CTC PC-Based Control

Technical Brochure

The Shortest Distance Between Man and Machine

Parker Automation

WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise. Before you select or use any product or system, it is important that you analyze all aspects of your application and review the information concerning the product in the current product catalog. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

MachineLogic™ PC-Based Control

A Complete System Solution for Open Machine Control

MachineLogic™ Control Software, combined with CTC's MachinePoint™ I/O products, gives you a single source for PC-based machine control.

This solution can also be integrated with other CTC systems — HMI software, application development software and factory-hardened operator workstations.

That means that CTC is the only supplier you'll need for your open machine control, motion control and industrial automation needs.

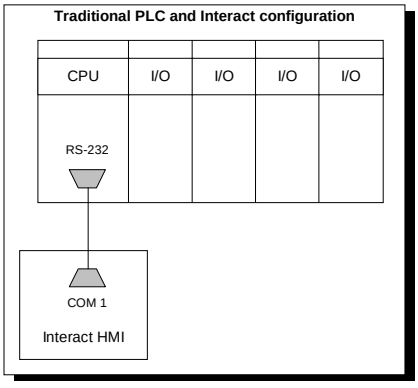
Why Switch from PLC to PC-Based Control?

In general, PC-based control solutions offer many advantages, including:

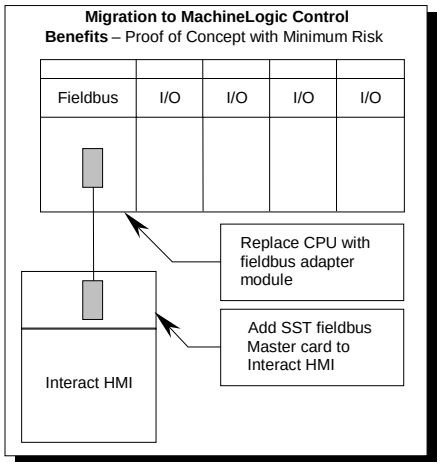
- Deterministic task execution times
- A more integrated control solution
- Hardware choices are more numerous and "open" versus a proprietary control solution
- Ability to use different third party I/O systems with no change in program code

Making the decision to switch from PLC to PC-based Control has gotten even easier with the introduction of MachineLogic Control Software.

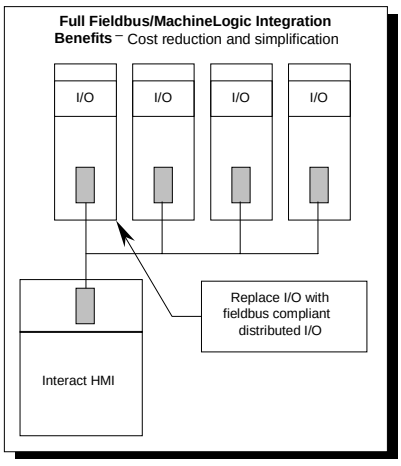
Three Easy Steps to Migrate from PLC to PC



Step 1. CTC PowerStation/Interact HMI Connected to a PLC



Step 2. Remove PLC CPU, install fieldbus adapter and move PLC Logic into MachineLogic



Step 3. Replace PLC I/O with fieldbus I/O for Full System Implementation

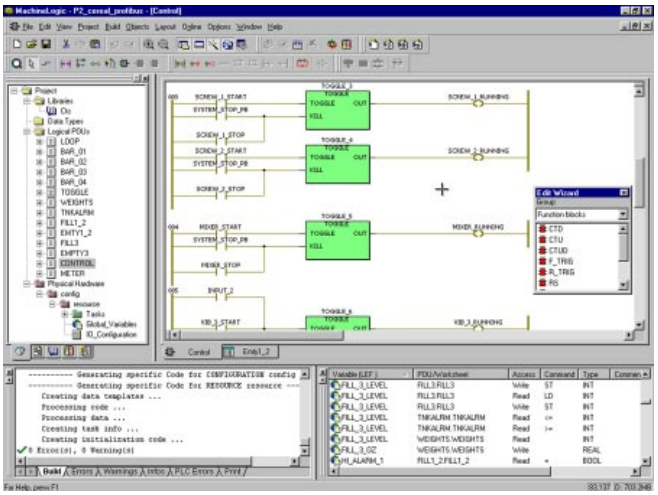
MachineLogic Control Software

With CTC's MachineLogic Control Software, the benefits of PC-based control are available to the machine builder – without all of the cost. MachineLogic is a deterministic, hard real-time control system with program execution times down to one millisecond. It offers the best of both PLC and PC-based technologies with its high level of reliability, time-proven PLC control engine and support of all IEC 61131-3 languages, including ladder logic.

MachineLogic can run on CTC's entire family of PowerStation workstations, ranging from the 6" display P1/P1P up to the 15" Pentium III P9, giving users the ability to match the workstation with the specific needs of the project. MachineLogic can run stand-alone or be used in conjunction with CTC's Interact, the #1 rated machine control HMI software.

MachineLogic 2.11: Additions and Updates

The following list details new product features and updates that are included with the MachineLogic 2.11 update.



General Features

Projects in any Language

Project comments may be translated into another language. To do so:

1. Export project comments to a standard ASCII file
2. Translate the comments into the desired language
3. Re-import the translated comments into the project

New HTML Help

The online help has been updated to an HTML help system. The new help allows you to enter a question to get faster, more exact and simpler information retrieval.

HTML Help for User POUs

In addition to the description textual worksheets, a user defined HTML help page may be added to a POU. This allows for the integration of videos, machine or company specific information, or links to WEB pages in the development environment.

Global Search and Replace

Search and replace can be used throughout an entire project. The worksheets in the project are automatically opened and closed when using the Global Search or Global Replace features.

Templates

Allows the user to create templates with a "save as template" menu option.

Automatic Project Backup and Autosave Function for Worksheets

A time interval can be defined for an automatic saving of projects and worksheets.

Cross References for Global Variables

Cross references include global variables and their direct addresses.

Storing of Cross References

Cross references can be stored in an ASCII file for use in another program.

Opening the Variables Worksheet While in Another Worksheet – by Mouse Click

The variable worksheet can be opened by a toolbar-button.

Automatic Compilation of Variable Worksheets

As soon as a variable worksheet or code worksheet is closed, it is compiled.

Graphical I/O Configuration Dialogs
The I/O Configuration text worksheet has been replaced with a dialog driver interface for the configuration of input/output blocks.

Editor Updates

Graphical Editor

LD EN/ENO Support (Supported by MachineLogic Slot Card only, not supported by MachineLogic PC)
Optional support for input and output enabled bits for function blocks in ladder editor. This gives LD a look similar to products like A-B PLCs.

Optimized Collision Handling
The risk of collisions has been reduced by automatically positioning elements that are being inserted in free places.

Snap to Grid
Optional Snap to Grid allows the insertion point of new elements to snap to a predefined grid nearest to the cursor.

Drag & Drop
All elements may be inserted into a graphical worksheet by means of Drag & Drop. This applies to individual elements (such as FUs/FBs, contacts or variables) as well as entire networks.

Clipboard for SFC
Clipboard functions are now supported for SFC elements.

Individual Setting of Colors
Colors can be defined for any object type.

Multi-Line Comment
Comments extending over several lines can be included.

Powerflow
When the Powerflow is active, accumulator values are now displayed.

Tooltips
If the mouse pointer is positioned on an online-value, the current value is shown in a tooltip.

Worksheet Properties
Settings like the zoom factor or the layout type are automatically saved when closing a worksheet and restored when opening it again.

Page Borders
The page borders of the page layout may be displayed in any editor.

Text Editor

Opening User FBs
In online mode, user FUs/FBs can be opened via the context menu.

Project Manager

Multiple Selections
Multiple selections for functionalities like the clipboard, printing or global search and replace may be used in the MachineLogic Project Tree.

Directories for Firmware Libraries
Firmware libraries may now be placed in any directory.

Online Functionality

Logic Analyzer (Supported by MachineLogic Slot Card only, not supported by MachineLogic PC)

The optional integrated Logic Analyzer provides the following functionalities:

- Real-time data recording from runtime
- Insertion of variables directly from the program-editors
- Automatic scaling
- Recording of definable number of cycles before and after the trigger condition
- Two trigger variables
- Captured data my be exported to CSV file

Representation of Online Values

Online values can be displayed in decimal, hexadecimal or binary representation. The representation modes can be easily switched at any time.

Debug in Libraries

Double-clicking on the corresponding FUs or FBs allows for debugging of user libraries.

Online Representation of VAR_IN_OUT

The online values of VAR_IN_OUT parameters can be displayed within an FB.

MachineLogic: Part of CTC's MachineShop™ Development Suite

MachineShop™ is an integrated suite of Windows-based software tools for developing Interact HMI and MachineLogic PC-based control applications. This allows users to develop PC-based control and HMI applications within the same environment, giving machine builders a time-saving approach to meet their machine requirements.

MachineShop uses a convenient toolbar to make it easy to manage, create, integrate and transfer Interact HMI and /or MachineLogic control applications. It also supports CTC's full line of PowerStations, integrating all of these products into a bundled solution that can fit the requirements of any machine.

MachineShop's toolbar includes a Project Manager, Environment Navigation and a PowerStation Transfer area. The toolbar is packaged with all CTC software – so you can take advantage of its features whether you are using Interact or MachineLogic or both

MachineShop Toolbar Enhancements (v1.05):

- Simplified, direct Serial communications for project downloads
- Selection and configuration of Slot Card or Soft Runtime targets
- Backup and restore updates
- MachineLogic source code management

Two Runtime Targets – One Development Software

For PC-based control, CTC now offers two runtime solutions that share the same MachineShop development environment and toolbar, with the ability to easily download a program. . .

MachineLogic "Soft Runtime" - runs control software on the host CPU of the PC

MachineLogic "Slot Card Runtime" - runs independent of the host CPU and operating system. For larger PC-based control applications, the PCI Slot Card features performance that is beyond even "higher-end" PLC and PC controls.

MachineLogic Soft Runtime Product Specifications

- **IEC 61131 Compliance:** IEC 61131-3 Programming Languages Specification

- **Operating System**

  Development: Windows 95/98/Me/NT/2000/XP
  Runtime: RTXDOS (executes in MS DOS or ROM DOS systems only)

- **Programming Languages**

  LD Ladder Diagram
  FBD Function Block Diagram
  SFC Sequential Function Chart
  IL Instruction List
  ST Structured Text

MachineLogic's Soft Runtime solution includes a Control Adapter Card, for fail-safe features such as retentive memory, watchdog timer and power fail detection.

- **Multitasking Execution**
  - Up to 16 simultaneous tasks
  - Cyclic task (fixed interval)
  - System task (internal)

- **Instruction Set**
  - All instructions outlined in IEC 61131-3
  - User developed function and function blocks
  - PID routines

- **HMI Interface**
  - Interfaces to CTC's Interact HMI product
  - MachineLogic communicates with Interact via shared memory

- **Data Types Supported (Runtime)**
  - Boolean
  - Short integer
  - Integer
  - Double integer
  - Unsigned short integer
  - Unsigned integer
  - Unsigned double integer
  - Byte
  - Word
  - Double word
  - Real
  - Time
  - String

- **Hardware Requirements**
  - Operates on any CTC PowerStation
  - Operates on any PC**
  - ISA or PC/104 slot
  - CTC Control Adapter Card
  - IRQ and UMB space

- **I/O Support**
  - Profibus DP
  - DeviceNet
  - Other bus topology (TBD)
  - Generic I/O (TBD)
  - PC/104 I/O (TBD)

- **Debug Tools**
  - Instance tree
  - On line monitoring
  - Forcing
  - Watchlist
  - Break points
  - Array and Structure debug
  - Logic analyzer (future)
  - Single stepping/single cycling

- **Additional Features**
  - Off-line simulation and debug
  - Application templates for simplified project creation
  - On-line documentation
  - Interact has the ability to exchange tags with MachineLogic
  - MachineShop™ utility interfaces MachineLogic and Interact development environments

*** Meeting minimum system requirements outlined*

MachineLogic Soft Runtime Technical Specifications

CPU	386SX (minimum)
CPU clock speed	40 MHz (minimum)
Hard drive space	10 Mbytes (minimum)
RAM	4 Mbytes (minimum)
Program Execution Speed	**PowerStation** / **Execution Time** / **Ladder Scan Setting** / **Ladder plus Interact** P1 - 386SX/40 — 1.4 ms — 2 ms — 11 ms PS10 – P266 — 0.1 ms — 1 ms — 1 ms (1,000 rungs with single contact and coil)
I/O Capacity	1024 bytes input (default) 1024 bytes output (default) also dependent on I/O system used
Number of Timers	Memory dependent
Number of Counters	Memory dependent
Number of PLC Tasks	Up to 16
Conventional Memory Requirements	415 Kbytes (RTXDOS, runtime, and Profibus driver)
Form Factor (Control Adapter Card)	PC/104, ISA
Retentive Memory	Disable, 4, 8, 16, 32 Kbytes – software configurable
Retentive Memory UMB Base Address Range	C8000 to EF000 (hex) – software configurable
Retentive Memory Storage	Occurs automatically when +5 VDC supply on ISA or PC/104 bus drops below 4.3 VDC.
Retentive Memory Storage Cycles	Up to 100,000
Watchdog Timer	Software configurable IRQ generated when watchdog failure is detected.
Watchdog Timer Features	• Software enable/disable • Monitors runtime failure (CPU is still executing) • Monitors hardware failure (CPU is not executing)
Watchdog Timeout	170 mSec (typical)
Watchdog Relay Rating	SPST N.O. contact Max. switching capacity: • 240 VAC @0.5 amps (180 W) • 115 VDC @ 0.3 amps (69 VA) • 24 VDC @ 2.0 amps
Power Fail Detect	Software configurable IRQ generated when +5VDC supply on ISA or PC/104 bus drops to 4.75 VDC.
Power Fail Detect features	• Software enable/disable • Maintains retentive data integrity • Disables I/O outputs • Disables MachineLogic control system

** Specifications subject to change without notice*

MachineLogic Slot Card Runtime

CTC now provides machine builders with a package of PC-based control capabilities, never before available on a PCI card. The new MachineLogic™ Slot Card Runtime combines PC openness with PLC reliability and features performance that is beyond even "higher-end" PLC and PC controls. This new PC-based control solution includes standard offerings such as simultaneous fieldbus and Ethernet communications, full IEC 61131 programming language compliance, massive program size, and 16K of I/O.

MachineLogic Slot Card Runtime shown in a complete PC-based control system, with a PowerStation host PC (running Interact HMI) and MachinePoint™ I/O.

Independent Processor and OS

Although the Slot Card can be bundled with Interact software and PowerStation hardware for a complete CTC control solution, it has its own processor and real-time operating system for deterministic, real-time performance, regardless of the host PC's operating system or HMI system. Delivering the fail-safe reliability of a PLC for critical machine applications, the MachineLogic card can continue to run even if the host computer is re-booted.

- **Use in any PCI bus PC (Office or Industrial PC).**
- **Runs independent of host CPU and operating system – not dependent on Windows real-time extensions.**

CTC will also release an OPC Server for the MachineLogic Slot Card. This will allow any Windows-based application (HMI, SCADA, VBA, etc.) to run the card, while maintaining control system independence.

Fieldbus and Ethernet Communication – Simultaneously!

In addition to Profibus and DeviceNet drivers, a newly-released Modbus TCP I/O MachineLogic driver will allow both the Slot Card and Soft Runtime to communicate with Ethernet I/O from several manufacturers including CTC's MachinePoint™ I/O, Opto22, Sixnet, Modicon, Wieland and Wago. This will take advantage of the 100 Base-T Ethernet port that is included on the Slot Card for dedicated I/O communications. With both a fieldbus and Ethernet connection, the Slot Card can actually communicate via Ethernet and either Profibus or DeviceNet - at the same time.

MachineLogic Slot Card Runtime Features

- Independent 133 MHz CPU processor will more than handle most any machine control application.
- Card operation not interrupted by host system reset (Ctrl-Alt-Del)
- Dedicated CPU/Embedded OS guarantees real-time, deterministic operation
- Designed to handle small to very large applications (up to 4 MB of application space)
- Supports Profibus/DeviceNet (1 card per application) and Ethernet I/O at the same time.
- 3 connections available for system debug - Ethernet and RS232 (card) and PowerStation Ethernet port.
- Compact FLASH application storage with automatic transfers between CF disk (on PowerStation) and PCI card.
- Built-in Ethernet port for communication to CTC development system, Ethernet I/O or OPC compliant systems.
- Power failure detection
- Watchdog timer and relay for MCR

MachineLogic Slot Card Runtime Product Specifications

- **IEC 61131 Compliance:** IEC 61131-3 Programming Languages Specification

- **Operating System**
  Development: Windows 95/98/Me/2000/NT
  Runtime: Embedded Real-Time OS

- **Programming Languages**
  LD Ladder Diagram
  FBD Function Block Diagram
  SFC Sequential Function Chart
  IL Instruction List
  ST Structured Text

- **Multitasking Execution**
  - Up to 16 simultaneous tasks
  - Cyclic task (fixed interval)
  - System task (internal)

- **Instruction Set**
  - All instructions outlined in IEC 61131-3
  - User developed function and function blocks
  - PID routines

- **HMI Interface**
  - Interfaces to CTC's Interact HMI product via high speed PCI bus
  - OPC server to host computer via high speed PCI bus

- **Data Types Supported (Runtime)**
  - Boolean
  - Short integer
  - Integer
  - Double integer
  - Unsigned Short integer
  - Unsigned integer
  - Unsigned double integer
  - Byte
  - Word
  - Double word
  - Real
  - Time
  - String

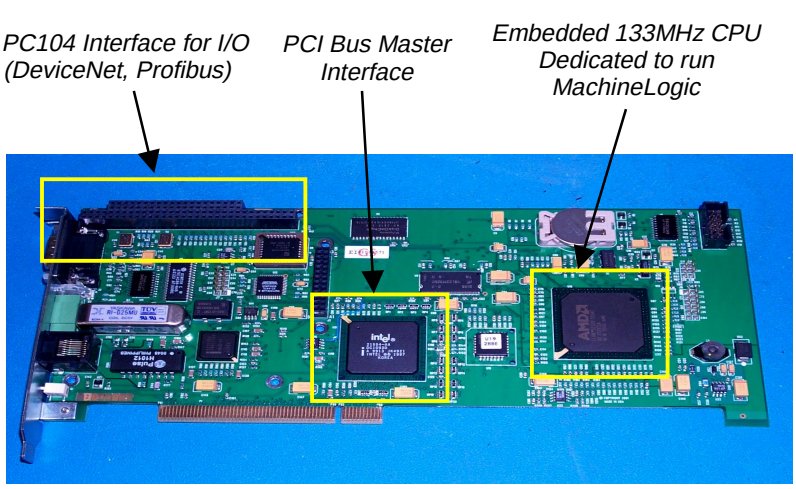
- **Hardware Requirements**
  - Operates on PS10/12/15 (-3 or -4 expansion) or PS9 PowerStations
  - Operates on any PC with PCI Bus v. 2.1 or later
  - One CTC Slot Card per system
  - CTC Slot Card requires one ¾ length slot
  - One expansion slot for optional I/O card

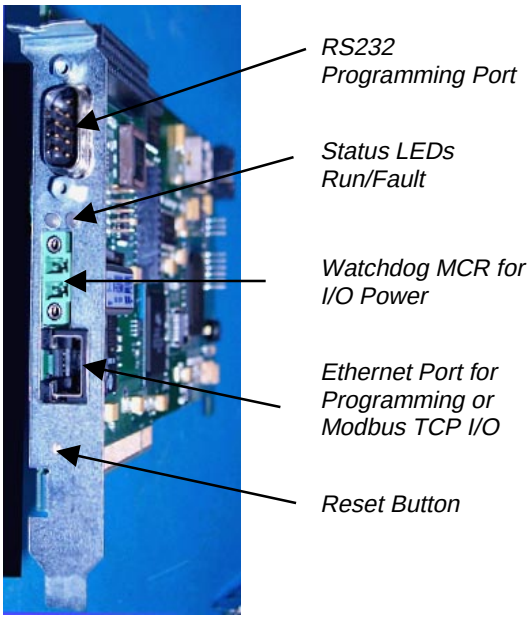
- **I/O Support**
  - Profibus DP
  - DeviceNet
  - Ethernet Modbus TCP I/O
  - PC/104 I/O (TBD)

- **Debug Tools**
  - Instance tree
  - On-line monitoring
  - Forcing
  - Watchlist
  - Break points
  - Array and Structure debug
  - Single stepping/single cycling
  - Logic Analyzer

- **Additional Features**
  - Off-line simulation and debug
  - Application templates for simplified project creation
  - On-line documentation
  - Interact has the ability to exchange tags with MachineLogic
  - MachineShop™ utility interfaces MachineLogic and Interact development environments

Complete PC-Based Control System on a Card





Slot Card Runtime Technical Specifications*

CPU	Embedded 133 MHz CPU
CPU clock speed	133 MHz
Application Memory	4 Mbytes (minimum)
I/O Capacity (Up to 8K inputs and 8K outputs)	1024 bytes input (default) 1024 bytes output (default) dependent on I/O system used
Number of Timers	Memory dependent
Number of Counters	Memory dependent
Number of PLC Tasks	Up to 16
I/O Ports	[1] RS232 – On-line Debugging [1] 10/100 Base-T Ethernet – On-line Debugging, I/O Network [1] PC/104 – On-card I/O Interface Mounting
Status LEDs	Run/Fault
Form Factor	PCI version 2.1 or later (3.3V and 5.0V on Bus)
Retentive Memory	32 Kbytes
Watchdog Relay Rating	SPST N.O. contact Max. switching capacity 24 VDC @2.0 amps

**Specifications subject to change without notice*

MachinePoint™ I/O Solutions

MachinePoint™ I/O is CTC's I/O system for connecting field devices to MachineLogic. It is part of a bundled solution, giving you a single source for machine control, HMI, workstations and I/O.

MachinePoint I/O solutions work with CTC's MachineLogic to provide a systems solution for machine control. Although other third party I/O products work with MachineLogic, MachinePoint I/O offers more features (such as replaceable circuitry) than many other solutions. Plus, you'll benefit because the MachineLogic and MachinePoint I/O combination has already been factory tested to work together as an integrated solution for machine control applications.

MachinePoint I/O is an I/O system to connect field devices to an industrial fieldbus.

How it works

The MachineLogic™ PC-based control program communicates to I/O through a fieldbus option (Profibus or DeviceNet) or Ethernet Modbus TCP/IP. You can choose one of CTC's buscoupler products to read the fieldbus protocol, and then select from several I/O solutions to handle your machine inputs and outputs.

CTC's buscoupler and I/O products provide a compact, easily configurable approach to meeting industry trends toward open systems and application flexibility.

Buscoupler Hardware

CTC offers two models to meet your specific project needs: the Standard Buscoupler model (for applications that require more advanced features such as remote diagnostics) or the Economy Buscoupler (same performance as the standard buscoupler, but at a lower cost). Both Buscoupler families support two major bus systems (Profibus and DeviceNet) for open control, and future expansion will include other fieldbus standards and Ethernet I/O.

Standard Buscoupler

Features:

- 4 character display
- Keypad for advanced features
- Diagnostic features
- Service functions
- Error code display
- Mode operation access

Ethernet I/O Buscoupler now available!

Standard Buscoupler – Profibus DP, DeviceNet, or Ethernet Modbus TCP/IP

Service functions:

- Set data transmission rate
- Save bus node configuration
- User lock out ON/OFF
- Clear EEPROM
- Byte-swap ON/OFF

Operating modes:

- FORCE – for setup and commissioning, user can "one-time" outputs high or low for testing
- LOCK – freeze I/O as a temporary fix to field device failures
- TRIGGER – use trigger point to store last 20 states of I/O
- RUN/STOP – Change operating mode

Economy Buscoupler

The Economy Buscoupler provides the same level of communication capability as the Standard model, but has a lower cost than the Standard unit. The Economy Buscoupler also has a reduced feature set, and does not support the following:

- 'On module' diagnostics
- Operating Mode display
- Remote forcing
- Remote Run/Stop capability

Economy Buscoupler – Profibus DP or DeviceNet

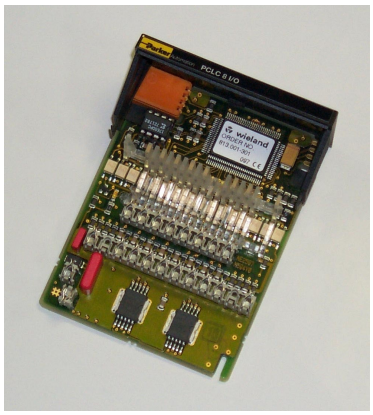
I/O Hardware

CTC offers a variety of expansion I/O modules — available for both digital and analog I/O — that attach to the buscoupler in a modular configuration, providing maximum application flexibility.

Modular I/O* is a full-featured I/O option that allows for any combination of I/O, plus is expandable up to 6 modules or 96 I/O points. Compact I/O** incorporates I/O and the buscoupler in one unit, resulting in space and cost savings. The modular I/O works with both the Standard or Economy family of Buscouplers.

Modular I/O*

MachinePoint™ Modular I/O offers a variety of benefits, including a unique replaceable circuitry feature that allows modules to be replaced without having to disconnect field wiring. Other product highlights include I/O and field power indicator lights, an area for labeling or marking, DIN rail screw panel mounting options, and unique clamping levers to simplify wiring. Modular I/O can accommodate up to 6 modules per buscoupler.



MachinePoint Modular I/O includes replaceable circuitry

Other Modular I/O Features:

- Opto-isolation at fieldbus connection
- Full range of addresses for Profibus
- Easy error code indication
- Fast/easy setup and commissioning
- No software required
- Low cost analog I/O
- Reset I/O to "zero" or "last known" state on bus failure

Modular Digital MachinePoint I/O Products:

- 8 input or output (mix and match)
- 16 input
- 16 output
- 8 input and 8 input or output (mix and match)

Modular Analog MachinePoint I/O Products:

- 4 analog input, 0 to +10 VDC
- 4 analog input, -10 to +10 VDC
- 4 analog input, 0 to 20 mA
- 4 analog input/4 analog output, -10 to +10 VDC
- 4 analog input/4 analog output, 0 to 20 mA

Modular Specialty MachinePoint I/O Products:

- Thermocouple input module
- RTD input module
- Counter module
- Quadrature (positioning) input module

** Not compatible with Compact family (Buscoupler/IO combination)*

Compact I/O*

Features:

- Incorporates buscoupler and I/O into one package
- Suitable for small I/O count nodes
- Supports Profibus and DeviceNet
- No analog I/O supported

Compact I/O MachinePoint™ Products:

- 8 input or output (mix and match)
- 16 input
- 16 output
- 8 input and 8 input or output (mix and match)

Compact MachinePoint I/O

** Does not support modular I/O expansion*

A Complete PC-Based Control Solution From One Source

Since 1980, CTC has been a pioneer in providing the automation industry with innovative Human-to-Machine Interface solutions that offer machine builders “The Shortest Distance Between Man and Machine”. In 1998, CTC became an operating unit of Parker Hannifin, strengthening its resources and commitment to meet emerging trends on the factory floor.

CTC can now offer a complete PC-Cased Control package that is as reliable and easy to implement as a PLC solution, but with the added advantages of a PC-Based system. CTC’s experienced applications engineering group has the expertise to assist you in putting together the right control system for your application and a technical support staff that is adept at troubleshooting problems with PLCs, PC-based control and I/O systems in the field.

PC-based control has now come of age and CTC is in the best position to help you realize tangible benefits from an open architecture control strategy!