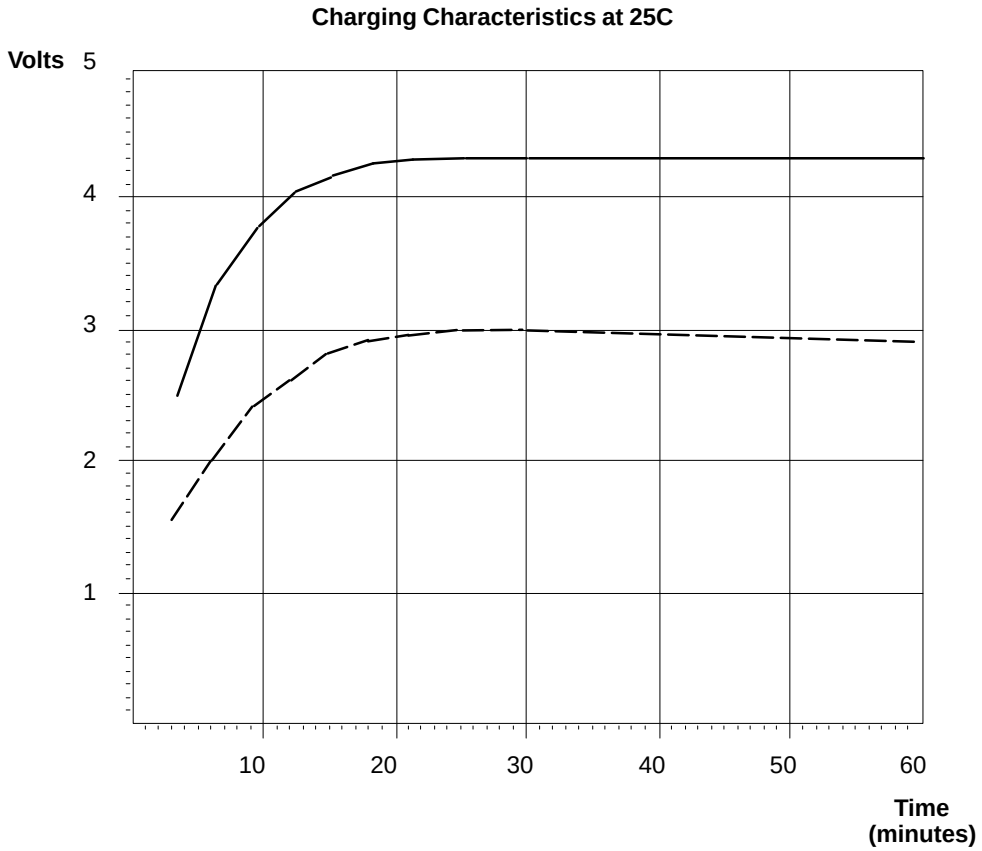
When an older Micro PLC CPU is installed and it will use its internal memory unit (not an optional EPROM) for program backup, power must connected for approximately 30 minutes to charge the memory unit. If that is not done, the Micro PLC will not be able to store an application program for its rated time *when disconnected from power.*

Once the memory unit is properly charged, reconnecting power even for a short time will recharge it.

Charging Characteristics

On the graph below, the solid curve shows the charging characteristics of the memory unit at 25C for all CPU units except models IC620MRDR014A and 114A. The dashed curve shows the charging characteristics at 25C for those two models.

46093

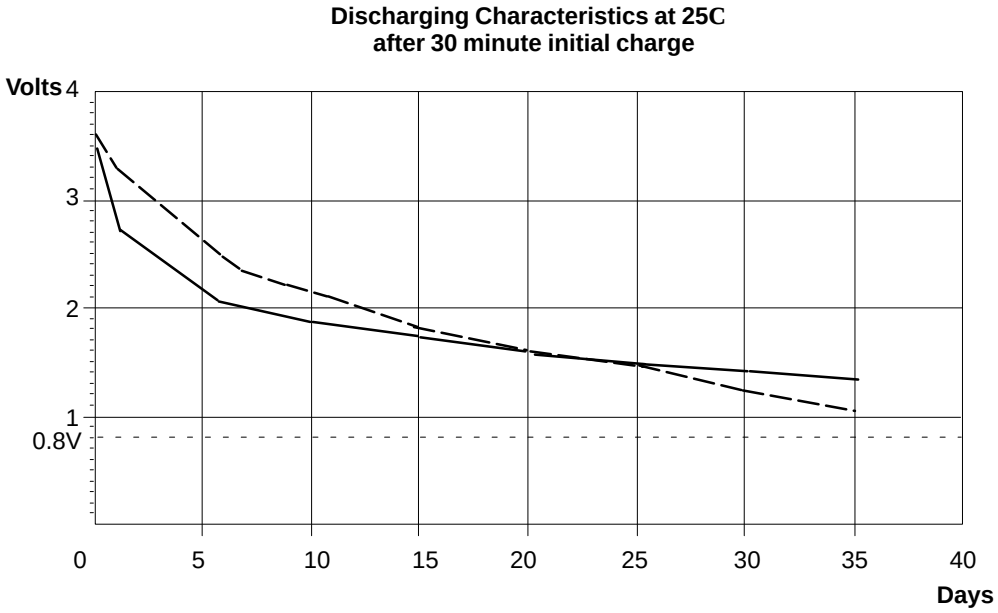


Discharging Characteristics

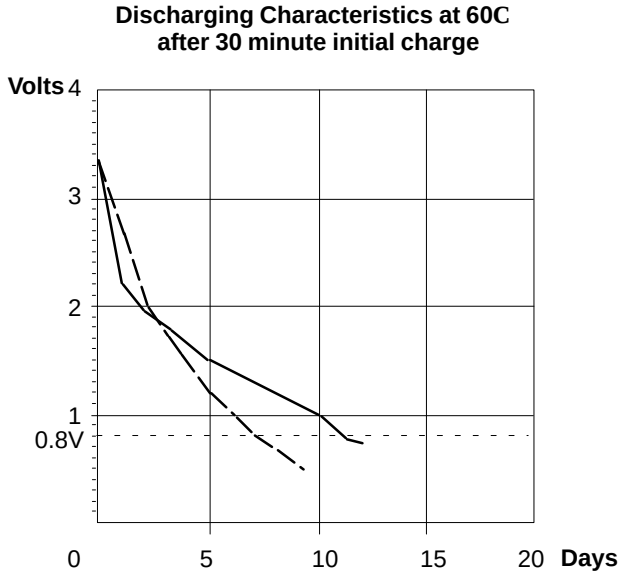
A minimum charge of 1.0 volt is required to store a program. The Micro PLC stores its application program as long as it is connected to its normal power source. If power is removed, the length of time a program can be retained depends on environmental conditions and other factors.

On the graphs below, the solid curves show the discharging characteristics of the memory unit for all CPUs except models IC620MRDR014A and 114A. The dashed curves show the discharging characteristics for those two models.

46094



46095



Installing an EPROM or Battery-Backed RAM

To use an application program stored on EPROM, the EPROM must be programmed and installed in the Micro PLC as explained below. Battery-Backed RAM can be programmed after installation.

Because EPROM installation requires access to the right side of the CPU unit, it should be done before permanently installing the Micro PLC.

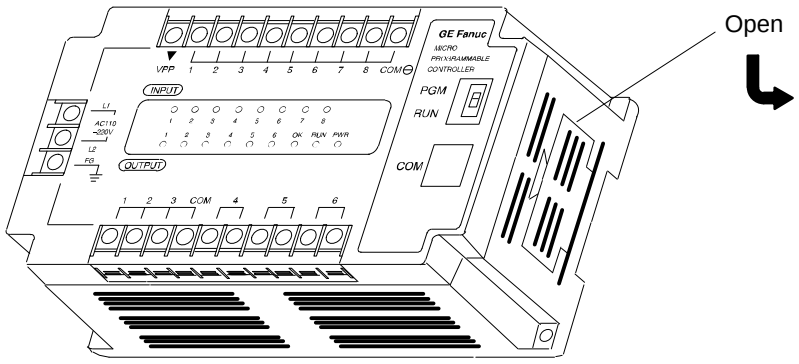
Caution

To prevent possible damage to the Micro PLC, this operation should be performed in an area equipped with suitable electrostatic discharge protection.

To install an EPROM or Battery-Backed RAM in the Micro PLC:

1. **If power is applied, turn it off.**
2. **Open the door in the right side of the CPU unit.**

46022

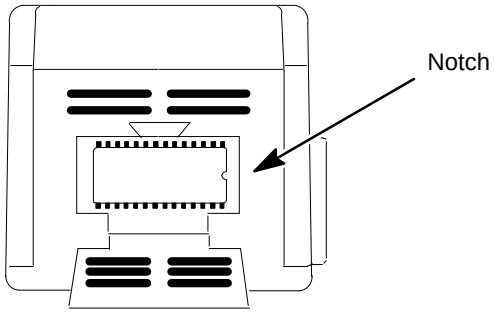


It is easiest to open the door by pressing it down toward the base of the unit, then pulling it outward.

3. **Gently pry up the RAM memory chip.** Use an EPROM extraction tool if possible.

   If you don't have an EPROM extraction tool, a small screwdriver can be used instead. Carefully working from side to side, remove the RAM chip from the socket.

46023

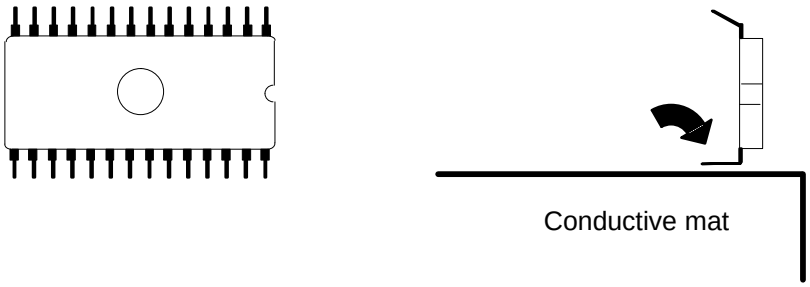


Note the position of the notch in the RAM chip.

4. **If necessary, bend the pins on the EPROM or Battery-Backed RAM so they line up properly with the holes in the socket.**

   The pins on a new EPROM or Battery-Backed RAM may not be correctly aligned for inserting into the socket. Bend the pins by pressing each side against a clean desk or table top as shown below. If possible, a conductive mat should be used.

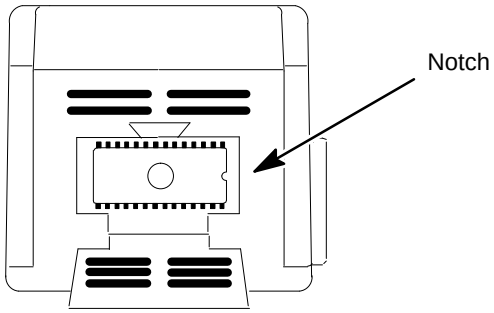
46024



5. **Insert the EPROM or Battery-Backed RAM into the socket.**

   Be sure the notch in the EPROM or Battery-Backed RAM is in the same position as the notch in the RAM chip:

46025



   IMPORTANT: Inserting the EPROM or Battery-Backed RAM backward can damage the Micro PLC and destroy the EPROM or Battery-Backed RAM. Damage caused by improper position of an EPROM or Battery-Backed RAM voids the Micro PLC unit's warranty.

6. **Close the door on the CPU unit.**

As you gain experience with this procedure, it becomes very easy.

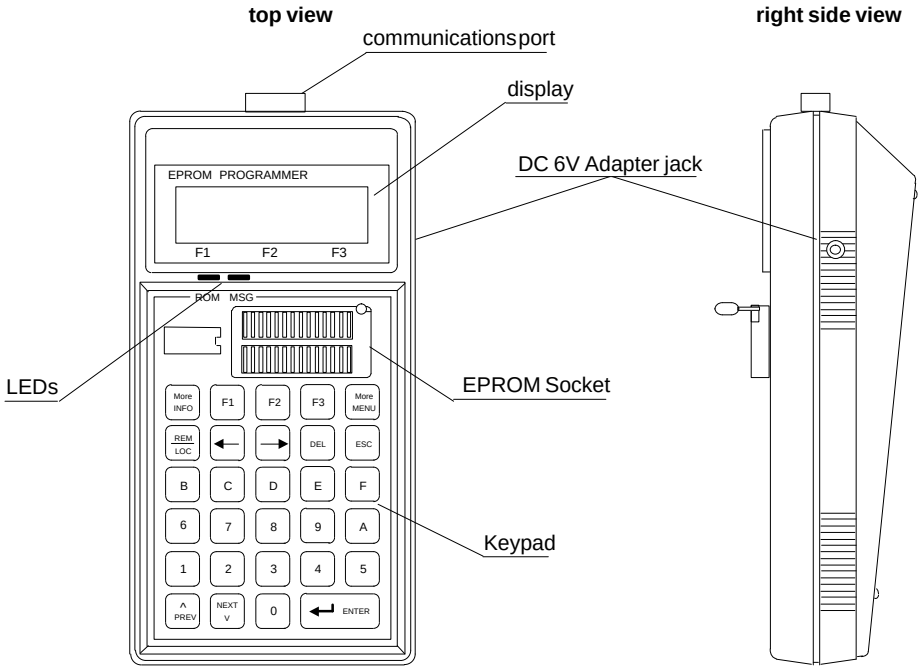
Charging the CPU Unit's Program Backup Memory

If you are installing a new Micro PLC CPU which will use its internal memory unit (not an optional EPROM) for program backup, be sure power is connected for approximately 30 minutes to charge the memory unit. If that is not done, the Micro PLC will not be able to store an application program for its rated time *when disconnected from power.*

Once the memory unit is properly charged, reconnecting power even for a short time will recharge it.

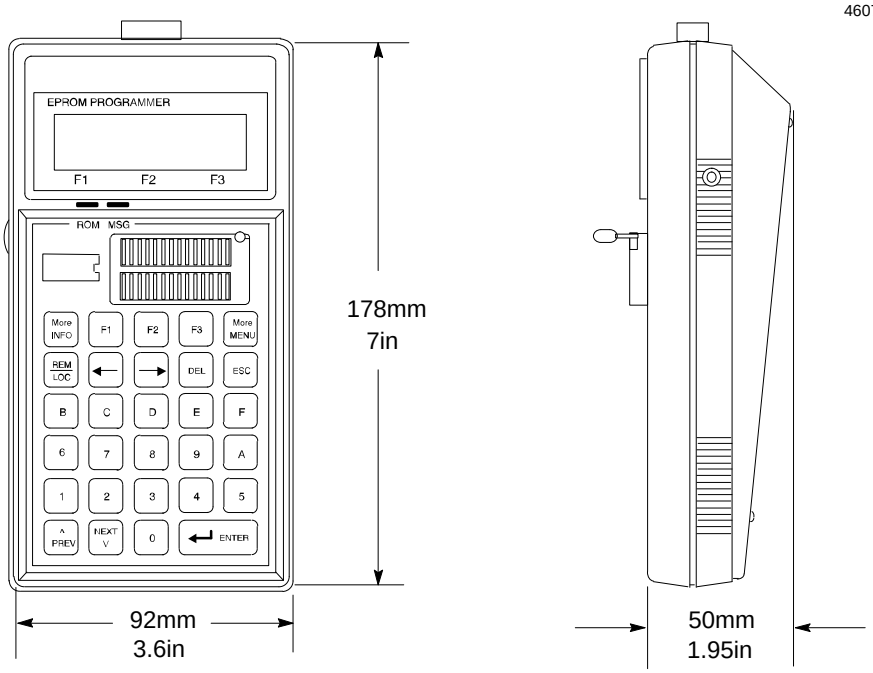
The EPROM Programmer

46070



Dimensions

46071



EPROM Programmer Specifications

Item	Specification
Processor	Intel8031AH
Memory	27C64, 8K bytes
Programmemory	CMOS RAM, 32K bytes
Interface type	RS–232C compatible 9-pin serial communications
System interfaces	Hand-held Programmer, PC, Micro PLC
Baud rate	9600 BPS
Data format	8 bits, no parity, 1 stop bit
Input voltage	from PLC, or from 6VDC, 400mA adapter
Power Consumption	1.5 Watt (250mA) @ 5VDC ± .23V
Programmingvoltage	Vpp: 12V ±0.3V
Dimensions	178mm H x 92mm W x 50mm D 7" H x 3.6" W x 1.95" D
Weight	320g (0.7 lb)
Operating humidity	5% to 95% relative humidity (no condensation)
Operatingtemperature	0 to 55C
Storagetemperature	–20 to +70C
Display	Backlit LCD 2 lines, 16 characters per line
Keypad	20-key soft-touch membrane contact keypad
LEDs	ROM and error LED indications

Software Version

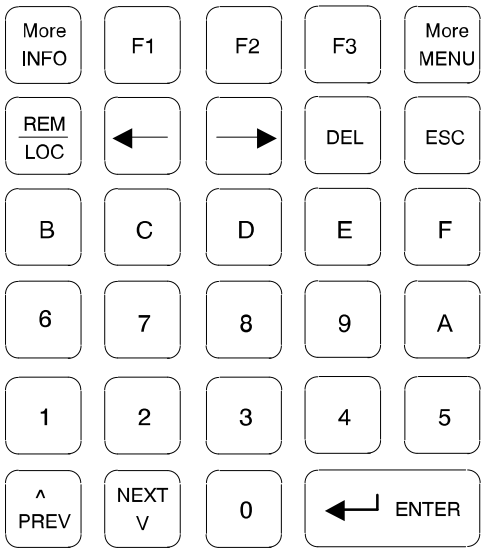
The HHP powerup screen shows the software version of the HHP. For example:

```
EPROM PROGRAMMER
     VERS  2.23
```

Keypad Functions

The keypad of the EPROM programmer has selection, alphanumeric, and execution keys:

46072



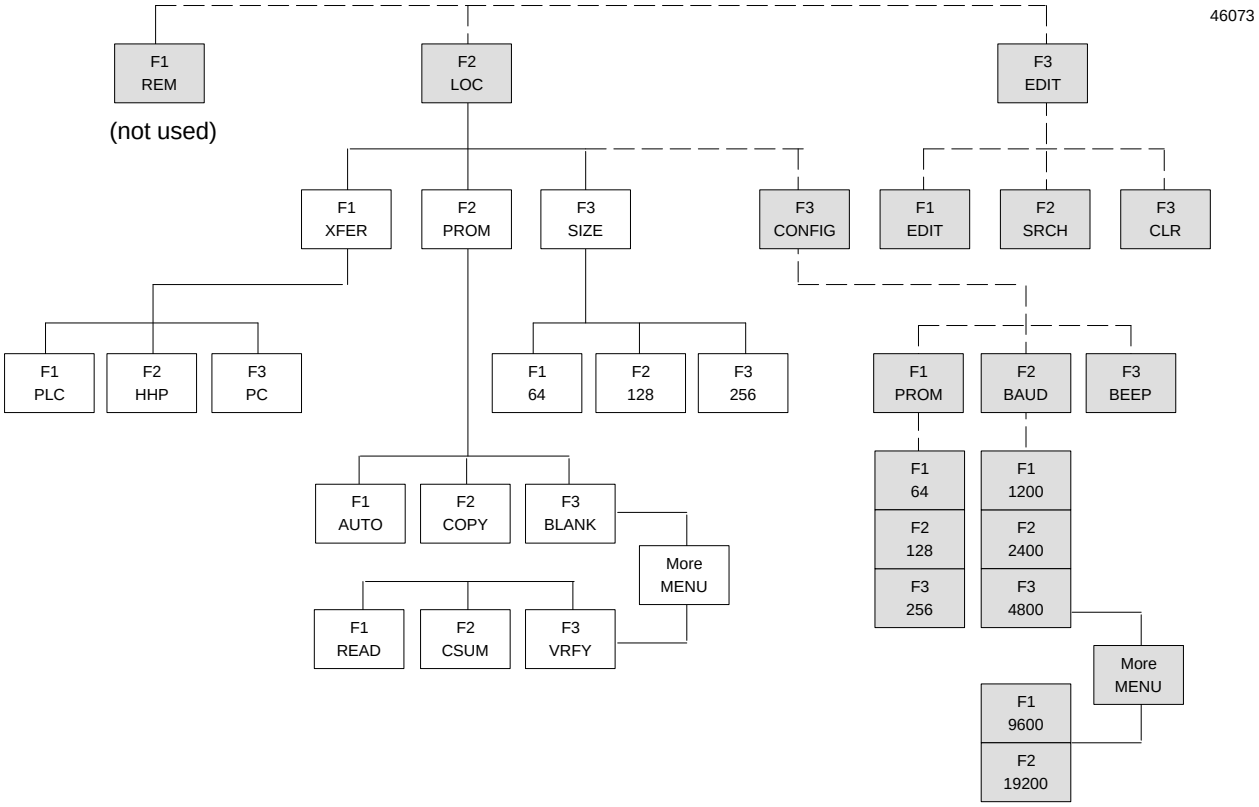
The DEL and REM / LOC keys are not used.

Key Definitions

Item	Key	Selection/Description
Selection	**F1** **F2** **F3** **More MENU**	Use these keys to access the EPROM Programmer menus, as explained on the next page.

EPROM Programmer Menus

Function keys F1, F1, and F3 access the EPROM Programmer menus. Menu contant depends on the EPROM Programmer version. The shaded boxes represent menus for versions IC620ACC001 A and B. The unshaded boxes represent menus for version C.



1st Selection	2nd Selection	3rd Selection	4th Selection	Functions
F2 (LOC)	F1 (XFER)	F1 (PLC) F2 (HHP) F3 (PC)		Transfer program from PLC Transfer program from HHP Transfer program from PC
	F2 (PROM)	F1 (AUTO) F2 (COPY) F3 (BLANK) F1 (READ) F2 (CSUM) F3 (VRFY)		Check blank and copy ROM Copy ROM Check blank Read program from ROM Checksum Verify
	F3 (SIZE)	F1 64 F2 128 F3 256		Select EPROM type. **Must be 64 (for 27C64).**
	F3 (CONFIG)	F1 (PROM)	64 128 256	Select EPROM type. **Must be 64 (for 27C64).**
		F2 (BAUD)	1200, 2400, 4800, 9600, or 19200 BPS	Select baud rate. **Must be set to 9600.**
		F3 (BEEP)	ON or OFF	Turn beep on or off

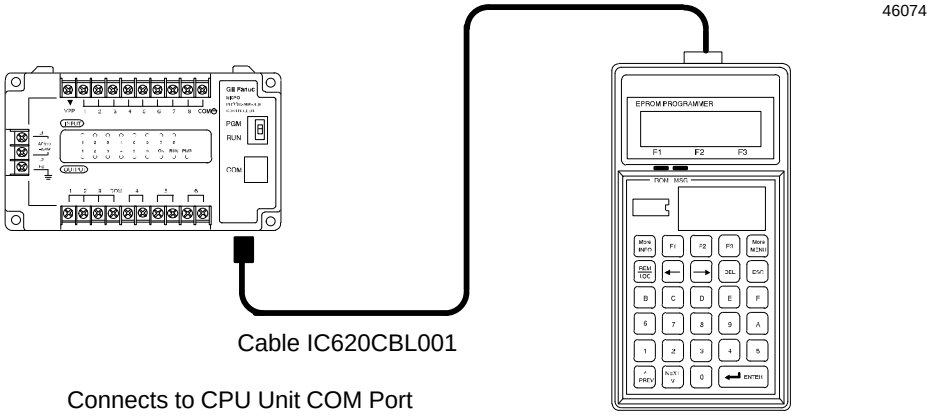
Transferring a Program to the EPROM Programmer

The first step in storing a program on EPROM is to transfer it to the EPROM Programmer from another device:

- a Micro PLC
- a computer running the programming software
- a Hand-held programmer
- an EPROM

Transferring a Program from a Micro PLC

1. **Connect the programming cable (IC620CBL001) between the EPROM Programmer and the Micro PLC:**



   The EPROM Programmer will get its power from the Micro PLC, do not connect an external AC adapter.

2. **Configure the baud rate:** select **Local (F2)**, **CONFIG (F3), BAUD (F2)**, **More Menu**, then **9600 (F1)**. Press **ESC** to return to the Local menu.

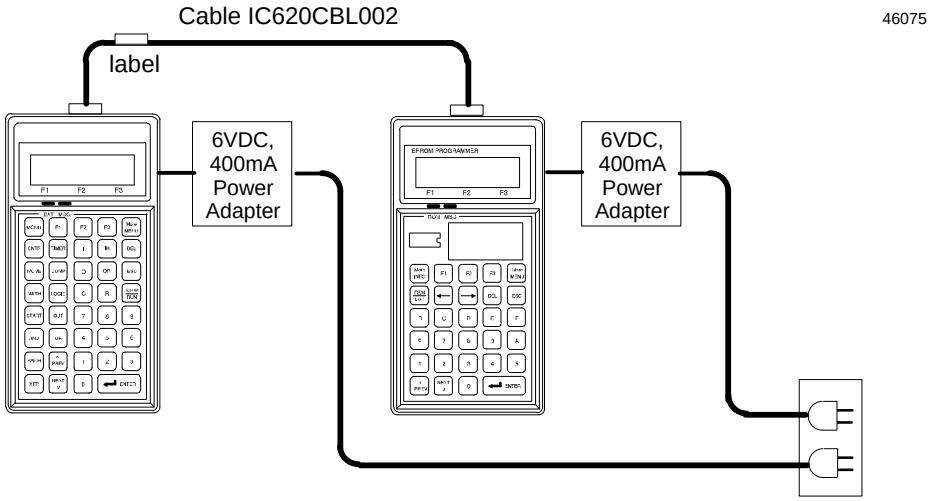
3. **Follow the steps shown below to transfer the program.**

Key Operations	EPROM Programmer Displays
The screen shown at right appears on version C of the EPROM Programmer (see page C-10 for information about earlier versions).	EPROM PROGRAMMER XFER PROM SIZE
F1 XFER	TRANSFER TO/FROM PLC HHP PC
F1 PLC The screen shown at right appears when the transfer is complete.	Upload Complete Press Any Key

Turn to “Writing the Program to EPROM”.

Transferring a Program FROM a Hand-held Programmer

- Connect the programming cable (IC620CBL002) between the EPROM Programmer and the Hand-held Programmer. Connect the end nearest the label to the HHP.
- Connect both the EPROM Programmer and the HHP to the same input power source, using 6V adapter cables.



Follow the steps shown below to transfer the program.

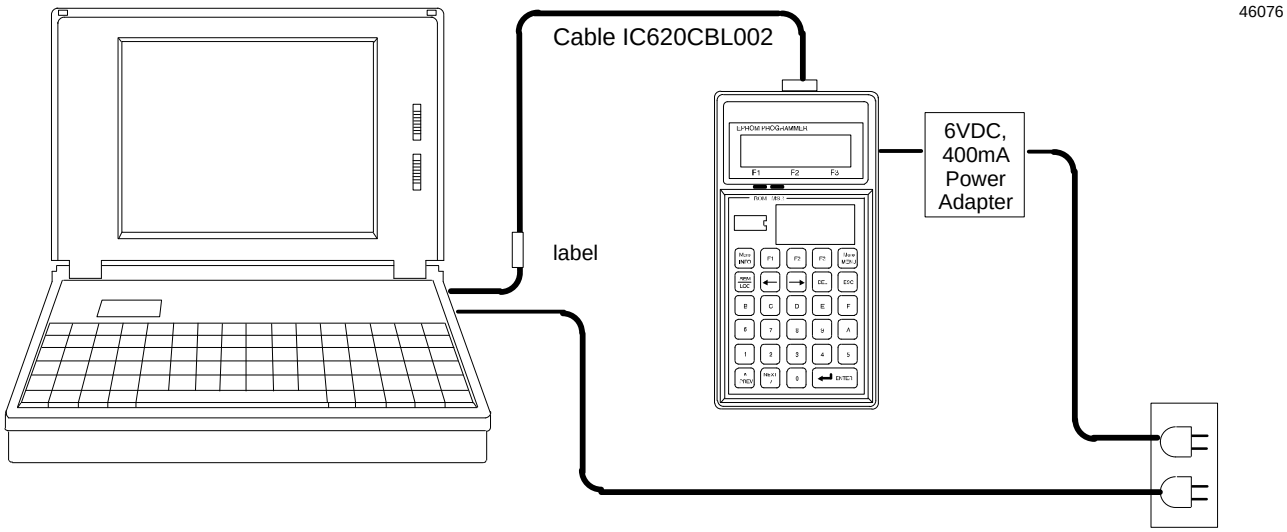
HHP Key Operations	HHP Displays	EPROM Programmer Key Operations	EPROM Programmer Displays
	HHP LOADER 2.32 COMM TARGET 0.0		
F1 XFER	TRANSFER TO/FROM PLC HHP PC		
F2 PROM	PROM TRANSFER UPLD DWNLD		EPROM PROGRAMMER XFER PROM SIZE
		F1 XFER	TRANSFER TO/FROM PLC HHP PC
		F2 HHP	Exec HHP XFER Then press ESC
F2 DWNLD	Download Complete Press Any Key		

Turn to “Writing the Program to EPROM”.

Transferring a Program FROM a Computer

1. **Connect the programming cable (IC620CBL002) between the EPROM Programmer and the computer.** Be sure the label end is connected to the computer.

2. **Connect the EPROM Programmer and the computer to the same input power source.**



3. (For EPROM Programmer version IC620ACC001 A only): **configure the baud rate for the EPROM Programmer:** select **Local (F2)**, **CONFIG (F3), BAUD (F2)**, **More Menu**, then **9600 (F1)**. Press **ESC** to return to the Local menu.

4. **Follow the steps shown below to transfer the program.**

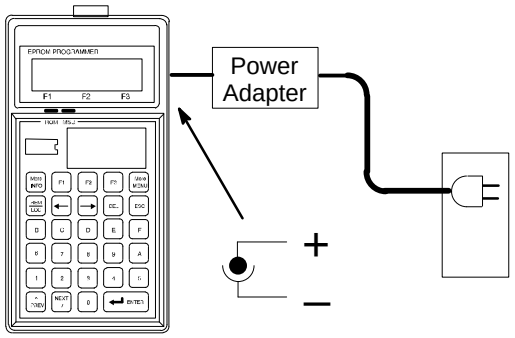
Computer Key Operations	Computer Displays	EPROM Programmer Key Operations	EPROM Programmer Displays
Start the PC and access the programming software.			
F2 ONLINE			EPROM PROGRAMMER XFER PROM SIZE
		F1 XFER	TRANSFER TO/FROM PLC HHP PC
		F3 PC	Execute PC XFER Then press ESC
F2 DWNLD			

Turn to “Writing the Program to EPROM”.

Reading a Program from an EPROM

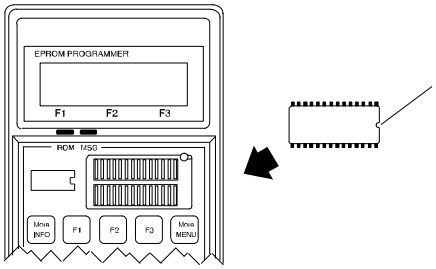
1. **Connect the EPROM Programmer to input power using a 6VDC, 400 mA adapter.**

46077



2. **Insert the EPROM to be read into the EPROM socket**. Be sure the small notch is toward the handle (right) end of the socket. Writing on the EPROM may or may not be upside-down.

46078



This operation should be performed in an area equipped with suitable ESD (electrostatic discharge) protection to prevent damage to the EPROM Programmer.

3. **Lower the handle on the socket to lock the EPROM in position.**

4. (For EPROM Programmer version IC620ACC001 A only): **Configure the PROM type:** select **Local (F2)**, **CONFIG (F3), PROM (F1)** then **64 (F1**). Press **ESC** to return to the Local menu.

   (For EPROM Programmer version IC620ACC001C only): **Configure the PROM type:** select **SIZE (F1)** then **64 (F1**).

5. **Follow the steps shown below to read the program.**

Key Operations	EPROM Programmer Displays
	EPROM PROGRAMMER XFER PROM SIZE
F2 PROM	—— EPROM —— AUTO COPY BLANK *
More MENU	—— EPROM —— READ CSUM VRFY *
F1 READ	Reading . . . xxxx Read Complete

Turn to “Writing the Program to EPROM”.

Writing the Program to EPROM

After transferring the program to the EPROM Programmer, the screen displays one of the following messages:

Upload Complete press Any Key	following program transfer from a Micro PLC
	or
Exec HHP XFER Then press ESC	following program transfer from a computer or Hand-held Programmer
	or
Read Complete	after reading a program from EPROM

The program stored in the EPROM Programmer can now be programmed on a blank EPROM.

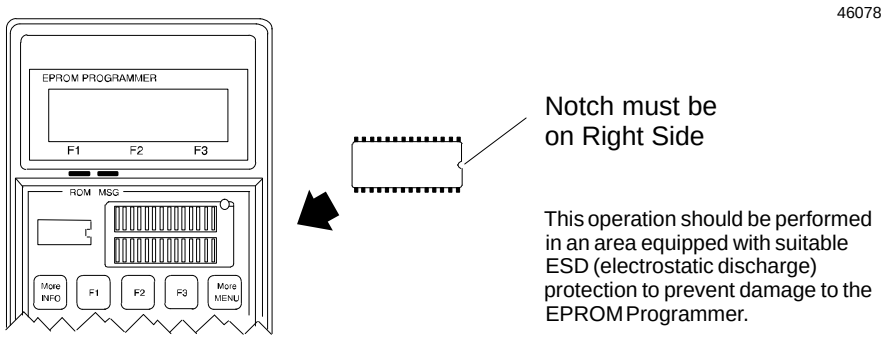
1. **If you haven't already done so, configure the PROM type**.

   For EPROM Programmer version IC620ACC001 A only: select Local (F2), CONFIG (F3), PROM (F1) then 64 (F1). Press ESC to return to the Local menu.

   For EPROM Programmer version IC620ACC001C only: select **SIZE (F1)** then **64 (F1**).

2. **Select PROM (F2).**

3. **Insert the EPROM to be programmed into the EPROM socket.** Be sure the small notch is toward the handle end of the socket. Writing on the EPROM may or may not be upside-down.



4. **Lower the handle on the socket to lock the EPROM in position.**

5. You can check the blank EPROM then copy the program separately, or do both automatically.

If you want to check the EPROM and copy the program automatically, select F1 (AUTO).

If you want to check the EPROM then copy the program separately, follow these steps:

Key Operations		EPROM Programmer Displays
F3 BLANK		Blank Check O.K.
ESC		—— EPROM —— AUTO COPY BLANK *
F2 COPY	The program is copied to the EPROM	Copying . . . xxxx Verify Complete
ESC		

Compare the Programs

If you want to compare the program copied to EPROM against the version stored in the EPROM Programmer, follow these steps:

Key Operations	EPROM Programmer Displays
	—— EPROM —— AUTO COPY BLANK *
More MENU	—— EPROM —— READ CSUM VRFY *
F3 VRFY	Verifying . . .
ESC	Verify Complete

Copying EPROMs

The program in the EPROM Programmer can be written to additional EPROMs as needed.

If a large quantity of identical EPROMs is required, a commercial EPROM burner can be used to make multiple copies of any EPROM programmed with the EPROM Programmer.

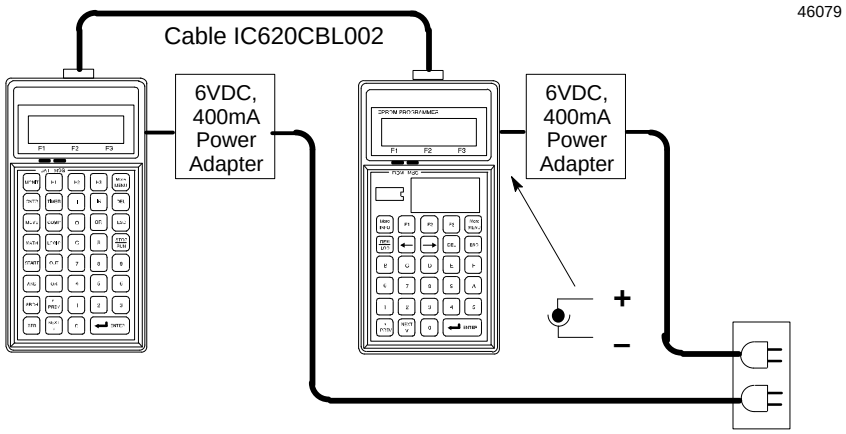
Transferring a Program from the EPROM Programmer

A program that is located in the EPROM Programmer can be directly transferred to:

- a computer running the programming software
- a Hand-held programmer

Transferring a Program TO a Hand-held Programmer

- Connect the programming cable between the EPROM Programmer and the HHP.
- Connect both the EPROM Programmer and the HHP to the same input power source.

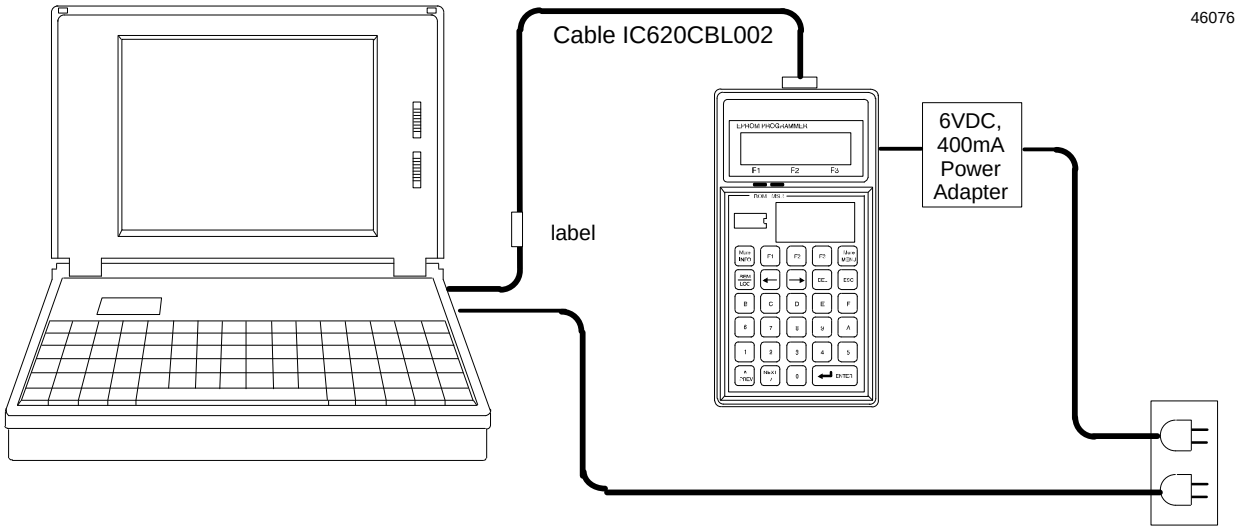


Follow the steps shown below to transfer the program.

HHP Key Operations	HHP Displays	EPROM Programmer Key Operations	EPROM Programmer Displays
	HHP LOADER 2.32 COMM TARGET 0.0		
XFER	TRANSFER TO/FROM PLC HHP PC		EPROM PROGRAMMER XFER PROM SIZE
		F1 XFER	TRANSFER TO/FROM PLC HHP PC
		F2 HHP	Exec HHP XFER Then press ESC
F2 PROM	PROM TRANSFER UPLD DWNLD		
F1 UPLD	PROGRAM START START I1		

Transferring a Program TO a Computer

1. **Connect the programming cable between the EPROM Programmer and the computer.** Connect the end nearest the label to the computer.
2. **Connect both the EPROM Programmer and the computer to the same input power source.**



3. **Follow the steps shown below to transfer the program.**

Computer Key Operations	Computer Displays	EPROM Programmer Key Operations	EPROM Programmer Displays
Start the PC and access the programming software.			
F2 ONLINE			EPROM PROGRAMMER XFER PROM SIZE
		F1 XFER	TRANSFER TO/FROM PLC HHP PC
		F3 PC	Execute PC XFER Then press ESC
F1 UPLD			

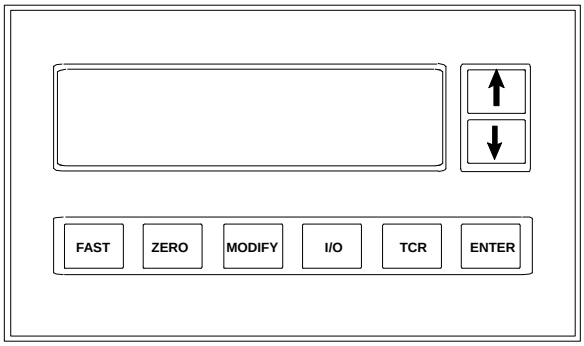
Appendix D Related Products

This appendix introduces some products, made by other companies, that can be used to enhance a Micro PLC application.

- Data Access Unit
- Multidrop Hardware Network for the Micro PLC

Data Access Unit

The Data Access Unit is a panel-mountable, NEMA 4–12 operator interface for the Micro PLC. It displays I/O data, which can be forced and modified using the sealed function keys. No programming is required; the unit is ready to use.



Shown at 50% actual size

The Data Access Unit communicates with a Micro PLC via the COM port. It can be powered by either 12 VDC or 24 VDC.

Key Functions

The keys on the Data Access Unit have the following functions:

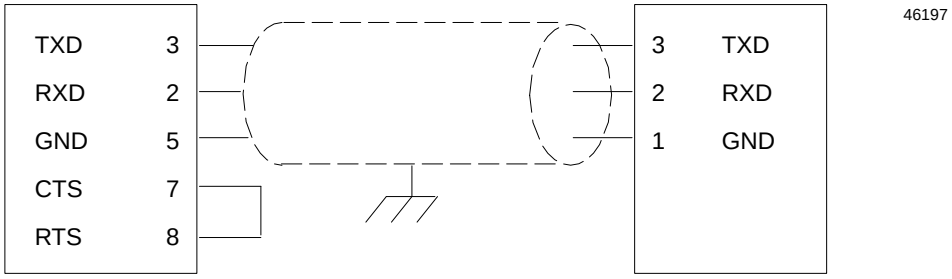
I/O	Selects the I/O monitoring function.
Modify	Modifies data.
Zero	Sets a value to 0.
Up Arrow & Down Arrow	Incrememt or decrement a value.
Fast	Speeds up incrementing or decrementing.
Enter	Writes the modified data to the Micro PLC.

Specifications

NEMA Rating	4–12
Size (Height x Width x Depth)	3.50 in (8.89cm) x 6.00 in (15.24cm) x 2.13 in (5.41cm)
Display Lines X Characters	2 X 16
Character Height	.375 in (.95cm)
Baud Rate (fixed)	9600
Parity, Data Bits, Stop Bits	N, 8, 1
DC Operating Voltage	8–32V
Current @ 24 VDC	100mA
Operating Temperature	0C to 60C
Relative Humidity	5% to 95%

Connection

The Data Access Unit connects to the COM port on the front of the Micro PLC CPU. The cable should not be longer than 6 feet.



For More Information, Contact:

Horner Electric
1521 East Washington Street
Indianapolis, IN, 46201

telephone: (317) 639–4261

Multidrop Hardware Network for the Micro PLC

MicroPLC Net allows up to 16 Micro PLCs to be multidropped on an RS-485 twisted-wire network. One device, usually a personal computer with an RS-232 serial port, is used as a master. The Micro PLCs serve as slaves.

MicroPLC Net can be used for:

- downloading application programs to multiple PLCs
- building automation
- simple machine automation
- supervisory systems

A master interface module connects the computer to the bus. A slave interface module is needed for each slave.

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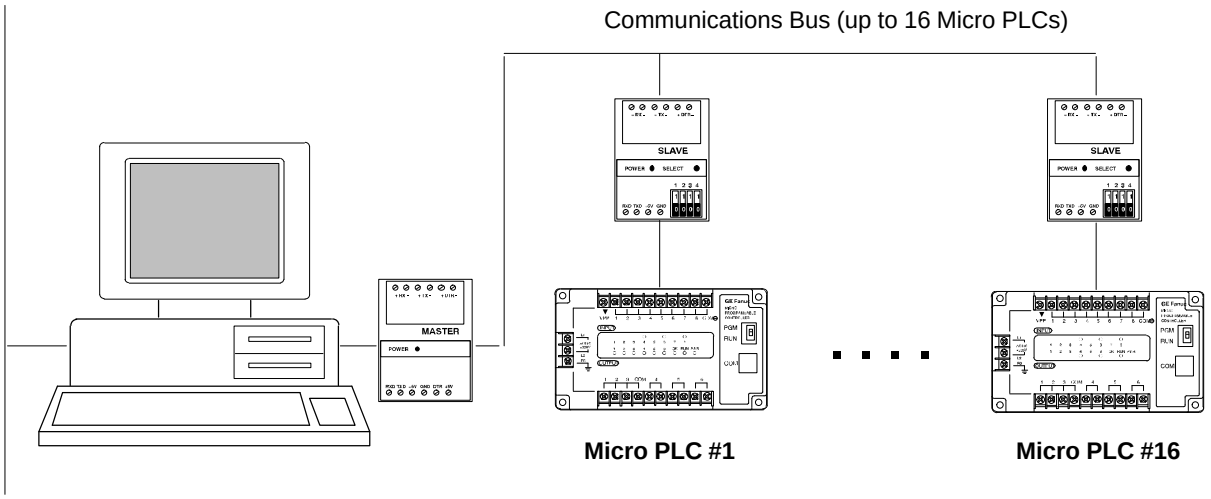


Power Sources

Power for a slave interface module comes from the Micro PLC to which it is attached. Power for the master interface module can come either from the closest slave or from a separate 9 volt DC supply.

Data Transfer

The MICRONET software in the computer essentially establishes a point-to-point connection between the master interface module and a specified slave interface module.

Once the link is established, the computer initiates communications with the Micro PLC at that location. Communications use the designated communications protocol (either Micro PLC protocol or RTU protocol).

Although multiple Micro PLCs may be present on the network, the MICRONET software can only establish a point-to-point link with one Micro PLC at a time. If the application software involves communicating with more than one Micro PLC, it is necessary to call the Micro PLC Net software to establish each new communications link.

Specifications

Item	Specification
Computer connections (master module)	RS-232 RX, TX, DTR, and GND
Micro PLC connections (slave module)	RS-232 RX, TX, and GND
Network	RS-485 RX+ – , TX+ –, DTR+ –
Network ID (addressing)	Set by DIP switches in the slave interface module
Micro PLCs per network	Up to 16 (addresses 0 to 15)
Baudrate of serial channels	Determined by Micro PLCs and the master software
Maximum distance	1000 meters (3280 feet)
Power supply (slave module)	5 volt +/–5%, from Micro PLC 50 milliAmps
Power supply (master module)	5 volt +/– 5%, if from Micro PLC or 9 to 12 VDC power supply 15 milliAmps
Connections	Screw terminals
Dimensions	3.5 in (8.89cm) x 2.1 in (5.33 cm) x 2.3 in (5.84 cm)
Mounting	35mm DIN rail
Operating temperature	0º to 55º C (32º to 131º F)
Storage temperature	–20º to 70º C (–4º to 158º F)
Humidity	20% to 95% non-condensing

For More Information, Contact:

Horner Electric
1521 East Washington Street
Indianapolis, IN, 46201

telephone: (317) 639–4261

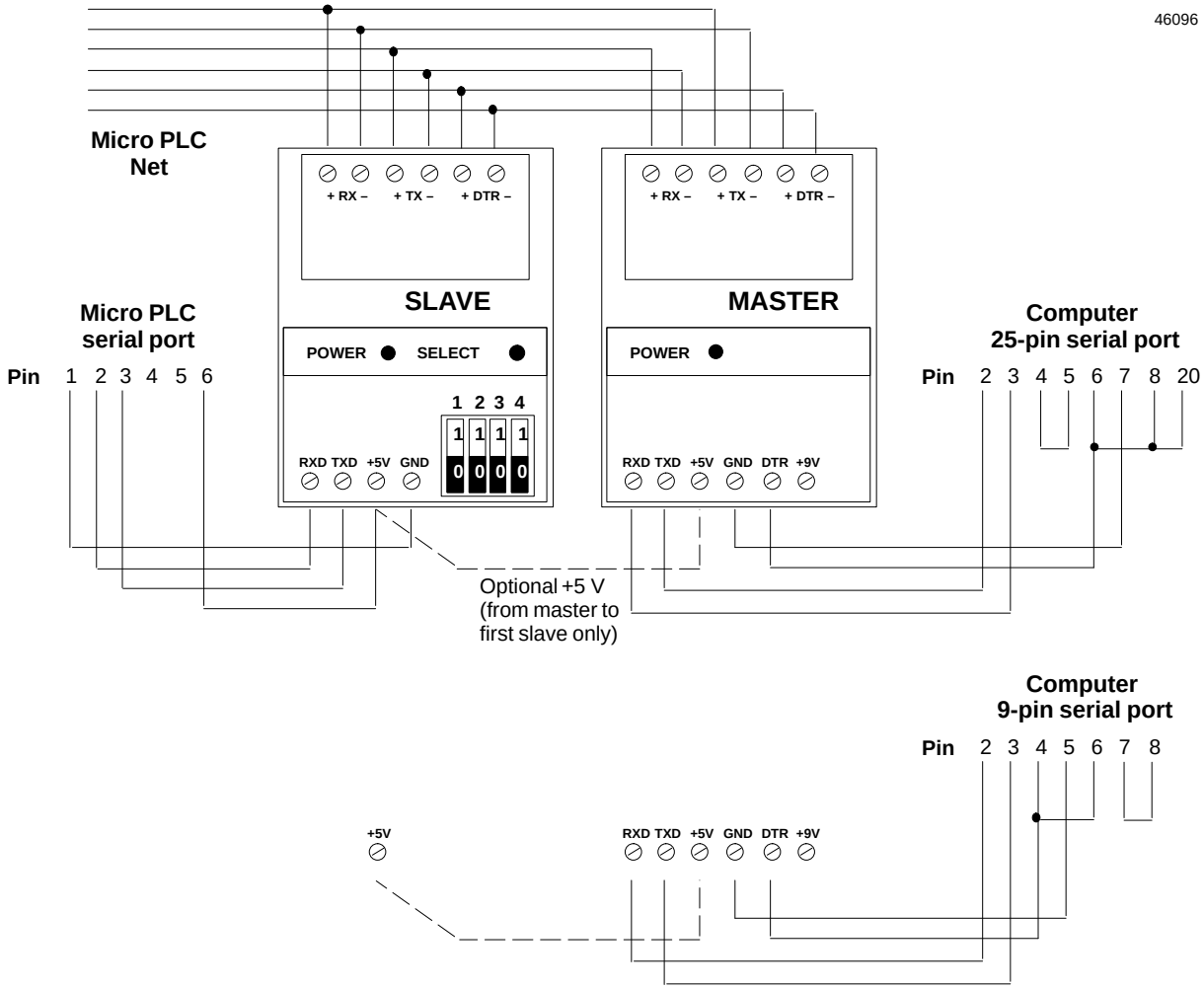
Part Numbers

Master interface module:	HE485MST232
Slave interface module:	HE485SLV232
Software:	part number not available at time of publication; contact Horner Electric for information.

Installation

Micro PLC Net interface modules are ready to install and operate.

Connections between modules, and from modules to master and slave devices, are shown below.



The cable from an interface module to a slave or master may be up to 15 feet (4.5 meters) long.

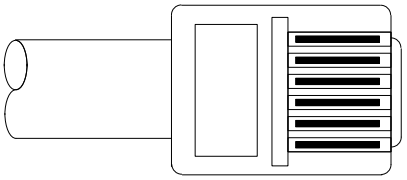
Power Sources

A slave interface module gets 5V power from the COM port on the Micro PLC. If the master interface module is located within 15 yards (13.5 meters) of a Micro PLC, it can get its 5V power from the Micro PLC as shown above. Or it may be powered by an external 9 VDC power supply.

Connecting a Slave Interface Module to the Micro PLC

Connection from a slave interface module to a Micro PLC is made via the COM port on the Micro PLC CPU unit. The COM port accepts a standard RJ-11 (telephone) connector. The cable (not provided) may be up to 15 feet (4.5 meters) long.

The connector pin assignments are:



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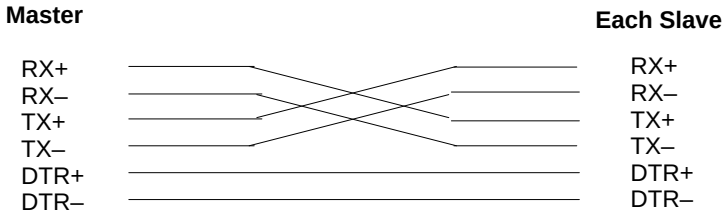
Pins	
6	blue
5	yellow
4	green
3	red
2	black
1	white

Connecting an Interface Module to the Micro PLC Net

Connections between interface modules and the Micro PLC Net are shown below. Each slave is connected in the same way.



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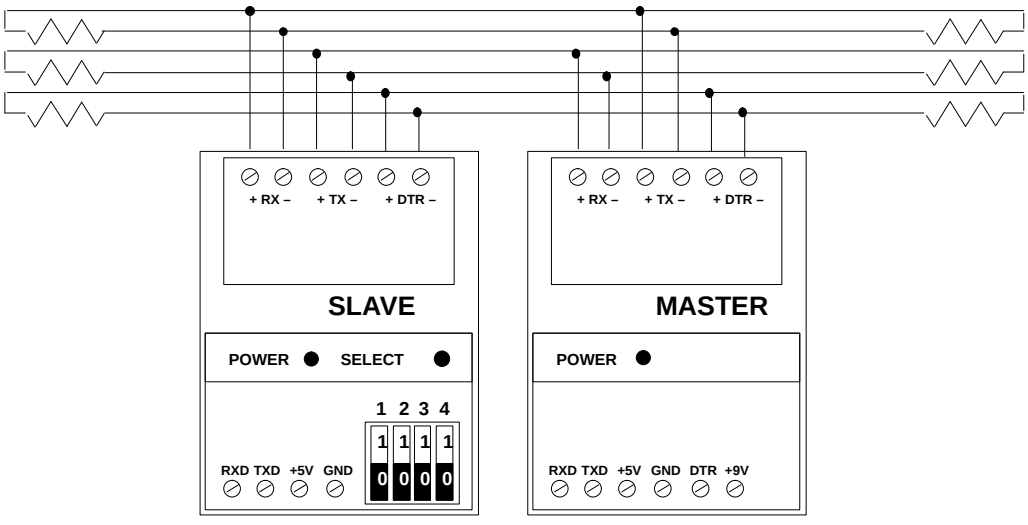
The maximum length from the computer to the last Micro PLC is 1000 meters (3280 feet). For long distances or in electrically noisy environments, 120 Ohm resistors should be installed at both ends of the transmission lines as indicated below. They can be added with the wiring at the screw terminals.



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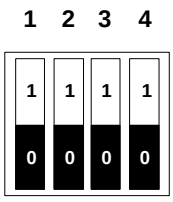
Setting the Address Selection DIP Switches

The DIP switches on each slave interface module must be set to select a unique ID from 0 to 15. This ID is the communications address *of the slave interface module*, not of the Micro PLC or computer. The chart below shows DIP switch positions for each possible Micronet ID.

	DIP Switches			
ID	**1**	**2**	**3**	**4**
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

46093



Note that the Micronet ID is used only by the MICRONET software, as it establishes the link from the master interface module to a particular slave interface module. Some (but not all) applications assign IDs to the Micro PLCs on a network. Those IDs are not related to the Micronet IDs assigned using the DIP switches.

Using the MICRONET Software

A limited DOS-based version of the MICRONET software is provided with the Micro PLC programming software. Fully-functional software, including a Windows-compatible version, is available from Horner Electric.

Using the Demonstration Software

There are three basic ways to use the demonstration MICRONET software:

- The MICRONET demo software can be used with the Micro PLC programming software, for uploading and downloading programs and monitoring data from Micro PLCs. This requires MicroPLC programming software version 2.42 or later.

  Communications between the computer and a Micro PLC on the network are initiated by pressing the F9 (protocol) key from the programming software main menu. Pressing F9 allows you to select a port and name the slave interface box to communicate with.

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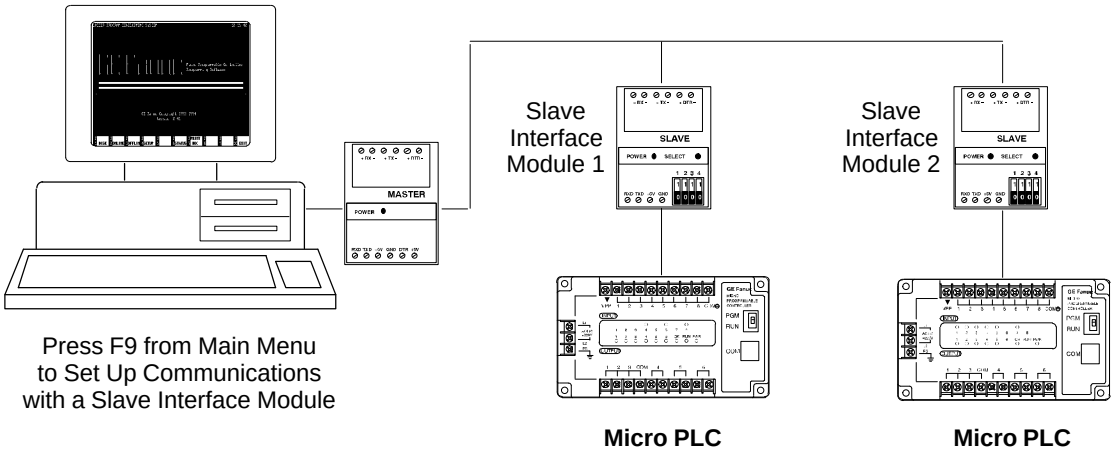


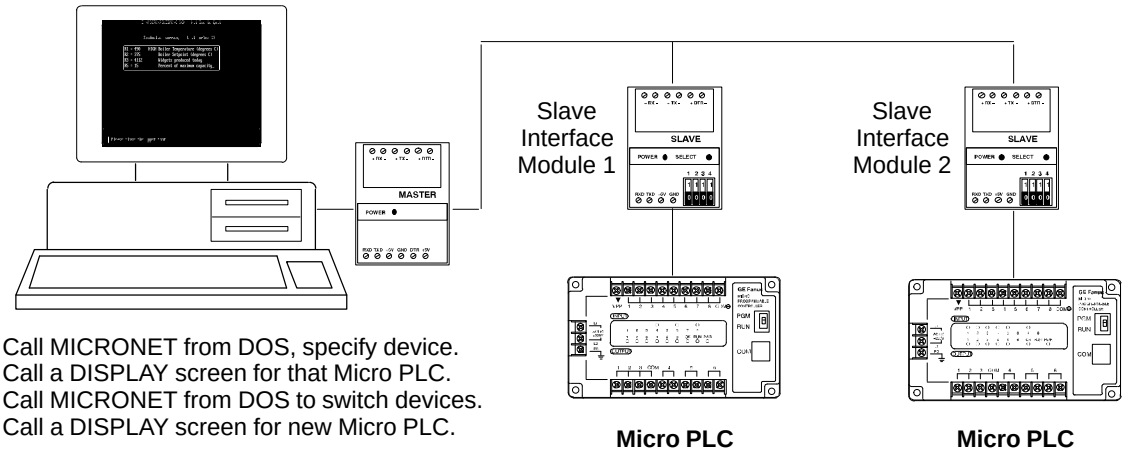
Press F9 from Main Menu
to Set Up Communications
with a Slave Interface Module

After setting up communications, you can upload or download programs, monitor data, or use the other functions of the programming software with the selected Micro PLC.

- The MICRONET demo software can be used with an application such as DISPLAY, which is also included with the Micro PLC programming software. The MICRONET software can be called from the DOS command line (as described later in this appendix).

  The application can use either Micro PLC protocol or RTU protocol. For RTU protocol, the Setup screen of the Micro PLC programming software must be used to assign an ID to each device on the network. While it is not necessary for this ID to match the slave interface module's ID (set with the DIP switches), it may be helpful to assign matching numbers.

46091



- The MICRONET software can be used with a customized program written in a programming langage such as C or BASIC. The application can call the MICRONET software as a task / function / shell, whenever the application needs to communicate with a different device on the network.

  In this type of application, multiple Micro PLCs could supply data for the same display screen or other purpose in the computer. The DISPLAY application, described previously, can only access data from one Micro PLC at a time.

Calling MICRONET from the Micro PLC Programming Software

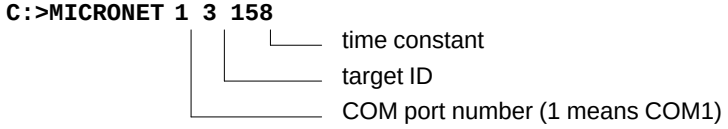
From within the Micro PLC programming software, the MICRONET software can be called by going to the programming software startup screen and pressing the F9 key. On the screen that appears next, you can enter the communications parameters (see below) directly. The time constant is automatically computed the first time you call MICRONET. After that, the same time constant will be used each time you call MICRONET. Note the following:

– If you want to have the time constant re-calculated, first go to DOS and delete the file NETTIME.DAT from the \MICRO directory.

– If, after starting communications, you want to change to a different slave Micro PLC, you will need to return to the startup menu and press F9 again to select the new device.

Calling MICRONET from DOS

If you are not using the Micro PLC programming software, MICRONET can be executed from the DOS command line. It can also be executed as a shell (or equivalent) command from an executing program. The command is entered with three parameters: COM port number, target ID number (see above), and time constant. See the following example.



COM Port The first parameter is the number of the computer's COM port (1, 2, 3, or 4). The COM port you use must have the appropriate address shown below for the MICRONET software to operate properly.

COM1	03F8
COM2	02F8
COM3	03E8
COM4	02E8

Target ID The number set with the slave interface module DIP switches.

Time Constant To find the time constant initially for your computer, enter the MICRONET command with a time constant of 0 (see below). The software will automatically find the correct time constant value.

```
C:>MICRONET 1 3 0      example command with time constant set to 0
Time constant = 203    software returns appropriate value
```

After finding the time constant, you can re-enter the command with the correct value. (If the speed of the computer is changed, you should find a new time constant value as shown above).

A

B

C

D

E

N

O

P

R

S

T

W