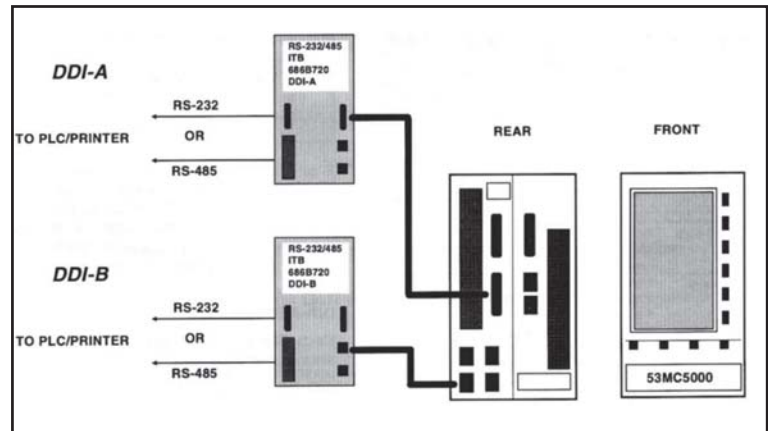




PLC / Printer Interface for Micro-DCI 53MC5000

- Support five different PLC communications protocols
- Up to two separate communication ports available
- Up to 512 discrete inputs and outputs along with 64 analog inputs and outputs per PLC per port
- Supports serial (parallel, with convert) printer interface (using built in driver)
- Can be installed as a field upgrade to existing controller



53MC5000-PLC
Micro-DCI™ PLC/Printer Interface

Process Control Station PLC/Printer Interface

The 53MC5000 Process Control Station (PCS) now provides additional communications choices for its Digital Device Interface channels A and B (DDI-A, DDI-B). These choices are offered as the DDI-A Printer/PLC option and the DDI-B Printer/PLC option. With either of these options, the PCS has the capability to transfer logical bits (contacts) and floating point values to/from a Programmable Logic Controller (PLC®) or the capability to send serial output PCS datalog information to a printer.

PLC types supported by the DDI-A/B options are as follows:

- **Allen-Bradley**
- **Modbus RTU** (master or slave)
- **Siemens S5**
- **Koyo**
- **OPT022**

The DDI-A option can also co-exist with the Multi-Channel Analog HART® option for analog and digital communication to HART® devices if that option is installed.

Hardware Description

As shown in Figure 1, the full hardware complement for each DDI-A/B option includes an Auxiliary Processor Board (APB), an RS-232/485 Interconnection Terminal Board (ITB), and a five foot cable. The ITB is mounted externally to the PCS on PVC track and connects to the PCS via the five foot cable. Also required for each option is a custom fabricated cable that connects from the ITB to the PLC or printer serial/parallel converter. Cable diagrams are provided in the documentation supplied with the DDI-A/B Printer/PLC option.

Interface Characteristics

The baud rates and protocols shown in the following table are user selectable.

Baud Rate	38.4 K, 28.8 K, 19.2 K, 14.4 K, 9600, 4800, 2400, 1200, 600, 300, and 110 baud.
Protocol	8 bits, 1 stop bit, no parity 8 bits, 1 stop bit, even parity 8 bits, 1 stop bit, odd parity 7 bits, 1 stop bit, even parity * 7 bits, 1 stop bit, odd parity * 7 bits, 2 stop bit, odd parity *

* *Applicable with OPTO 22 mode or Printer interface*

Data Transfer

Data transfer is continuous, on a cyclical basis, at an execution rate from 100 ms to 25,500 ms. The execution rate is configurable in 100 ms increments. Data transfer is with respect to the PCS: *read* data is transferred from the PLC to the PCS and *write* data is transferred from the PCS to the PLC.

Error Handling

Processing of a message is aborted if the PCS detects a character, framing, parity, or BCC error. The PCS indicates a time-out error if the PLC is not responding.

Floating Point-to-integer Conversion

In the PCS, floating point numbers are converted to 16 bit unsigned integers before being written to the PLC. When converted from a floating point number to a 16 bit unsigned integer by the PCS, the following rounding procedure applies:

PCS Range	Conversion to PLC Integer Value
$-\infty$ to <1	0
1 to $<32,76$	Rounded down to nearest integer
32,769 to $<65,536$	Rounded down to the nearest even integer
65,536 to $+\infty$	All values are stored as 65,535

Data read from the PLC (with the exception of OPTO 22) is considered to be 16 bit unsigned integers and is converted to floating point numbers by the PCS as follows:

PLC Integer	PCS Floating Point Conversion
0 to 32,768	Unchanged
32,769 to 65,535	Rounded down to the nearest even integer

It should be noted that a process measurement range (e. g., temperature) with negative numbers is possible using an algorithm in the PLC that converts the range to all positive numbers; a BF&P Translator (F-TRAN™) routine can be written to perform the same task in the PCS.

Micro-DCI™ is a trademark of MicroMod Automation, Inc.

PLC® is a registered trademark of Allen-Bradley Company

Modbus™ is a trademark of Modicon, Inc.

HART® is a registered trademark of the HART Communication Foundation

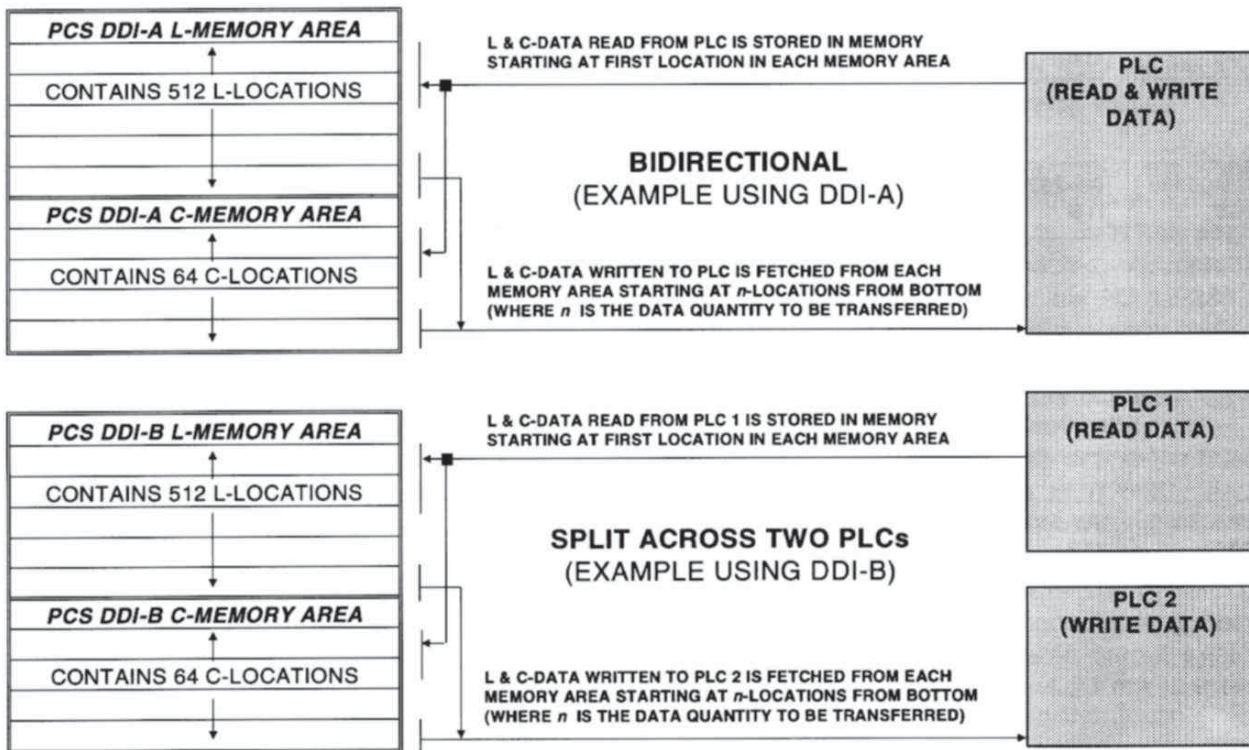
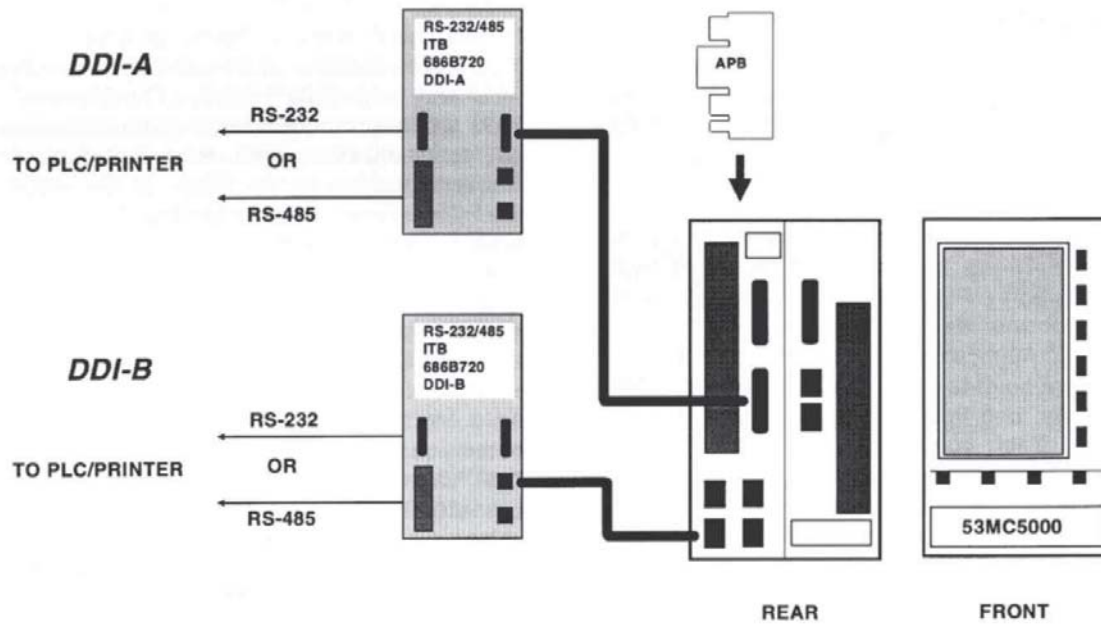
DDI-A/B Memory Areas

Each DDI-A/B option has an assigned memory area in the PCS that is capable of storing 512 logical bits (contacts) and 64 floating point values. As shown in Figure 2, read data is entered into each memory area starting at the first location: write data is taken n number of locations from the bottom of each memory area, where n is the data count to be transferred to the PLC. Because of this multiple entry memory access capability, in a multidrop configuration, the PCS can serve as the network master, with bidirectional communication to a single PLC or with separate read and write functions across two PLCs if necessary.

Applications Approach

Complex PCS strategies incorporating loop control and contact management can be affected with F-TRAN™ routines that allow the PCS to interlock analog values with the pump/motor enables, starts, stops, etc., from a DDI-A/B PLC option. Also, using F-TRAN™ the PCS status display can be configured to provide local indication of contact status in the PLC (e.g., motor running, etc.) or a customized PLC status display can be designed.

Figure 1. DDI-A and DDI-B Channels



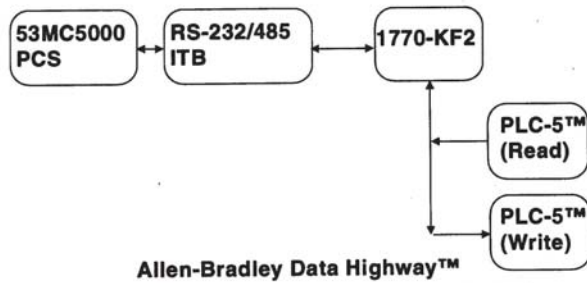
PCS-to-PLC Operating Modes

The operating modes for the PCS DDI-A/B options are user selectable as necessitated by the PLC type connected to each RS-232/485 ITB.

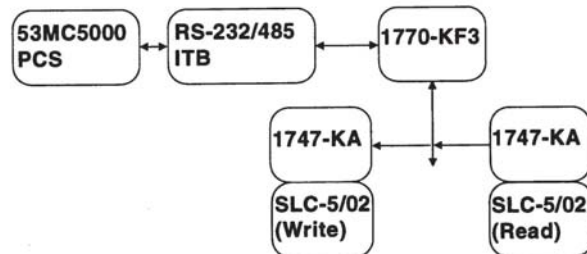
Allen-Bradley Mode

In Allen-Bradley mode, data transfer is provided between the PCS and an addressed Allen-Bradley PLC. The Allen-Bradley DF-1 protocol with data table addressing is supported. Applicable communication configurations are point-to-point, the Allen-Bradley Data Highway, and the Allen-Bradley DH-485 Network. Each configuration requires the appropriate interface card (e.g., RS-232) to be installed in the PLC. In a multidrop configuration, the PCS can serve as the network master, with bi-directional communication to a single PLC or with separate read and write functions across two PLCs if necessary.

Supported configurations are illustrated as follows:



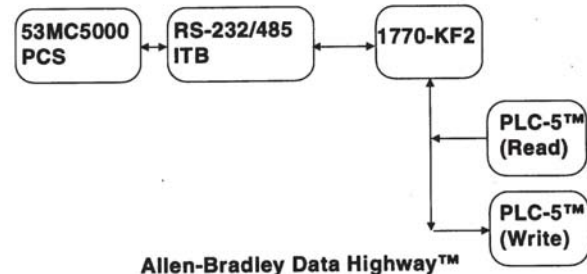
PLC-5™ and Data Highway Plus™ are trademarks of Allen-Bradley Co.



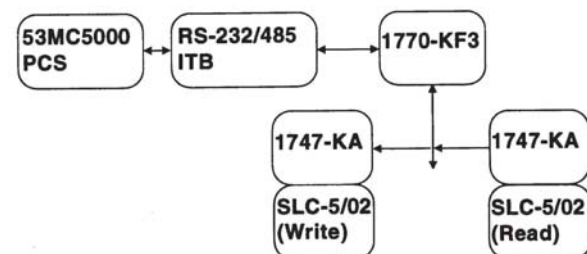
Modbus™ RTU Mode

In Modbus™ Remote Terminal Unit (RTU) mode, data transfer is provided between the PCS and a Modbus™ PLC. The Modbus™ RTU binary protocol, with a given command set for initialization, write, read, and diagnostics is supported by the PCS. In this mode, the PCS can function as a Modbus™ master or a slave. As a Modbus™ master, the PCS controls the communication requests. In a multidrop configuration, the PCS serves as the network master, with bi-directional communication to a single PLC or with separate read and write functions across two PLCs if necessary. As a Modbus™ slave, the PCS responds to communication requests issued by a Modbus™ host. In slave mode, the host can access 2048 logical bits and 768 floating point values (PCS datapoints LOGO through L2047 and COOO through C767). Because each PCS slave has a unique address, 32 slaves can reside on a single network.

Supported configurations are illustrated as follows:



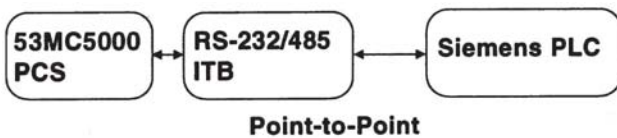
PLC-5™ and Data Highway Plus™ are trademarks of Allen-Bradley Co.



Siemens S5 Mode

In Siemens S5 mode, data transfer is provided between the PCS and a Siemens PLC via the 3964 protocol. For read and write operations, the PCS supports Siemens Data Block, and Absolute Address commands. For read-only operations, the PCS supports Siemens Counter Locations, Input Bytes, Output Bytes, and Flag Bytes commands. The two read/write commands transfer logical bits and floating point values. Of the four readonly commands, Counter Locations transfers floating point values and the other three commands transfer logical bits. The maximum data transfer in either direction is 512 logical bits and 32 floating point values (compared with 64 floating point values for other PLC modes). A minimum of 16 logical bits are transferred for the two read/write commands and a minimum of 8 -only commands (10 logical bit indicators for the Counter Locations command).

Installation is point-to-point as follows:

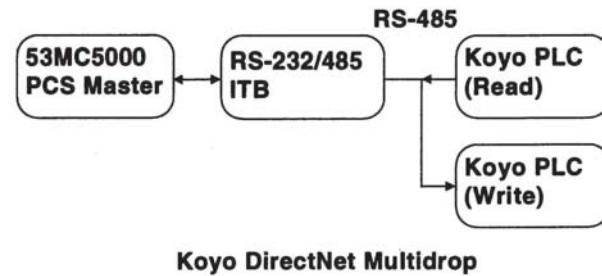
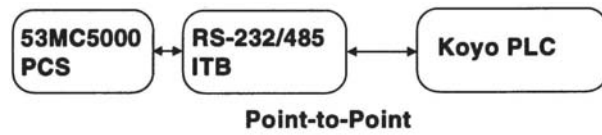


Koyo Mode

In Koyo mode, data transfer is provided between the PCS and an addressed Koyo PLC or a Koyo vended PLC for companies such as General Electric, GE Fanuc, Texas Instruments, and Siemens (e.g., Series One™, Series One™ PLUS, Series One™ Junior Series 305™, Series 405™, SIMATIC® T1305™, and SIMATIC® T1405™ PLCs). Data transfers are via the Koyo DirectNET™ communications protocol.

PCS-to-PLC communication is point-to-point or via a multidrop network. In a multidrop configuration, the PCS can serve as the network master, with bi-directional communication to a single PLC or with separate read and write functions across two PLCs if necessary.

Supported configurations are illustrated as follows:



OPTO 22 Mode

In OPTO 22 mode, data transfer is provided between the PCS and OPTOMUX™ digital and/or analog units over the OPTO 22 serial I/O communications system. Connection to an OPTOMUX™ unit is through 4 wire RS-485 communications. The maximum cable length is 4000 feet (1219 m).

This function allows each PCS DDI-A/B channel to directly control up to 512 input/output relays and read/write 64 analog values.

A DDI-A/B channel can support a maximum digital configuration of 32 units: each having a B1 Brain Board, power supply, and fully populated rack of 16 contact modules. Acceptable input contact module types are AC 12-280 V and DC 4-280 V; acceptable output contact module types are AC 12-280 V, DC 5-200 V, AC and DC N.O./N.C., and dry contact.

A DDI-A/B channel can also support a maximum analog configuration of 8 units: each having a B2 Brain Board, power supply, and a rack populated with 8 modules. Acceptable input analog module types are 100 ohm RTD; Type R, S, T, and E thermocouple; frequency; and AC 28-140 V; acceptable output analog module types are 4-20 mA, 4-20 mA isolated, DC 0-5 V, and DC-10 to+10 V.

DirectNet™ is a trademark of Koyo, Inc.

OPTOMUX™ is a trademark of OPTO 22.

DDI-A/B Printer Interface

In printer interface mode, a PCS DDI-A/B channel can output serial data under control of the resident standard format datalog program or a user generated free format datalog program. Output is provided via the

RS-232/485 ITB, without the need of a personal computer. The output is bit serial; therefore, a serial-to-parallel converter is required for parallel printer connectivity. Printers should have a minimum 1 KB buffer. A buffered converter with minimum 1 KB memory is necessary for printers without buffers. No special drivers or software are required for this application.

A typical standard datalog output is as follows:

```

PRINT DEMO      11:11      17-1-95

HOURLY REPORT FOR FLOW AND TOTALS

      LOCATION 567  RATIO LOADER

INPUT 0  119.734380  TOTAL 0  4887.00000
INPUT 1  20.0107430 TOTAL 1  1521.00000
INPUT 2  30.0009770 TOTAL 2  2272.00000
INPUT 3  40.0000000 TOTAL 3  3001.00000
INPUT 4  123.769990 TOTAL 4  44589.00000
INPUT 5  345.666990 TOTAL 5  237654.000
INPUT 6  476.779000 TOTAL 6  87531.00000
INPUT 7  17.4399990 TOTAL 7  23875.00000
PLC IN0  12345.0000 TOTAL    61725.00000
HART 4   2.00000000 TOTAL    45998.00000
    
```

A typical free format datalog output is as follows:

```

*****BATCH REPORT*****

BATCH NUMBER      102
TIME              4: 37: 46
DATE              2/10/95

RECIPE NUMBER 0
PRODUCT NAME     UNKNOWN FORMULA
MATERIALS

      TARGET      MEASURED
ADDITIVE A       1000.0      1001.0
ADDITIVE B       1000.0      1000.0
MIX TIME         60.000
COOK TEMPERATURE 250.00
COOK TIME        120.00
COOL TEMPERATURE 100.0
COOL TIME        180.00
EMPTY TIME       90.000

***** END OF BATCH REPORT *****
    
```

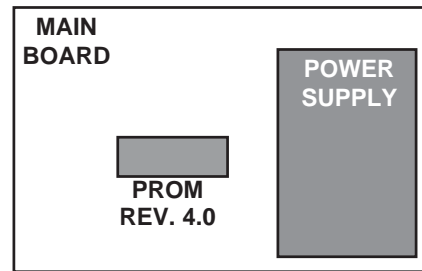
Model Number Breakdown

A model number breakdown of the 53MC5000 PCS is provided in Figure 3. In Figure 3, the DDI-A and DDI-B Printer/PLC options are listed in bold type for easy identification.

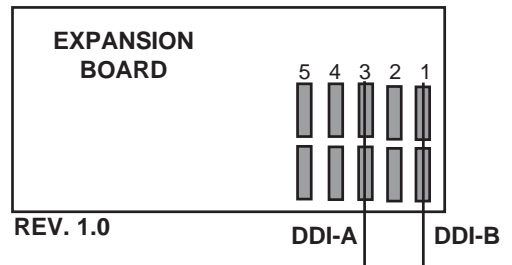
Field Upgrades

This information pertains only to existing PCS product in the field where upgrading with one or both PLC DDI options (DDI-A/B) is being contemplated. As shown in Figure 1 and below, the Printer/PLC DDI-A/B options require the following:

- A Main board at the firmware level of 4.0 (the Main board firmware revision level can be determined by displaying the PCS Software Level datapoint B382).



- A PCS that has an Expansion board.
- An available Expansion board slot for the DDI-A APB (slot 3) and/or the DDI-B APB (slot 1), as applicable.



- An Auxiliary Processor Board (APB) at a firmware level of 1.0 (DDI-A datapoint B297 = 27 or higher and DDI-B datapoint B463 = 27 or higher).
- An RS-232/485 ITB with ITB-to-PCS cable for the DDI-A/B option.
- *Also required:* A custom fabricated ITB-to-PLC cable or ITB-to-serial/parallel converter cable for the printer.
- *Also required:* Instruction Bulletin 53MC9015, 53MC5000 PLC and Printer Interfaces (Publication Number 24627) for the custom cable descriptions.

Model Code	53MC5	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Process Control Station	53MC5															
No. of Control Loops																
One Loop (Note 2)		1														
Two Loops (Note 2)		2														
Four Loops (Note 2)		4														
Power Requirements																
AC (110/220, 220/240 Vac 50/60 Hz)		1														
DC (24 Vdc)		2														
Functional Requirements																
Standard			1													
Extended Programmable <i>provides F-TRAN programming language</i>			2													
Design Level/Display Type																
Standard Resolution (48x96 pixels)					A	2										
High Resolution (96x192 pixels -SEE NOTES)					B	4										
Main Rear Terminal Requirement																
Standard Rear Terminal Board							1									
Cord Set Connector (for remote termination of standard I/O - includes backplane, ITB and 5 ft. cable. For special cable lengths see Accessories)							5									
Chassis																
Standard (supports standard I/O only)								A								
Expansion Ready (required for any I/O or communication options)								B								
Safety Classification																
General Purpose									A							
Factory Mutual Class 1, Division 2 Class A,B,C,D									B							
Discrete I/O Option - includes PCB, 5 ft cable and ITB																
Not Implemented										X						
6 DI (26V max) and 4 DO (150mA, 50V max.) - no additional modules required										C						
16 DI/DO - requires plug-in modules, select from Accessories										F						
DDI-A Printer / PLC Interface (includes PCB, RS-232/485 converter ITB & 5 ft cable)										M						
Dual Relay Board (adds two SPDT, 24 Vdc powered relays with 10A, 240 Vac contacts)																
Not Implemented											X					
One board											1					
Two boards											2					
Three boards											3					
Analog I/O Option (Note 7)																
Not Implemented												X				
Single Channel (requires Analog Conversion Module - see next line)												A				
Multi Channel Analog I/O (analog conversion module required if using universal input)												D				
Analog Conversion Modules (Required for Analog I/O option - select additional modules from P-DCI-Spares)																
Not Implemented													X			
0-5Vdc													B			
RTD 100 Ohm, -100 to 100 C													C			
Thermocouple Type J, 0 to 760 C													D			
Communication A Option																
Not Implemented															X	
Datalink cable and ITB (connect between controllers with Cord Set terminations for standard I/O)															C	
MicroLink-A - high speed host & peer-to-peer communications (includes PCB, 2.5 Ft cable and ITB)															F	
Communication B Option (Includes PCB, cable and ITB)																
Not Implemented																X
MicroLink-B Communications (provides redundant MicroLink when ordered with MicroLink A.)																C
DDI-B Printer/PLC Interface (includes PCB, RS-232/485 converter ITB & 5 ft cable)																J
Conformal Coating																
Not Implemented																X
Required																A

ACCESSORIES**Configuration Software**

MicroTools for Windows 2000 and XP/Professional - see price list P-DCI-53MT600

Mounting & Installation Hardware

Channel for wall mounting remote termination boards (4 ft. length)	129A003U03
DIN Rail Adaptor Kit	614B958U01
DIN to 3x6 Panel Mounting Adaptor	614B762U02
Panel Filler Kit	612B403U01
Horizontal Multiple Mounting Trim Collar - see Spare & Expansion Parts P-DCI-Spare	
Rear-of-case Tag	388B708A11
Plastic Tag (front door latch)	
250-ohm Input Resistors	161M417U05

Digital Input/output Modules for 16 DI/DO Option:

Digital Input Modules	<i>Opto model:</i>	<i>MicroMod model number:</i>
12-32Vac / 10-32Vdc	G4IDC5	2004AP10120A
2.5 - 28Vdc	G4IDC5D	2004AP10100A
90 - 140Vdc	G4IAC5	2004AP10140A
180 - 280Vdc	G4IAC5A	2004AP10150A
Digital Output Modules		
5 - 60Vdc	G4ODC5	2005AP21100A
5 - 200 Vdc	G4ODC5A	2005AP21110A
12 - 140 Vac	G4OAC5	2005AP21120A

*Note: Additional digital I/O modules may be purchased directly from OPTO 22.***Notes:****Functionality**

Standard Functionality provides FCS and FCIM configuration (pre-configured, modifiable control strategies and function-block configuration)

Extended Functionality provides F-TRAN high-level language programming.

Main Rear Terminals

Standard rear terminal board provides connection for standard I/O on the back of the controller.

Cord Set Connector allows remote connection of standard I/O only.

Design Level / Display

Design Level B provides High Resolution display, new front panel menu configuration system, real-time clock and hot-swap display features.

The Design Level B is a licensed product. The following end-user information is required prior to shipment:

End-user Company Name

Complete Address

Contact Name

Telephone and Fax Number

Digital and Dual Relay I/O Options

6 DI / 4 DO option does not require any additional modules.

16 DI / DO option requires plug-in digital modules

Dual Relay option may also be used with 6 DI / 4 DO or Standard Digital I/O as interposing relays

Analog I/O Options

Single Channel Analog option provides one additional universal input. Input type is determined by selection of Analog Conditioning Module.

Multi-Channel Analog option provides four additional analog inputs, two additional analog outputs, and one universal input. Input type is determined by selection of Analog Conditioning Module.

Additional Analog Conditioning Modules are available for other input types. Refer to Price Sheet P-DCI-Spares for full listing.

Special Cable Lengths

All I/O and communication options are supplied with the option board (PCB), standard cable and ITB (termination board). If non-standard cable length is required, select "Not Implemented" (X) in model number and specify PCB, cable and ITB separately from Spare and Expansion Parts List P-DCI-53MC5000-Spare

Factory Configuration

MicroMod Automation can provide custom configuration services. Contact Customer Service for quotation.

Notes

www.micromodautomation.com

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Application-smart control solutions

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