

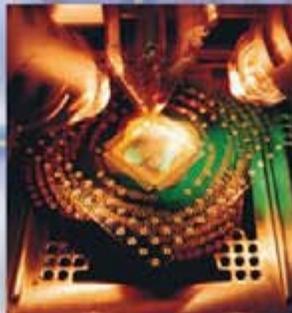
INNOVATIVE



AUTOMATION



CONTROL

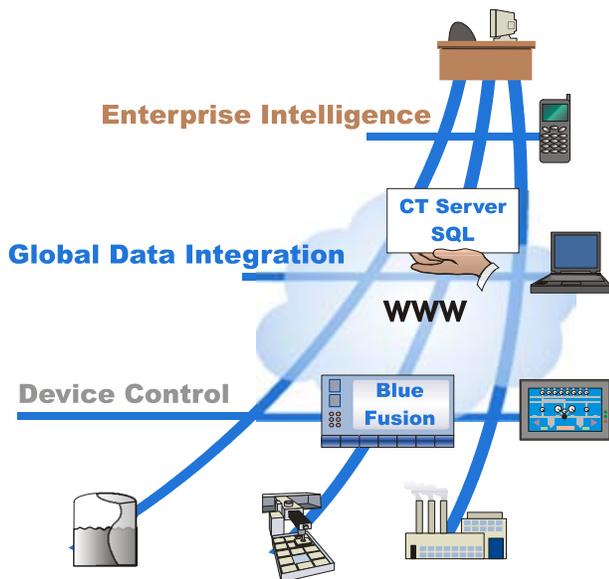


 **Control
Technology**

**5100/5200 Series
Automation Catalog**

Control Technology Corporation

Company profile



Control Technology designs, manufactures and markets products that enable electronic automation devices to be monitored, controlled, configured or reprogrammed at the machine level and through network connections.

Since its founding in 1975, CTC has introduced a number of breakthrough technologies that have had a significant impact on the automation industry. In the 1980's, Control Technology was one of the first companies to take advantage of advanced microprocessor technology to integrate servo motor control, stepping motor control, analog and digital I/O control, user interface control, and network communications into a single control device we call the programmable automation controller.

In the 1990's, CTC was the first company to incorporate Web Server and Internet Technologies into automation controllers and was granted several patents in this area. This breakthrough technology enables true Enterprise Connectivity right down to the device level without the need for expensive middleware or intermediary PCs and servers. CTC products provide the ability for our customers to easily monitor and/or control machines and equipment in their local factory, or in remote locations around the world.

In 2001 we introduced our Blue Fusion automation controllers that combine the functions of a PLC, PC, and Motion Controller into a single compact and highly reliable package. The 5200 series significantly expands the capacity and performance of the Blue Fusion product line by giving customers the ability to replace mid-level PLCs and PCs in a wider range of applications.

To learn more about Blue Fusion and other award winning products from CTC, visit our website:

www.ctc-control.com

The CTC 5100 and 5200 series automation controllers are ideal for small- to mid-size automation applications where a full featured controller is needed in a compact package.

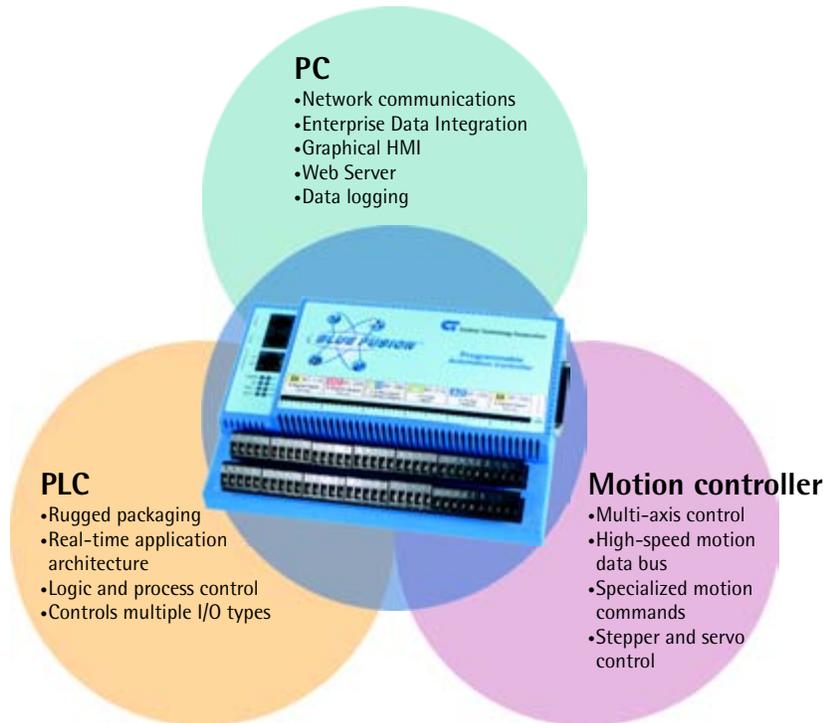
They can control digital, analog, and motion and have built-in serial and Ethernet ports.

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Programmable automation control

The CTC concept

The concept of a Programmable Automation Controller or PAC was first introduced by CTC in the early 1980's together with the Quickstep™ state based language as an improvement over the traditional PLC based automation solutions that had been in use since the 1960's. With its PAC approach CTC retained the rugged deterministic operating characteristics of the PLC, but built this functionality into a new architecture that allowed the PAC to handle all machine automation functions in a single package. CTC's hardware architecture and programming interface adeptly integrate the best features of a PLC, PC and Motion Controller.



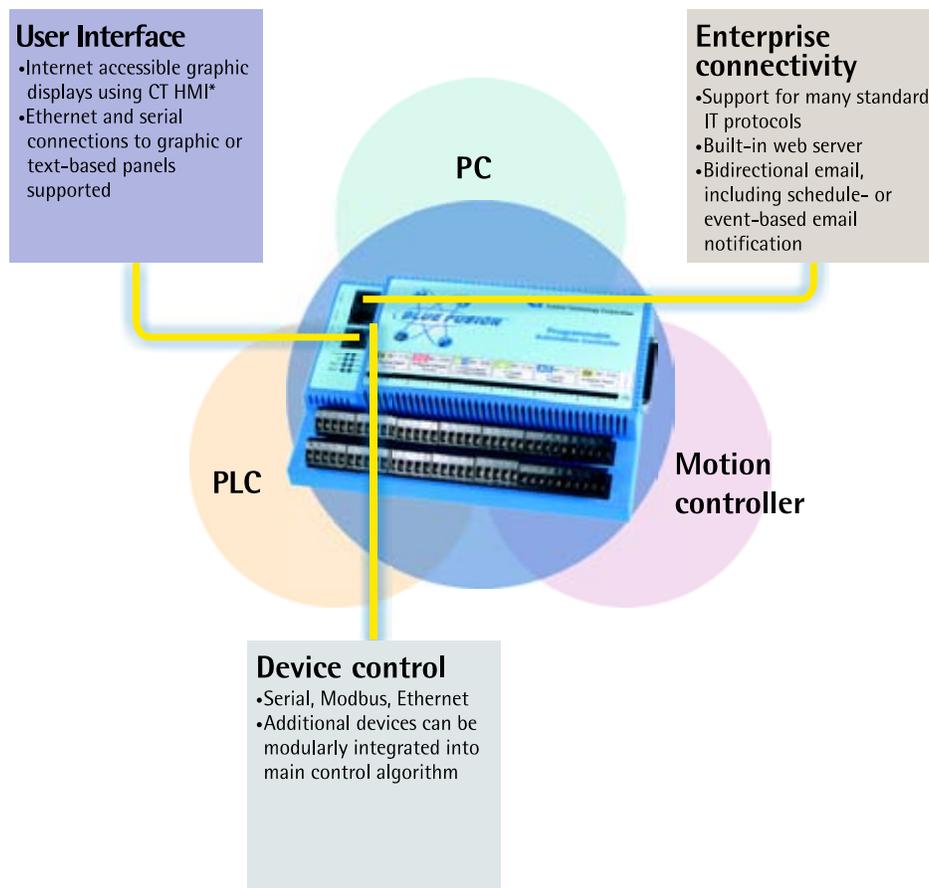
Blue Fusion PAC benefits

- Simplifies machine design
- Eliminates multi-component integration hassles
- Avoids the stability problems of PC based automation
- Provides transparent enterprise access to plant floor data

Integrated automation control

For more than 25 years, CTC has pioneered the combination of advanced automation control capabilities into highly integrated, reliable and easy to use products. Webster's Dictionary defines fusion as "a merging of diverse, distinct, or separate elements into a unified whole" – and as you can see below, that's exactly what CTC's Blue Fusion controllers do! With a single compact controller you can handle Device Control, Motion, User Interface, and Enterprise Connectivity requirements – with one unified programming language.

On the following pages you'll see how Blue Fusion controllers extend the fusion concept beyond the factory floor with CTC's web enabled automation technology. Now you can fuse IT (Information Technology) with IA (Industrial Automation). Supporting open communication standards like HTTP, SOAP and XML, Blue Fusion controllers connect your devices directly to the rest of the enterprise without expensive middleware.



*Model 5222/5223 controllers only.

Blue Fusion features

Multitasking

Each controller can operate 84 simultaneous tasks. This multitasking approach greatly simplifies application programming by eliminating the complexity of the "big loop programming" and the delays of the PLC ladder scanning approaches.

Multi-processors

In addition to the main CPU, most models feature additional on-board processors. These additional processors automatically offload the main CPU and assure maximum performance as modules are added.

Motion

The controllers can be configured to provide up to twelve axes of precision stepper or servo motor control.

I/O

Monitor and control nearly any type of real world signal with Blue Fusion's broad array of analog, digital, and temperature I/O modules.

Networking

High performance networking capabilities are an integral part of the Blue Fusion architecture. All models support both serial and Ethernet communications with a wide variety of remote devices and computers.

Email

Controllers can send and receive email. Sent email can combine text with embedded controller resource values – ideal for detailed alarm notification. Email sent to the controller can include embedded commands that can cause nearly any controller function to be executed. Not available on Model 5100 controllers.

Data logging*

Easily log controller data based on time or an event. All data is stored in non-volatile memory in .CSV formatted files. Files can be retrieved by remote computers using the built-in FTP server, or the controller can automatically "push" the file to a remote computer based on time or event.

Web Server

CTC's patented controller based web server technology allows the Blue Fusion controllers to host web pages that have secure access to all controller resources.

CT webHMI*

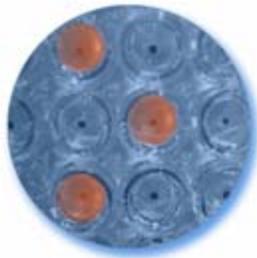
Using CTC's award winning CT HMI designer software, it's easy to create interactive web based operator interface screens. Multiple authenticated users can access these screens simultaneously. All that is needed to interact with the controller is an Internet browser.

*Model 5222/5223 controllers only.

Blue Fusion applications

Industrial automation control

Blue Fusion combines the functions of a high performance PLC, motion controller and PC into a small DIN rail mountable package. All controller resources, including firmware, can be accessed via a secure network connection.



Lab monitoring

Monitor and control the lab environment and processes through a standard browser interface. Receive automatic alarm notification via the web, phone, or pager.

Enterprise data acquisition

Use Blue Fusion to add a real-time bi-directional link between real world devices and enterprise IT systems without disturbing existing control systems.

Supply chain integration

Optimize inventory levels and delivery timing by linking usage information with your supply chain in real time.



Building automation

Monitor and control all building systems over a wired or wireless network.

Site security

Monitor assets and receive multimedia alarming through any browser-based device. Supports parallel wireless network interfacing and battery backup for system redundancy.



Utility management

Monitor and troubleshoot remote assets via a network connection. CTC offers multiple methods to connect Blue Fusion controllers to your existing SCADA or enterprise systems.

Energy management

Easily track, capture and store energy usage statistics to better optimize utilization and reduce costs.

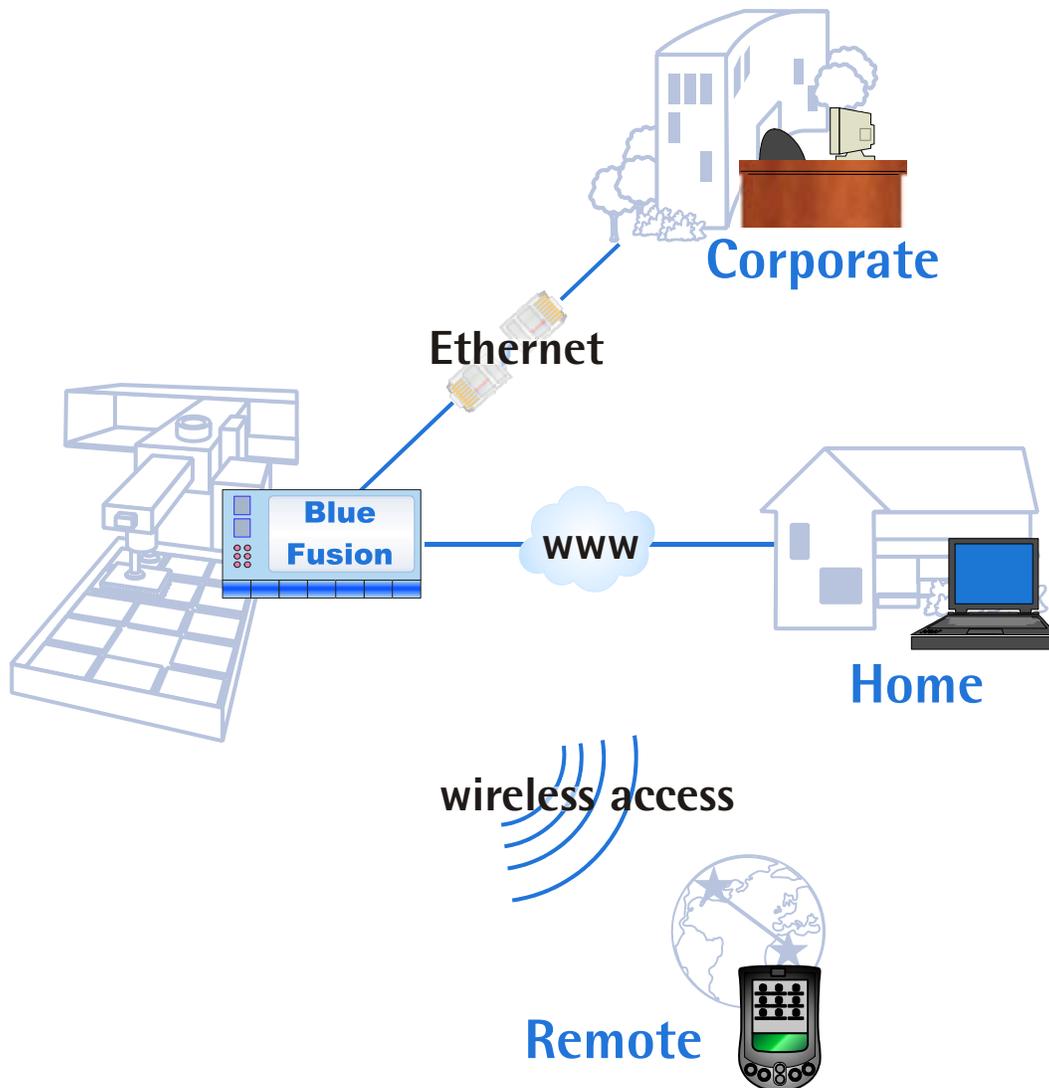


Remote monitoring and control

Instant access to remote data from anywhere

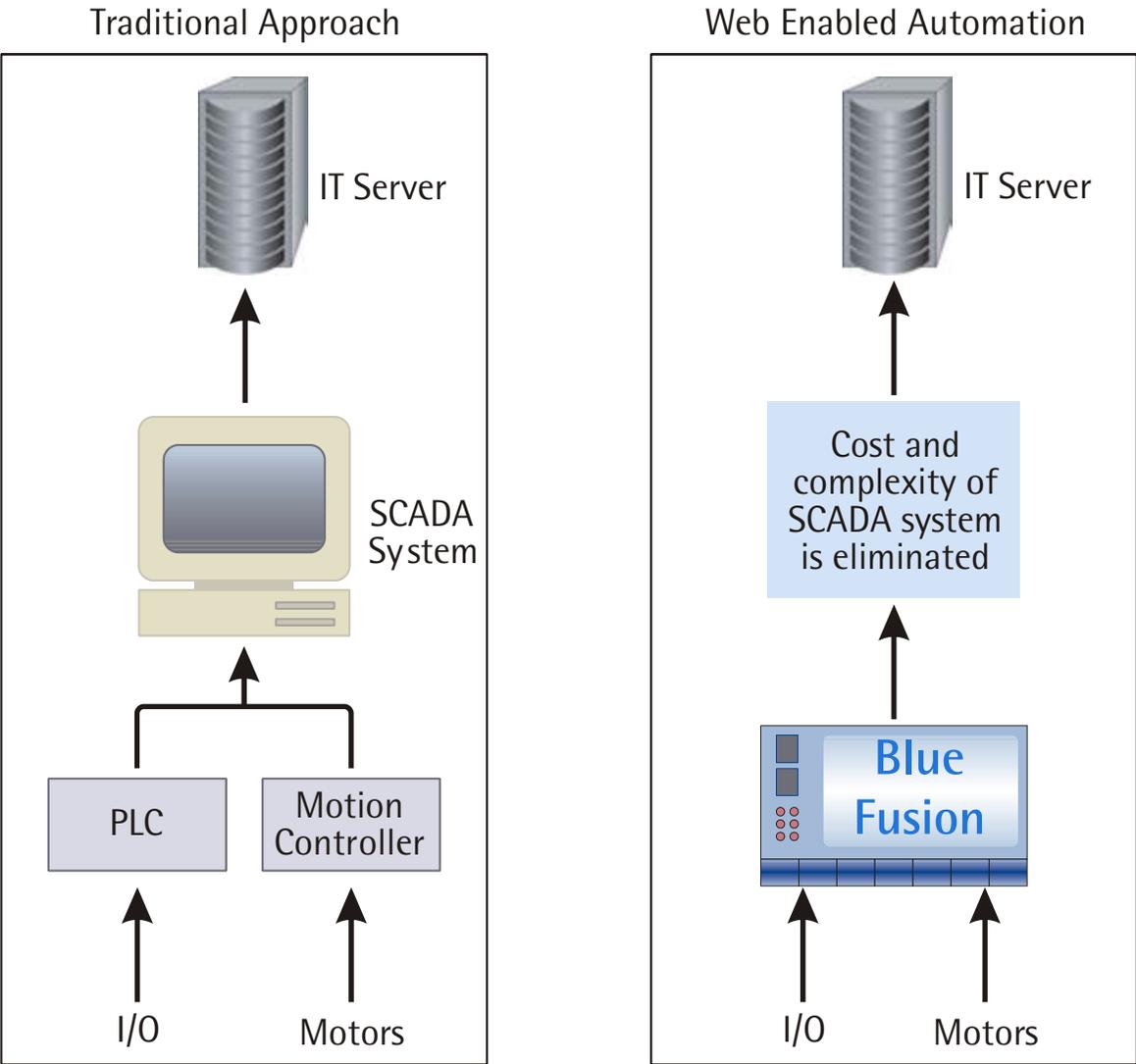
Powerful web technology embedded into CTC's hardware and software provides bi-directional data exchange between your devices and enterprise applications. Using CTC solutions, you can share real-time operational data from machines and devices with:

- Browser-based devices and HMIs
- Pagers and email systems
- MRP, ERP, CRM, and quality systems



Streamlined enterprise integration

CTC controllers integrate the functions of PLCs, motion controllers, and PCs into a single compact module. Their data connectivity and display functions can eliminate the need for a separate SCADA (Supervisory Control and Data Acquisition) gateway, simplifying communications with business information systems.

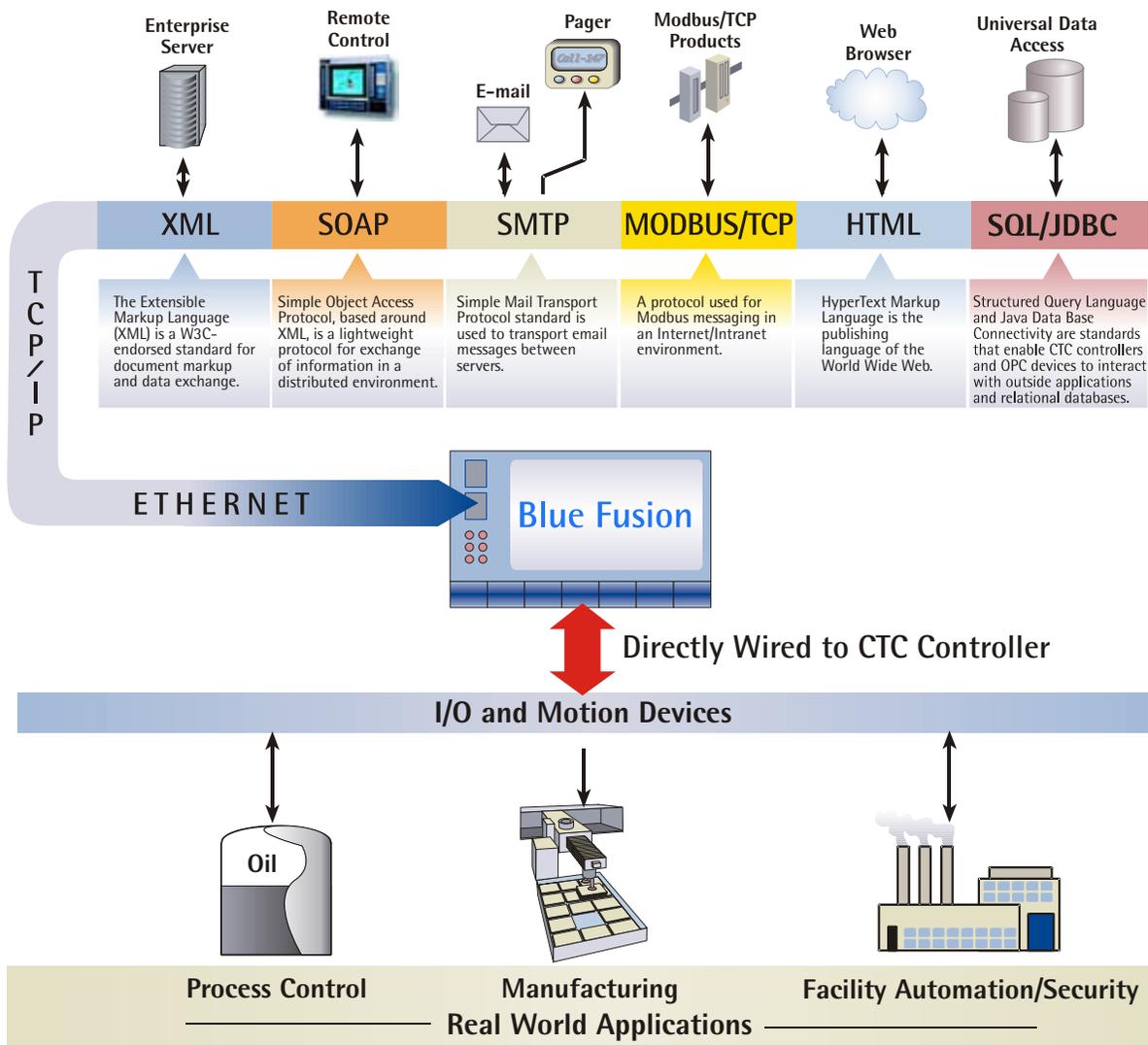


Enterprise connectivity

Streamlined communications bring industrial data to your desktop

An early proponent of open networking communications, CTC has been granted numerous patents in this area. At the core of CTC's open solution is CTServer, a Java-based server engine that implements HTTP, XML, SOAP (Web Services), and SQL (through ODBC and JDBC). By supporting these industry standard protocols, CTC controllers provide a seamless way for IT professionals to obtain dynamic, real-time data without the need for expensive and difficult to maintain middleware.

In addition to its monitoring capabilities, CTC controllers can also be remotely controlled or even reprogrammed by authorized users. This capability enables remote service technicians to monitor, update, and repair controllers without wasting time and money traveling to remote sites.



Note: see page 11 for more detailed information on system requirements for protocol support.

Enterprise connectivity

Supported IT and security standards

Name	Description	Application
HTTP	A simple extensible protocol for data exchange over the Internet. Browsers use HTTP to communicate with servers.	Used to serve static pages as well as diagnostics and monitoring applets. Advanced web interface also available when used with CTServer.
SMTP*	A standard protocol for transporting email messages between servers.	Alarm and error conditions can trigger an email or pager alert, enabling faster detection and resolution of system events.
POP3*	A protocol that provides a simple, standardized way for users to access Blue Fusion mailboxes and download messages.	Send script commands to a Blue Fusion controller by embedding them in an email.
Modbus/TCP	Users can exchange and integrate data with other devices conforming to Modbus/TCP protocol.	Users can exchange and integrate data with other devices conforming to the Modbus/TCP protocol.
XML**	A World Wide Web (W3C)-endorsed standard for document markup and data exchange. Highly user-configurable means of defining data and its structure.	Users can push or pull production data from the controller and display it on a Web page, manipulate it using XSLT, store it in XML-compliant databases, or use it with other XML-savvy applications.
SOAP**	Based around XML, SOAP is a lightweight, cross-platform protocol for data exchange and control in a distributed environment.	SOAP enables applications running on different platforms to exchange data bi-directionally. It extends XML's capabilities to be "read/write."
SQL/JDBC**	SQL is an international standard used to query and modify relational databases. JDBC is a standard protocol that allows remote applications to query and change these databases using SQL.	Query and modify CTC virtual databases that contain real-time and historical controller and device-level data. Applications can use JDBC to connect to these databases, or use a third-party ODBC-JDBC gateway to connect via Microsoft's ODBC standard.

*5200 only.

**5200 with CT Server.

Enterprise Connectivity and Security

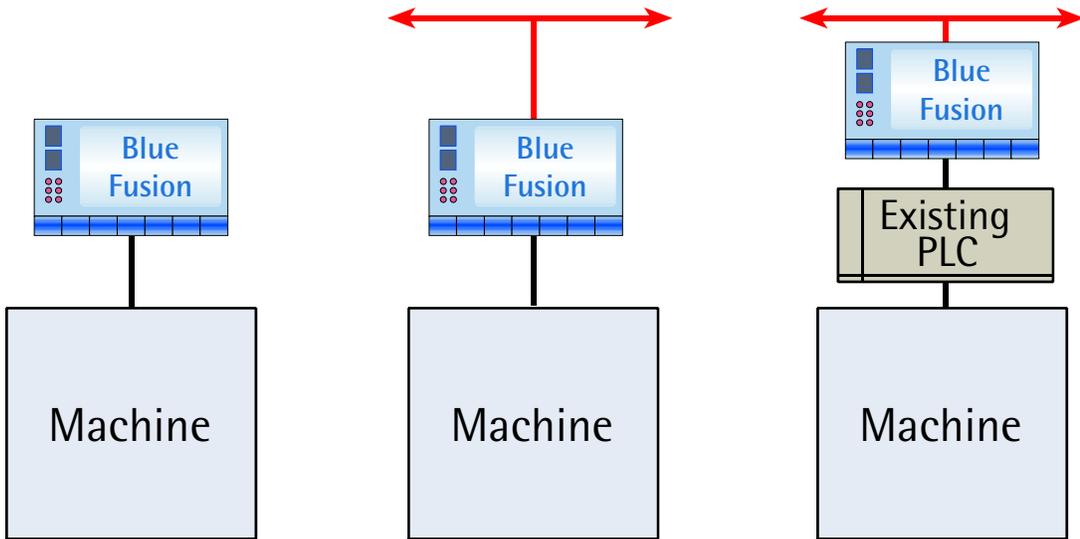
CTC has proactively addressed security concerns through a flexible, integrated and cooperative approach. CT Server, the engine that interfaces CTC controllers with the network, implements security at two levels:

1. CT Server™ itself supports industry-standard, browser-compliant W3C HTTP server authentication models such as MD5 digest authentication. Access may be further defined as no access, read access, or read-write access.
2. CT Server also supports the well-defined ports and standard protocols that are requisite to working well with third-party security products such as firewalls, proxy servers and VPNs (Virtual Private Networks).

This gives IT professionals the flexibility to extend existing security infrastructures to CTC controllers rather than developing new ones, minimizing network setup time and conserving investment in network security products and training.

3. Certificate-based SSL (Secure Socket Layer) encryption and HTTPS client-server communication can be enabled for the highest level of security. These are the same standards used by online banks and financial institutions to securely encrypt and transfer data between a client-side browser and a server.

Flexible to connect



Stand-alone

Control all application I/O and motion functions as well as the user interface with a single Blue Fusion controller.

Networked

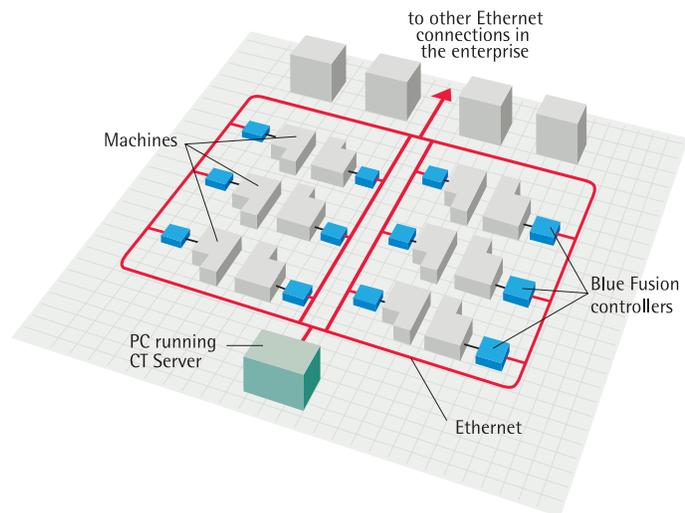
Easily connect multiple machines or machine sections to each other using standard Ethernet networks. Controllers can be monitored, controlled, configured or even reprogrammed over the Internet and/or Intranets.

Piggyback

Upgrade existing control equipment by providing Internet/Intranet access to both the PLC and various process controls. Easily add data collection without disrupting existing controls.

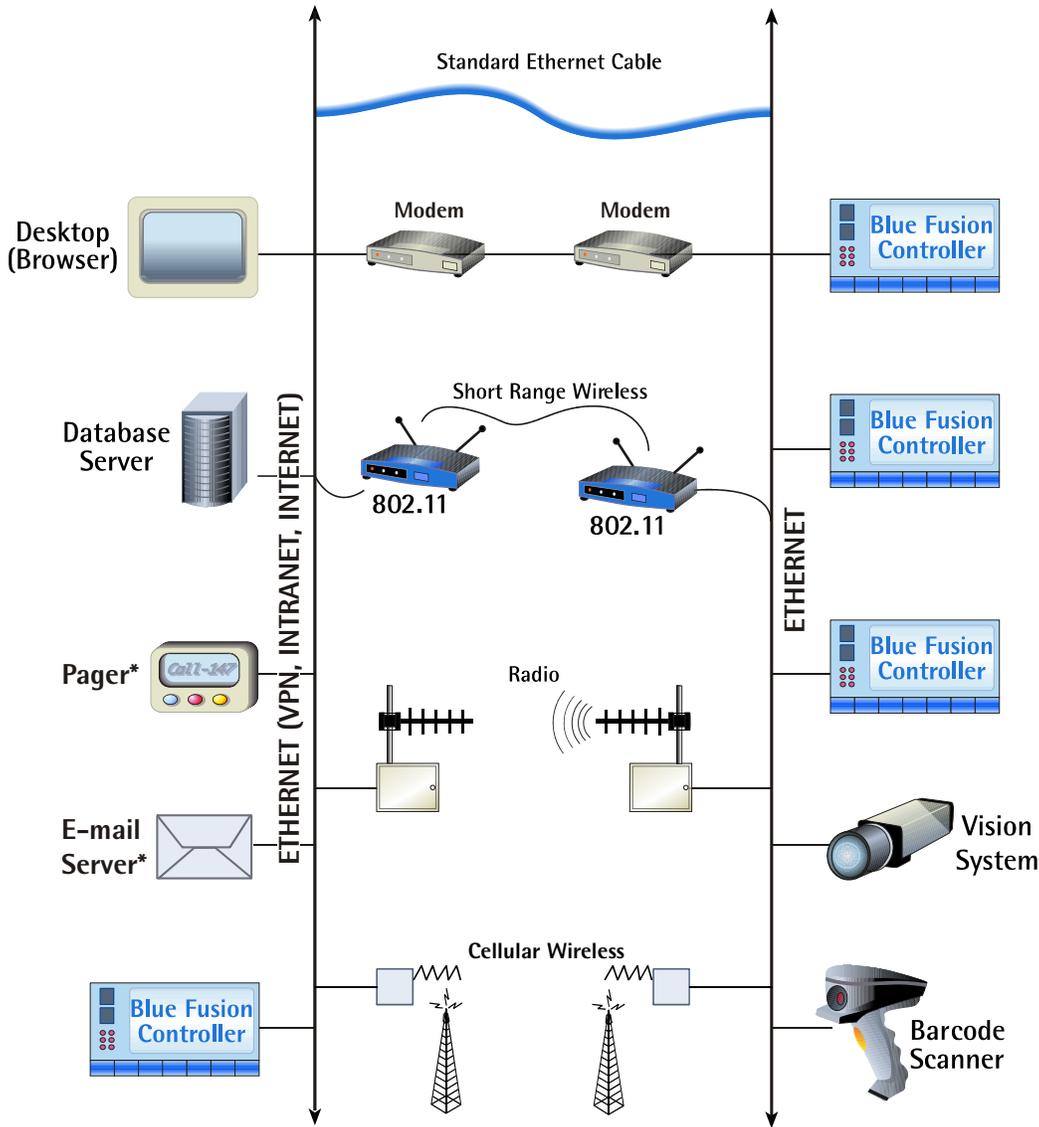
Distributed Scalable Control

Hundreds of controllers can be linked together and coordinated from a central point. By providing direct enterprise to device connectivity via standard IT network technology, Blue Fusion controllers provide the information for increased operational efficiency in small, medium and large-scale implementations.



Making the connection

CTC controllers enable you to transfer data via any of several widely available standard Ethernet implementations: physical connections, modem, and radio or cellular wireless.



*Supported by Model 5200

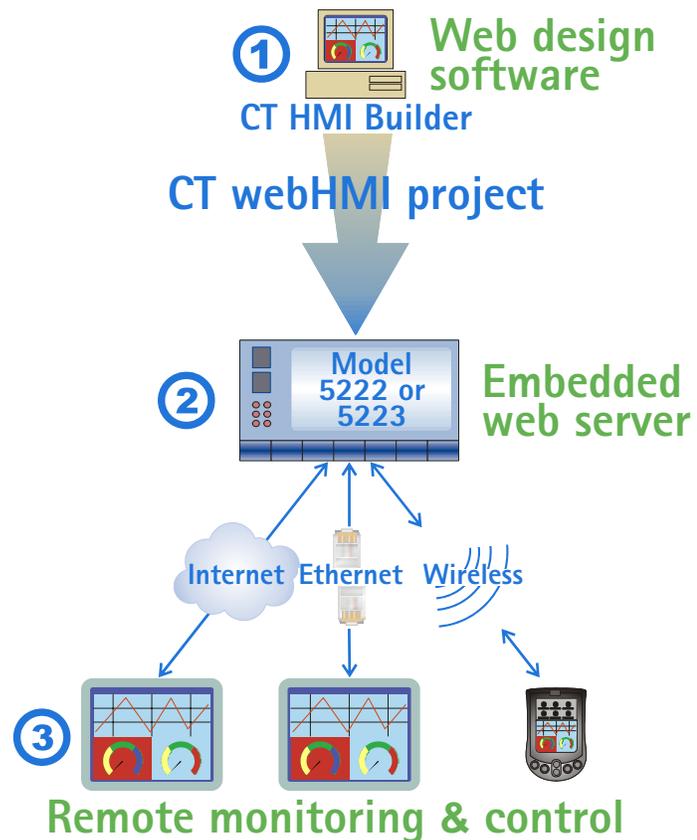
CT HMI and CT webHMI

Controllers serve web based HMI screens

The Blue Fusion model 5222 and 5223 automation controllers utilize patented CTC technology to serve up interactive web based HMI projects. The projects are created on a PC using CT HMI Builder, CTC's graphical development software. CT HMI builder has a large library of graphical elements including switches, displays, lights, meters, charts, etc. that speed the development process. Once the project has been created, CT HMI Builder converts the project to a CT webHMI project and exports it directly to the Blue Fusion controller. The CT webHMI project in the controller can then be accessed by any number of authenticated users via standard web browsers.

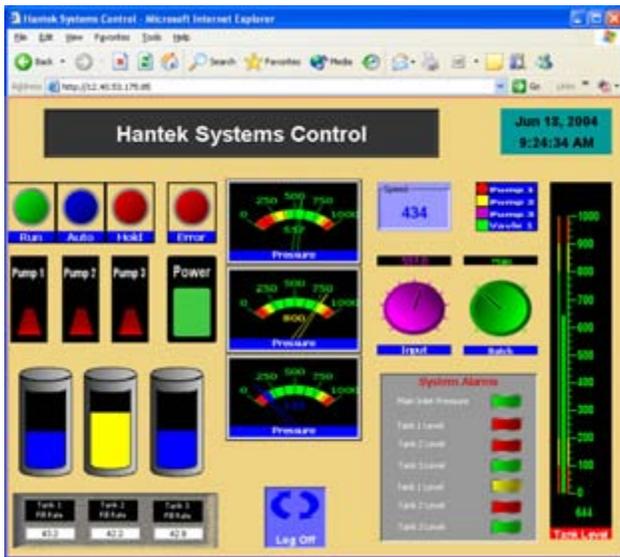
Exporting HMI displays to Blue Fusion controllers: three easy steps

1. Create interactive displays with CT HMI Builder software on your PC.
2. Publish CT webHMI projects to web server residing in a Blue Fusion Model 5222 or Model 5223 automation controller using patented web server technology.
3. Access real-time data as a web page from any network or Internet connection. No expensive software required on client devices to monitor or control your applications.



CT webHMI features

Model 5222/5223 comparison



Actual CT webHMI display accessed via Internet Explorer.

CT webHMI projects are accessed directly from the Blue Fusion controller by all authenticated users via standard web browsers like Internet Explorer. The browser "screen" is dynamically updated providing live read/write access to all of the controller's resources. Through the browser, users can both monitor and control any connected devices or processes remotely. For example, click on a FILL TANK button, and then watch the browser page dynamically fill the tank. The web page will look just like it did when originally designed using CT HMI Builder and will be fully interactive.

5200 CT webHMI features

Blue Fusion model no.	5222	5223
CT webHMI version	basic	advanced
Standard flash drive size	5 MB	9 MB
Simple graphics	✓	✓
Labels	✓	✓
User generated graphics	✓	✓
Active display boxes	✓	✓
Interactive switches	✓	✓
Indicator lights	✓	✓
Live video feeds	✓	✓
Interactive meters	✓	✓
Remote data logging	✓	✓
Number of controllers HMI project can access	1	unlimited
Multiple register (block) read	-	✓
String table translator	-	✓
Event scripts	-	✓
Project scripts	-	✓
Recipe manager	-	✓
Dynamic charting	-	✓
Encrypted multi-level security	-	✓
Multi-panel support	-	✓
Animation	-	✓
Multiple language support	-	✓
User logon authentication	-	✓

Data logging and FTP support

Model 5222/5223 Blue Fusion controllers are ideal for secure data logging and data acquisition in industrial, scientific, environmental, and agency compliance applications. Data from any of the controller's I/O or internal resources can be logged to protected non-volatile files. These files can then be retrieved by remote computers using the built-in FTP server. Alternatively the controller can automatically "push" the file to a remote computer automatically based on time or event using the built-in FTP client or email support.

Accurate time and date stamping is assured by the controller's SNTP time synchronization feature that automatically synchronizes the controller with a designated enterprise time source or an external reference clock time. And unlike traditional data loggers, CTC controllers can analyze logged data in real time and then take appropriate action based on the logged data.

Data logging features

- Supports data logging of any controller variable
- Log files support custom formatting
- Easily exported to Excel for detailed analysis
- Automatically upload log files to remote servers
- Automatic time and date stamping
- Data is logged to non-volatile memory
- Multiple formatting options
 - Comma delimited
 - Fixed field size
 - Free style record format
- Allows up to 999 log files
- Log files support mixed record formatting
- Provides I/O interface to SCADA systems
- Automatic record synchronization with remote server
- Local non-volatile logging of over 3 million values

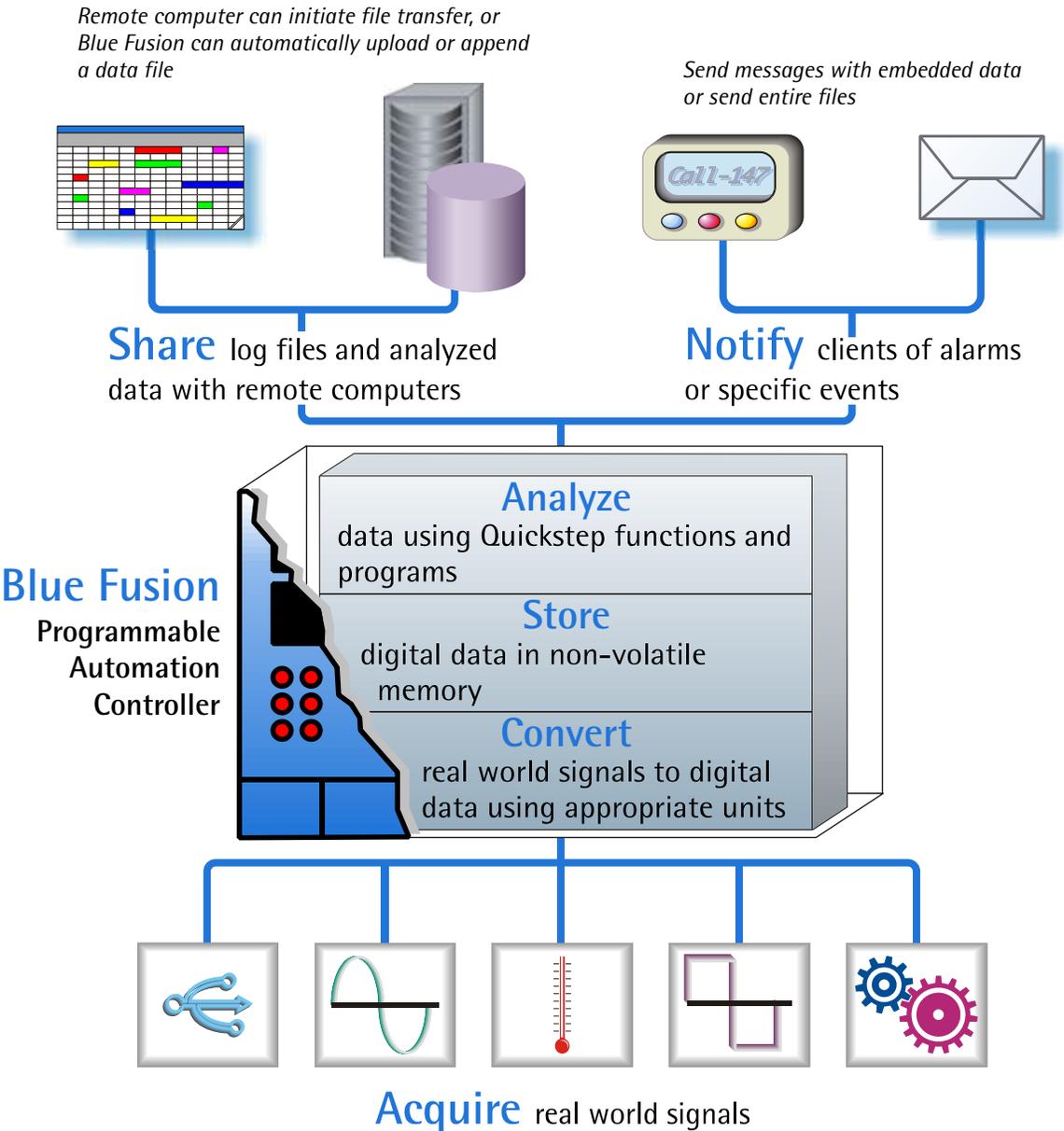
FTP support features

- FTP server support; allows remote computers to upload or download files on the controller
- FTP client support; allows the controller to upload, append, or download files automatically from remote computers

CT Server — Enterprise Intelligence Software

For large scale distributed data acquisition applications, CTC offers a high-performance SQL-based product called CT Server, which is designed to run on work-cell or enterprise-level computer hardware. CT Server is a powerful web-enabled application designed to log up to 100,000 data points per second. CT Server can log data from both CTC controllers as well as a wide variety of third party devices. For detailed product information, visit our website: www.ctc-control.com.

Data logging and FTP support



Model comparison

Model 5100 series



- Low cost solution for smaller systems
- 28 MHz RISC processor
- Supports 6 module bays
- Up to 48 I/O
- Up to 4 motion axes

Model 5200 series



- Expandable architecture for mid-range systems
- 62 MHz RISC processor
- Supports 24 module bays
- Up to 192 I/O
- Up to 12 motion axes
- High speed networking

Special Model 5222 features

- Data logging
- Basic web based HMI

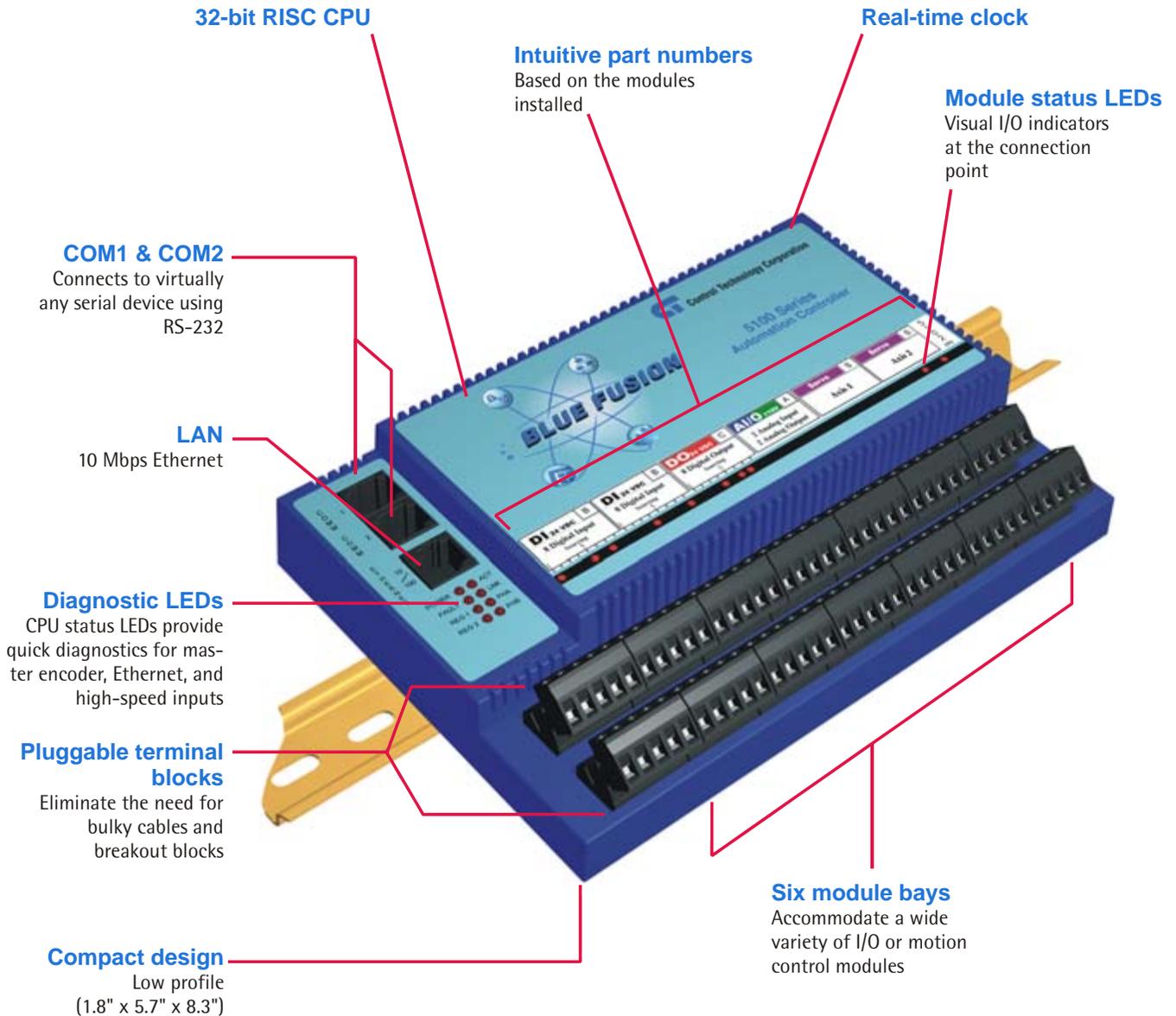
Special Model 5223 features

- Data logging
- Advanced web based HMI

Model comparison

Feature	5100	5220	5222/5223
CPU			
Processor	28 MHz RISC	62 MHz RISC	62 MHz RISC
Operating system	multitasking, multithreaded	multitasking, multithreaded	multitasking, multithreaded
Max simultaneous tasks	84	84	84
System memory (MB)	8	16	16
User flash (MB)	1	1 – 17	5 – 17 / 9 – 17
User NVRAM (MB)	–	1.5 – 5.5	3.5 – 5.5
User definable storage drives	–	yes	yes
Communication			
RS-232	2 @ 38.4 KB	1 @ 115 KB	1 @ 115 KB
RS-232/RS-485	–	1 @ 115 KB	1 @ 115 KB
Ethernet	1 @ 10 baseT	1 @ 10/100 baseT	1 @ 10/100 baseT
I/O capacity			
Module bays per rack	6	6	6
Racks per system	1	4	4
Max digital I/O per system	48	192	192
Max 24V I/O sourcing load per rack (A)	3	8	8
Max analog I/O per system	48	192	192
High speed encoder registration option	opt	opt	opt
Max motion axes per system	4	12	12
Application software			
Quickstep 2 State Language	yes	yes	yes
C/C++ programming	limited	expanded	expanded
Web enabled software			
Web server (built-in)	–	yes	yes
Browser based setup	–	WebMon 2	WebMon 2
Web monitoring and control	–	yes	yes
Multi-level security	–	yes	yes
Email client	–	yes	yes
FTP client and server	–	yes	yes
Data logging	–	–	yes
CT webHMI server	–	–	basic / advanced

5100 feature highlights



5100 specifications

General specifications

System resources

- 32-bit RISC CPU (28 MHz)
- Industrial real-time deterministic OS
- Real-time clock

User memory

- 128K user memory

Active program resources

- 4,500 non-volatile registers
- 16,000+ element data table
- 84 simultaneous tasks

Environmental

- Operating temperature: 0 – 50°C
- Storage temperature: -40 – 85°C

Performance specifications

Encoder and high speed counters (optional)

- Quadrature and encoder input (6 MHz)

Analog I/O (max 48 channels)*

- Voltage, current and thermocouple
- PID loop control

Digital I/O (max 48 channels)*

- Hardware counters 10 KHz/channel
- Supports 16 PLS outputs, actuation rate < 1msec
- Optional quadrature encoder input with 32-bit counter and 2 additional high-speed (1 microsecond response) registration inputs

Motion control (4 axes per controller)*

- Stepper
 - Velocity range: 0 – 1M steps/sec
 - Accuracy: ± 1 count
- Servo
 - Position loop rate: 500 μ sec/axis
 - Velocity range: 0 – 6M counts/sec

*Maximums are per controller or rack unit and are not necessarily mutually inclusive.

Networking specifications

Ethernet communications

- Supports wired and wireless networking
- UDP, TCP/IP
- Modbus master/slave (ASCII or RTU)
- Raw socket support

Serial communications

- Two RS-232 serial COM ports (38.4 Kbaud)

5100 specifications

Power, COM, and encoder specifications

Parameter	Value
Supply voltage^{1,2}	
5101 / 5102	18-27.0 VDC
5103 / 5104	10-27.0 VDC
Supply current @ 24 VDC	
Quiescent (comm inactive)	150 mADC
Fully loaded (all comm / Ethernet active)	384 mADC
External +5 VDC power ³	5 VDC \pm 10%; 2 ADC
Encoder inputs	
Type - RS-485 compliant	5 V Diff.
Termination resistor	100 Ω
Max. frequency	6 MHz
Registration inputs	
Minimum ON voltage ⁴	0.73 * VS
Maximum OFF voltage ⁴	0.61 * VS
Maximum input voltage ⁴	VS
Maximum input current	1.2 mADC
Input resistance	20k Ω \pm 10%

Parameter	Value
Communications capacities	
Ethernet (IEEE 802.3)	
No. of ports	1
Speed (auto-negotiating, full or half duplex)	10 Mbps
Media type	Base-TX
Connector type	8-pin Telco (RJ-45)
Isolation from CPU	1500 VDC
RS-232	
No. of ports	2
Max. speed	38.4 Kbaud
Default speed	19.2 Kbaud
Connector type	4-pin Telco (RJ-11)
Isolation from CPU	500 VDC
Max. Tx/D / Rx/D voltage	\pm 10 VDC

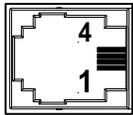
Notes

1. When analog I/O modules are installed in a controller, it is recommended that the controller be powered via a dedicated linear power supply.
2. Power to each controller should be individually fused with a 30 VDC (minimum) rated 5.0 amp, fast-acting fuse.
3. Derived internal to the controller to be used to power analog I/O modules as well as external encoder circuits.
4. VS refers to the voltage supply of the controller.

5100 specifications

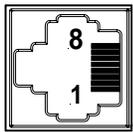
Pinouts, connector and LED specifications

Connector Pinouts



Pin #	Signal
1	TxD
2	Common
3	Common
4	RxD

Ethernet 10 base-T pinouts



Pin #	Signal
1	TX0+
2	Tx0-
3	RX1+
4	NC ¹
5	NC ¹
6	RX1-
7	NC ¹
8	NC ¹

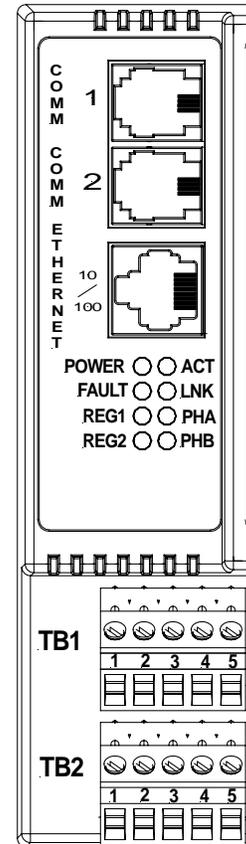
Power and input terminations

TB1-1	+VS Input
TB1-2 ²	REG1
TB1-3 ²	+PHA
TB1-4 ²	+PHB
TB1-5	+5 VDC Output
TB2-1	VS Return
TB2-2 ²	REG2
TB2-3 ²	-PHA
TB2-4 ²	-PHB
TB2-5	VS Return

LED identification

Power	Off = Power failure On = Normal operation	ACT Ethernet activity	Off = No activity Flashing = Activity
Fault Controller status	Off = Normal operation Solid = Hardware fault Slow flash = software fault Fast flash = DHCP negotiation	LNK Ethernet link	Off = Not connected On = Connected
REG1 ² REG1 status	Off = Open circuit On = Closed circuit	PHA ² PHA status	Off = Open circuit On = Closed circuit
REG2 ² REG2 status	Off = Open circuit On = Closed circuit	PHB ² PHB status	Off = Open circuit On = Closed circuit

Connector Identification



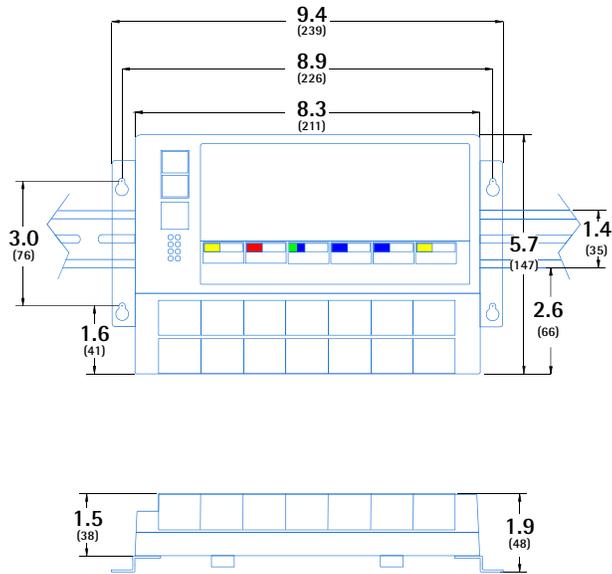
Notes

1. Series RC (75.0 Ω resistor / 0.001μF capacitor) to chassis for optional ground terminations.
2. On-board encoder and registration inputs are only present on the Models 5102 and 5104 controllers.

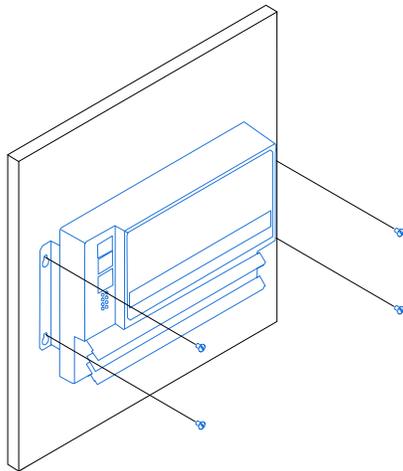
Minimum hardware revision: B, C, E
Minimum firmware revision: 4.04
Document number: 950-510001-0007

5100 dimensions

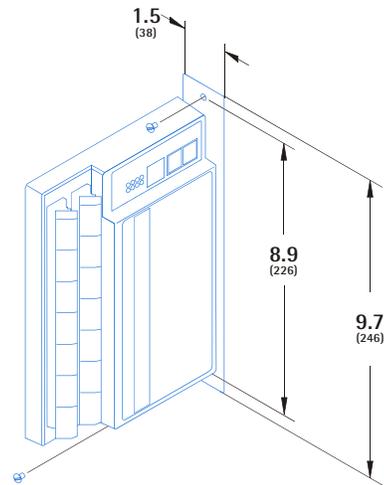
Dimensions are in inches (mm). DIN rail clips are standard.



SHOWN WITH OPTIONAL FLUSH MOUNTING BRACKET
Part number: 5180 (includes left and right brackets)



RECOMMENDED MOUNTING ORIENTATION



SHOWN WITH OPTIONAL RIGHT-ANGLE MOUNTING BRACKET (Part number: 5181)

5100 configuration

CTC has designed the 5100 series to be easily configurable to meet a wide variety of applications. Ordering is simple: you just select your CPU option and then add the modules needed for your application. Each controller has six internal module bays that can accommodate any combination of I/O or motion control modules. The 5100 model options as well as a sample configuration are shown below.

5100 Series Part Numbers

The part number for the controller at right is as follows:

Part No. 5102-ABBCSS

Controller series ———— Installed modules series

- Controller model
- 01 = 18-32 VDC
 - 02 = 18-32 VDC with encoder option
 - 03 = 10-32 VDC
 - 04 = 10-32 VDC with encoder option



Use the table below to select the controller series that will fit your application.

Model	5101	5102	5103	5104
Input power	18-32 VDC	18-32 VDC	10-32 VDC	10-32 VDC
Module bays	6	6	6	6
Digital inputs	48	50*	48	50*
Digital outputs	48	48	48	48
Analog inputs	24	24	24	24
Analog outputs	48	48	48	48
Servo axes	4	4	4	4
Ethernet ports	1	1	1	1
Master encoders	0	1	0	1
RS-232 channels	2	2	2	2

*Includes two high speed inputs on controller mother board in addition to standard per-controller maximum of 48 inputs.

**Capacities are per controller and are not necessarily mutually inclusive.

Accessory part numbers

Flush mounting brackets: 5180 (includes left and right brackets)

Right-angle mounting bracket: 5181

5200 feature highlights

COM1 & COM2

Connect to virtually any serial device using RS-232 or RS-485

LAN

High-speed 10/100 Ethernet

Diagnostic LEDs

Provide visual status information

Pluggable terminal blocks

Eliminate the need for bulky cables and breakout blocks

Web server

Set up, monitor, and control via built-in web pages.

E-mail client

Send and receive e-mail messages directly.

Local data logging

Log millions of data points in real time.

Real-time clock

Automatic SNTP network synchronization

Flash file system

Non-volatile program and data storage

CPU

High-speed 32-bit RISC processor

Module status LEDs

Visual I/O indicators at the connection point

Six module bays

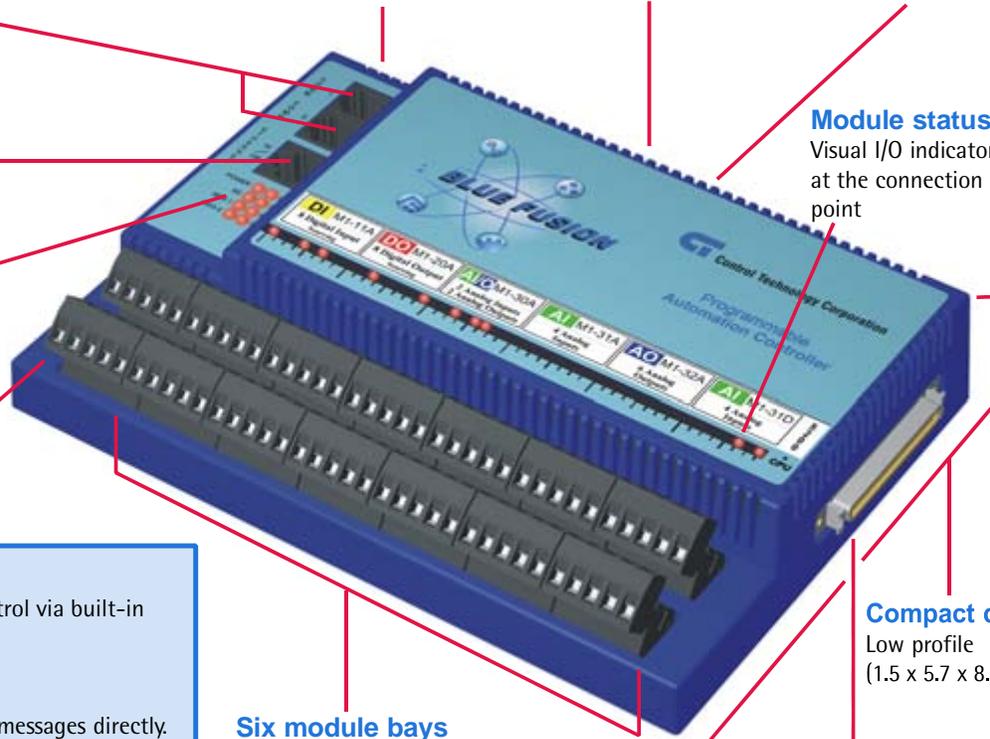
Accommodate a wide variety of I/O, communications, and motion modules

Compact design

Low profile
(1.5 x 5.7 x 8.4)

Expansion connector

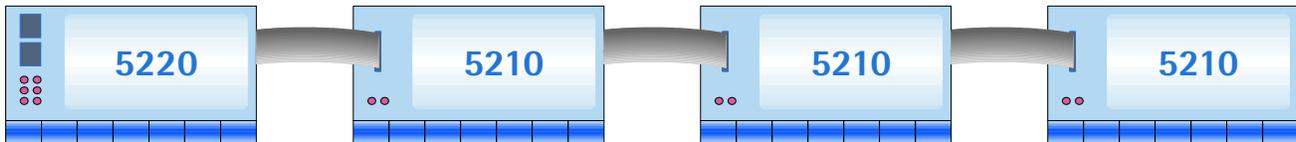
Connects one or more expansion racks



5200 system expansion

Expansion racks

Blue Fusion expansion racks provide full speed access to all I/O and motion modules in the system. Up to three expansion racks may be added to each CPU, allowing for up to 192 I/O points and up to 12 axes of motion control.



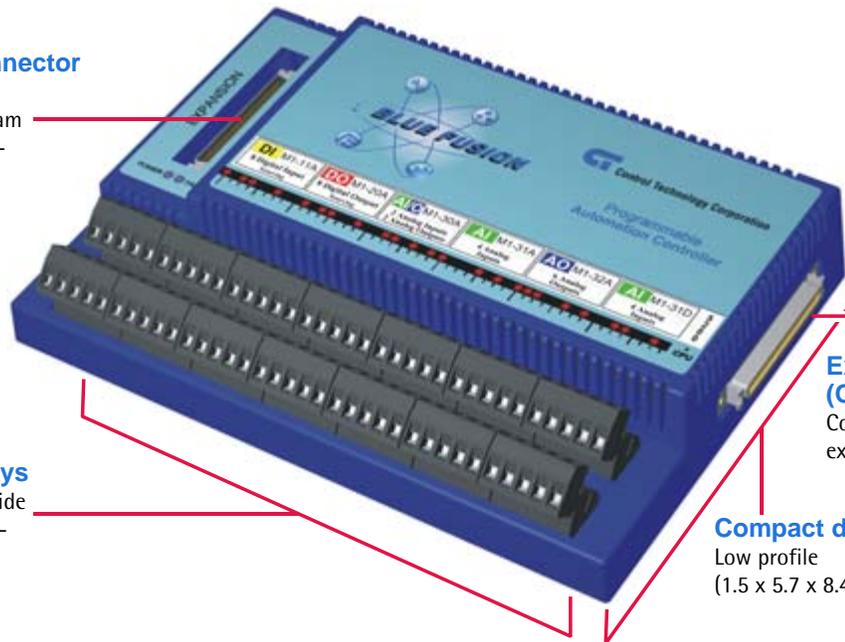
Model 5210 expansion rack feature highlights

Expansion connector (In)

Connects to upstream controller or expansion block

Six module bays

Accommodate a wide variety of I/O, communications, and motion modules



Expansion connector (Out)

Connects to additional expansion racks

Compact design

Low profile
(1.5 x 5.7 x 8.4)

Notes

1. One expansion cable is included with each expansion unit ordered. Replacement part number for expansion cable is 5282.
2. Minimum distance between units is 1.25" and maximum distance is 2.5".
3. Use only CTC approved expansion cables. Warranty is voided if an unapproved, damaged, or modified expansion cable is used.

5200 specifications

General and performance specifications

General specifications

System resources

- 32-bit 68 MHz RISC CPU
- Industrial real-time deterministic OS
- Real-time clock

User memory

- Flash file system: 1MB¹
- Non-volatile RAM drive: 1.5 MB¹

Active program resources

- 4,500 non-volatile registers
- 32,768-element data table
- 84 simultaneous tasks

Environmental

- Operating temperature (horizontal installation): 0 – 50°C
- Storage temperature: -40 – 85°C

Performance specifications

Encoder and high speed counters (optional)

- Quadrature encoder input (6 MHz)
- Dual high speed counters (6 MHz)

Analog I/O (max 48 channels)²

- Voltage, current and thermocouple
- PID loop control

Digital I/O (max 48 channels)²

- Hardware counters 10 KHz/channel
- Supports 16 PLS outputs, actuation rate < 1 msec
- Optional quadrature encoder input with 32-bit counter and 2 additional high-speed (1 microsecond response) registration inputs

Motion control (6 axes per controller, 12 axes per system)³

- Stepper
 - Velocity range: 0-1M steps/sec
 - Accuracy: ± 1 count
- Servo
 - Position loop rate: 500 μ sec/axis
 - Velocity range: 0 – 6M counts/sec

Notes

1. Other options available. See page 33 of this catalog for additional information on options.
2. Maximums are per controller or rack unit and are not necessarily mutually inclusive.
3. "System" maximum requires expansion units. Maximums are not necessarily mutually inclusive.
4. Model 5222/5223 only.

Data logging⁴

- Local data logging to internal non-volatile RAM disk
- Automatic integration with CTC's CTLog software
- Standard memory stores 384,000 values; expandable to 3 million values

Web server

- Monitor and control devices via a standard browser
- Built-in web pages allow controller to be fully configured and monitored with only a standard web browser
- Supports standard HTTP and XML interface

HMI integration

- Fully integrated Ethernet support for CTC's iPanel™ touchscreens
- Serial support for other touchscreens
- CT webHMI support⁴

5200 specifications

Networking specifications

Networking specifications

Ethernet communications

- 10/100 baseT Ethernet full duplex with DMA and flow control
- Supports wired and wireless networking
- UDP, TCP/IP, HTTP
- Modbus master/slave (ASCII or RTU)
- FTP, HTTP file server
- Raw socket support
- SNTP (Simple Network Time Protocol) time synchronization
- DHCP support enables network administrators to automate assigning of IP addresses within a network

Serial communications

- Two serial COM ports (115 KBaud)
- RS-232 (standard)
- RS-485 (optional); on COM2 only

5200 specifications

Power, COM, and encoder specifications

Parameter	Value	
Supply voltage^{1,2}		
Option P = 0 ³	18-32.0 VDC	
Option P = 1 ³	10-32.0 VDC	
Supply current @ 24 VDC		
	CPU	Expansion
Quiescent (comm inactive)	110 mA	25 mA
Fully loaded (all comm / Ethernet active)	270mA	25 mA
External +5 VDC power ⁴	5 VDC \pm 10%; 2 ADC	
Encoder inputs		
Type - RS-485 compliant	5 V Diff.	
Termination resistor	100 Ω	
Max. frequency	6 MHz	
Registration inputs / 24V DINs		
Minimum ON voltage ⁷	0.73 * VS	
Maximum OFF voltage ⁷	0.61 * VS	
Maximum input voltage ⁷	VS	
Maximum input current	1.2 mADC	
Input resistance	20k Ω \pm 10%	

Parameter	Value
Communications capacities	
Ethernet (IEEE 802.3)	
No. of ports	1
Speed (auto-negotiating, full or half duplex)	10/100 Mbps
Media type	Base-TX
Connector type	8-pin Telco (RJ-45)
Isolation from CPU	1500 VDC
RS-232	
No. of ports (Option C = 1 ³)	2
No. of ports (Option C = 2 ³)	1
Max. speed	115 Kbaud
Default speed	19.2 Kbaud
Connector type	4 / 6-pin Telco (RJ-11)
Isolation from CPU	500 VDC
Max. Tx/D / Rx/D voltage	\pm 10 VDC
Isolated power (voltage) ⁵	5 VDC \pm 10%
RS-485	
No. of ports (Option C = 2 ³)	1
Max. speed	38.4 Kbaud
Default speed	19.2 Kbaud
Connector type	6-pin Telco (RJ-11)
Isolation from CPU	500 VDC
+V, -V, DIR voltage range ⁶	0-5 VDC
Isolated power (voltage) ⁵	5 VDC \pm 10%

Notes

1. When analog I/O modules are installed in a controller, it is recommended that the controller be powered via a dedicated linear power supply.
2. Power to each controller should be individually fused with a 30 VDC (minimum) rated 5.0 amp, fast-acting fuse.
3. This is an option that may be selected when ordering the controller. See page 33 of this catalog for additional information on options.
4. Derived internal to the controller to be used to power analog I/O modules as well as external encoder circuits.
5. 5 VDC for external communication devices; port 2 only.
6. DIR Output: 0V = Transmit, 5V = Receive.
7. VS refers to the voltage supply of the controller.

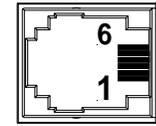
5200 specifications

Pinouts, connector and LED specifications

Connector Pinouts

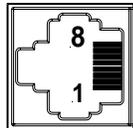
Comm1 and Comm2 RS232 / RS485 pinouts

Pin #	Option C = 1	Option C = 2 (port 2 only)
1	Not populated	+5
2	RS232 TxD	RS485 V+
3	Common	Common
4	Common	Common
5	RS232 RxD	RS485 V-
6	Not populated	DIR



Ethernet 10/100 baseT pinouts

Pin #	Signal
1	TX0+
2	Tx0-
3	RX1+
4	NC ¹
5	NC ¹
6	RX1-
7	NC ¹
8	NC ¹



Power and input terminations²

	Option H = 1	Option H = 2 and 3
TB1-1	+VS input	+VS input
TB1-2 ³	REG1/DIN3	REG1/DIN3
TB1-3 ³	+PHA/+CNT1/+DIN1	PHA/CNT1/DIN1
TB1-4 ³	+PHB/+CNT2/+DIN2	PHB/CNT2/DIN2
TB1-5	+5 VDC output	+5 VDC output
TB2-1	VS return	VS return
TB2-2 ³	REG2/DIN4	REG2/DIN4
TB2-3 ³	-PHA/-CNT1/-DIN1	VS return
TB2-4 ³	-PHB/-CNT2/-DIN2	VS return
TB2-5	VS return	VS return

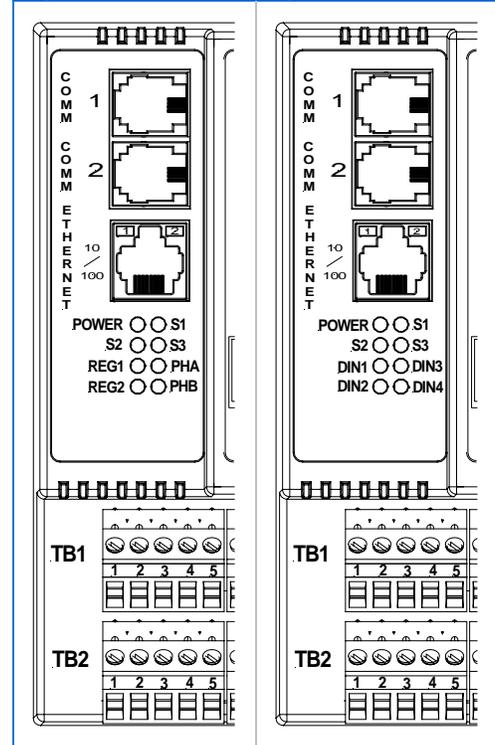
LED identification⁴

Ethernet #1 10mB status	Off = No connection Green vs. yellow = Half vs. full duplex Flashing = Activity
Ethernet #2 100mB status	Off = No connection Green vs. yellow = Half vs. full duplex Flashing = Activity
Power	Off = Power failure On = Normal operation
S1/2/3 Expansion fault	All off = Normal operation S1 flashing = Software fault S2/Expansion fault solid = Hardware fault S3 flashing = DHCP negotiating
REG1/2 and PHA/B CNT1/2 and DIR1/2 DIN1/2/3/4	Off = Open circuit On = Closed circuit

Connector Identification

Option H = 1

Option H = 2 and 3



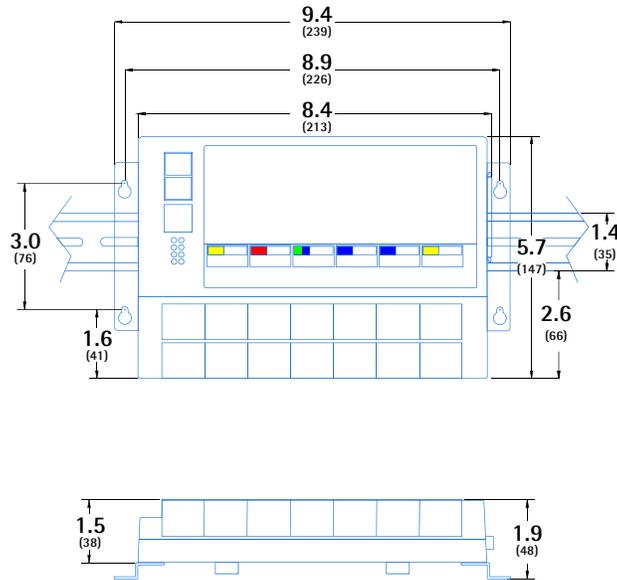
Notes

- Series RC (75.0 Ω resistor / 0.001μF capacitor) to chassis for optional ground terminations.
- All high speed inputs can operate as encoders with registration inputs, as counters with direction inputs, or as standard digital inputs.
- No connection on expansion racks.
- Expansion racks have two LEDs only: Power and Fault.
- Only use CTC approved expansion cables. Warranty is voided if an unapproved, damaged, or modified expansion cable is used.

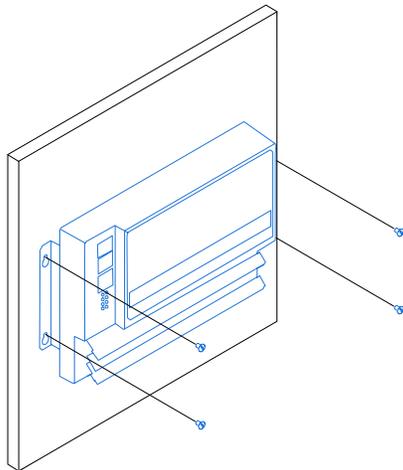
Minimum hardware revision: C, D
Minimum firmware revision: 5.01
Document number: 950-520001-0007

5200 dimensions

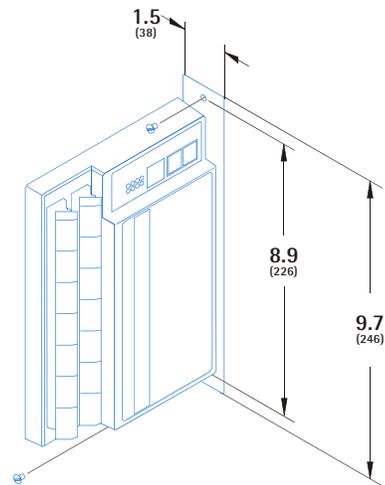
Dimensions are in inches (mm). DIN rail clips are standard.



SHOWN WITH OPTIONAL FLUSH MOUNTING BRACKET
Part number: 5180 (includes left and right brackets)



RECOMMENDED MOUNTING ORIENTATION



SHOWN WITH OPTIONAL RIGHT-ANGLE MOUNTING BRACKET (Part number: 5181)

1. All mounting instruction and physical dimensions also pertain to expansion racks.

5200 configuration

The part number used to order your controller is determined by the controller's configuration:

Part No. XX nnnn – PHCMcc

For Blue Fusion controllers (CPU), XXnnnn = BC5220 (default for CPU rack), BC5222 or BC5223, while for Blue Fusion expansion racks, XXnnnn = BX5210. Other variables in the part number are defined as follows:

P	H	C	M	CC
power	high speed inputs	communications	memory	custom code

CPU rack (XXnnnn = BC5220, BC5222 or BC5223)

18-32 V	0	none	0	two RS-232	1	1.5 MB NVRAM 1 MB Flash ⁵	0	00
10 – 32 V	1	two differential ended inputs (5V) ^{2,3} two single ended inputs (24V) ^{2,4}	1	one RS-232 one RS-485	2	3.5 MB NVRAM 5 MB Flash ⁶	1	
		two single ended inputs (5V) ^{2,3} two single ended inputs (24V) ^{2,4}	2			3.5 MB NVRAM 9 MB Flash	2	
		four single ended inputs (24V) ²	3			5.5 MB NVRAM 17 MB Flash	3	

Expansion rack (XXnnnn = BX5210)

18 – 32 V	0	none	0	none	0	base memory	0	00
10 – 32 V	1							

Accessory part numbers

Flush mounting brackets: 5180 (includes left and right brackets)

Right-angle mounting bracket: 5181

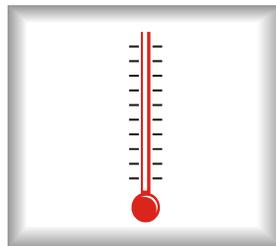
4" expansion cable: 5282. Note that one expansion cable is included with each expansion unit ordered.

Notes

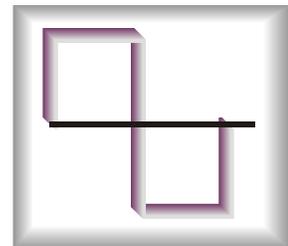
- Grey shaded rows in the above table represent the default configuration.
- All high speed inputs can operate as encoders with registration inputs, as counters with direction inputs, or as standard digital inputs.
- Voltage ratings and input type refers to Encoder #1 and #2 / Counter Trigger #1 and #2 / Digital Inputs #3 and #4 only.
- Voltage ratings and input type refers to Registration #1,#2 / Counter Direction #1,#2 / Digital Inputs #1,#2 only.
- Available for Model 5220 only.
- Available for Models 5220 and 5222 only.

I/O and motion modules

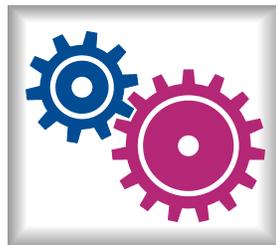
CTC offers a wide array of I/O and motion modules for customizing the functionality of the 5100 and 5200 controllers. Each controller or expansion rack has six module bays that can accommodate modules in any order. All modules except for the motion modules occupy a single module bay. Motion modules are double wide and require two adjacent module bays.



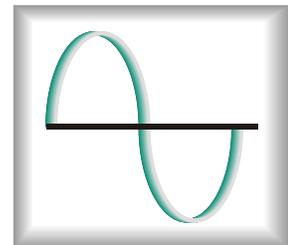
Temperature



Digital I/O



Motion



Analog I/O

Selection table

Part Number		Channels								
5100	5200	Digital In	Digital Out	Analog In	Analog Out	Temp	Encoder	Servo Control	Stepper Control	Page
B	M1-11A	8								36
L	M1-11B	8*								38
M	M1-11C	8 (5V)								40
N	M1-11D	8 (5V)*								42
C	M1-20A		8							44
O	M1-20B		8 (5V)							46
U	M1-22A		8*							48
A	M1-30A			2 (V)	2 (V)					50
R	M1-30C			2 (mA)	2 (V)					52
F	M1-31A			4 (V)						54
H	M1-31C			4 (mA)						56
D	M1-32A				6 (V)					58
E	M1-32B				8 (V)					60
V	M1-33B			2 (mV)						62
I	M1-33D					2				64
SS	M1-40A	2					2	2		66
TT	M1-50A	8							2	68

*Sinking

Digital input module

DI**M1-11A**

8 sourcing inputs (+VS VDC)

- ▶ Wide input hysteresis voltage for solid switch points
- ▶ Individual channel status LEDs
- ▶ Optically isolated

General specifications

Inputs per module	8
Input type	VDC sourcing
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Status indicator	One LED per input
Module size	1 controller bay

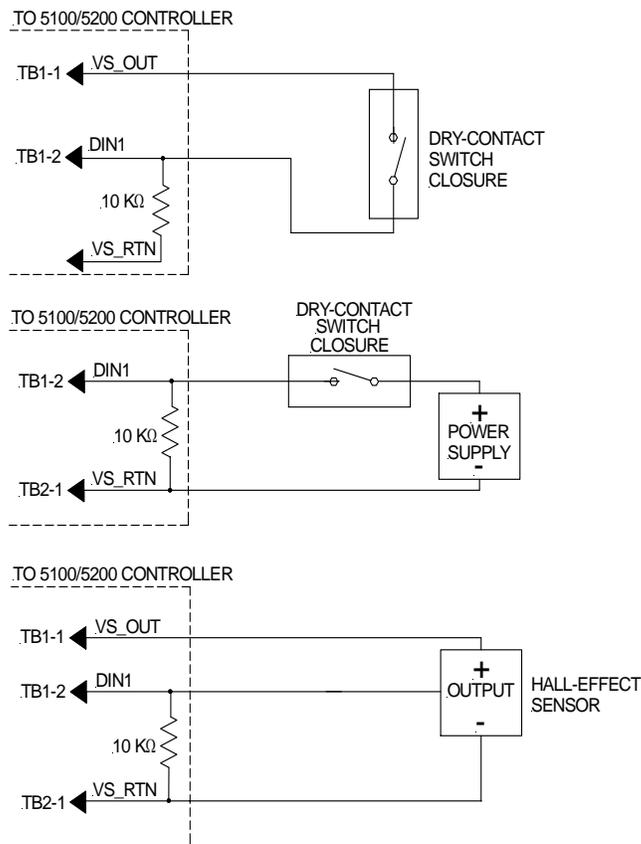
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	B

1. Refer to the applicable controller data sheet for proper mounting instructions.

Performance specifications

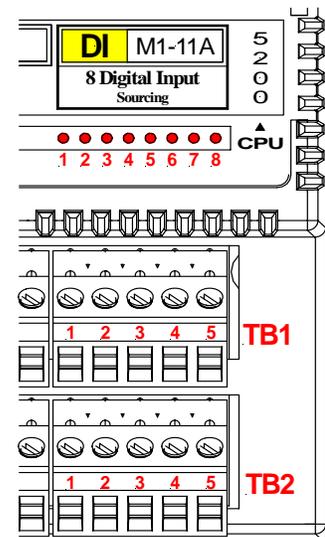
Parameter	Value
Input voltage (VS)	10 – 32 VDC
Max voltage	32 VDC
Nominal voltage (VN)	24 VDC
Turn ON threshold	0.46 * VS
Turn OFF threshold	0.12 * VS
Min hysteresis voltage	0.17 * VS
Min input current	2.6 mA @ 24 VDC
Input resistance to VS_RTN	10 K Ω \pm 10%
Min ON current	1.6 mA
Max OFF current	0.3 mA
Hardware filter	< 1 msec

Typical Application



	5100	5200
Minimum hardware revision	0, A	0, A
Minimum firmware revision	N/A	N/A
Minimum operating system revision	4.04	5.06
Document number: 950-511105-0003		

Connections



I/O Terminations

TB1-1		VS_OUT
TB1-2	LED1	Din #1
TB1-3	LED3	Din #3
TB1-4	LED5	Din #5
TB1-5	LED7	Din #7
TB2-1		VS_RTN
TB2-2	LED2	Din #2
TB2-3	LED4	Din #4
TB2-4	LED6	Din #6
TB2-5	LED8	Din #8

Notes

- When a digital device is powered via an external power source, it may be necessary to tie the ground of this power source to the controller's voltage supply ground (VS_RTN).
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.

Digital input module

DI**M1-11B**

8 sinking inputs (+VS VDC)

- ▶ Wide input hysteresis voltage for solid switch points
- ▶ Individual channel status LEDs
- ▶ Optically isolated

General specifications

Inputs per module	8
Input type	VDC sinking
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Status indicator	One LED per input
Module size	1 controller bay

Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	L

1. Refer to the applicable controller datasheet for proper mounting instructions.

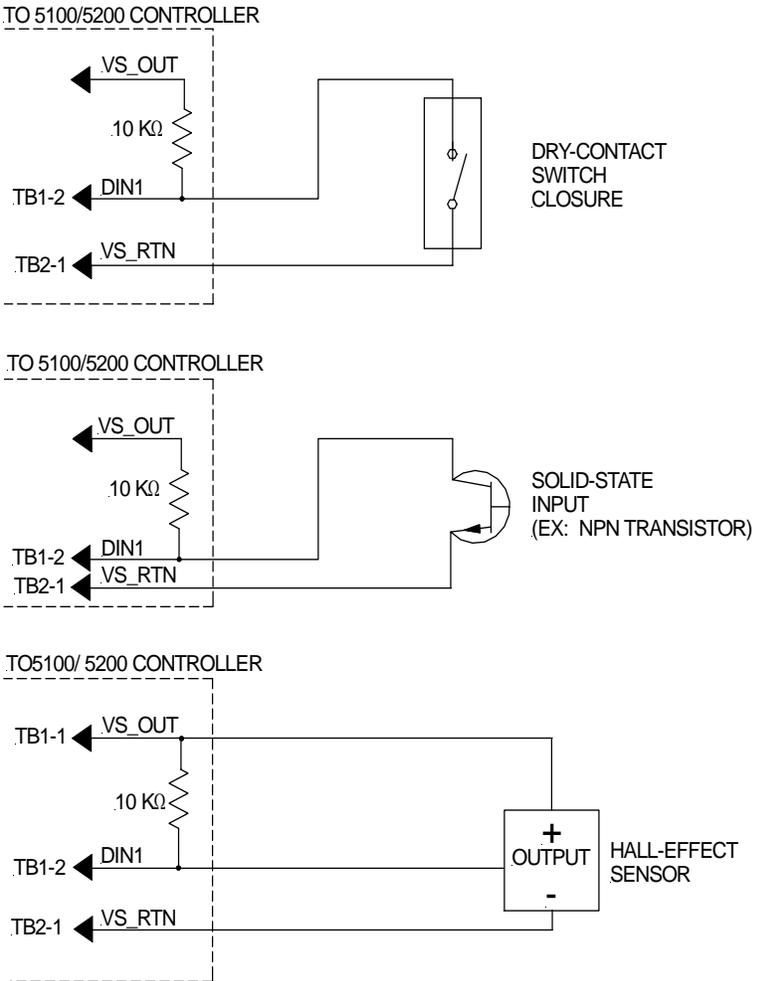
Performance specifications

Parameter	Value
Input voltage (VS)	10 – 32 VDC
Max voltage	32 VDC
Nominal voltage (VN)	24 VDC
Turn ON threshold	0.46 * VS
Turn OFF threshold	0.12 * VS
Min hysteresis voltage	0.17 * VS
Min input current	2.6 mA @ 0 VDC
Input resistance to VS	10 K Ω \pm 10%
Min ON current	1.6 mA
Max OFF current	0.3 mA
Hardware filter	< 1 msec

Digital input module

DI	M1-11B
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Typical Application

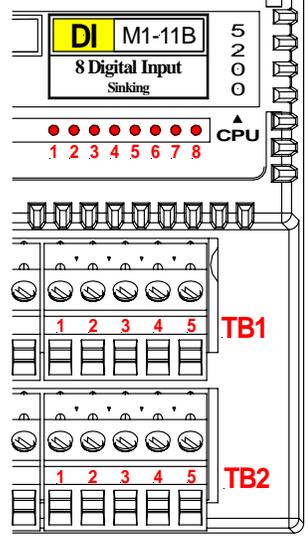


	5100	5200
Minimum hardware revision	0, A	0, A
Minimum firmware revision	N/A	N/A
Minimum operating system revision	4.04	5.06
Document number: 950-511106-0003		

Notes

- When a digital device is powered via an external power source, it may be necessary to tie the ground of this power source to the controller's voltage supply ground (VS_RTN).
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.

Connections



I/O Terminations		
TB1-1		VS_OUT
TB1-2	LED1	Din #1
TB1-3	LED3	Din #3
TB1-4	LED5	Din #5
TB1-5	LED7	Din #7
TB2-1		VS_RTN
TB2-2	LED2	Din #2
TB2-3	LED4	Din #4
TB2-4	LED6	Din #6
TB2-5	LED8	Din #8

Digital input module

DI**M1-11C**

8 sourcing inputs (+5 VDC)

- ▶ Wide input hysteresis voltage for solid switch points
- ▶ Individual channel status LEDs
- ▶ Optically isolated

General specifications

Inputs per module	8
Input type	VDC sourcing
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Status indicator	One LED per input
Module size	1 controller bay

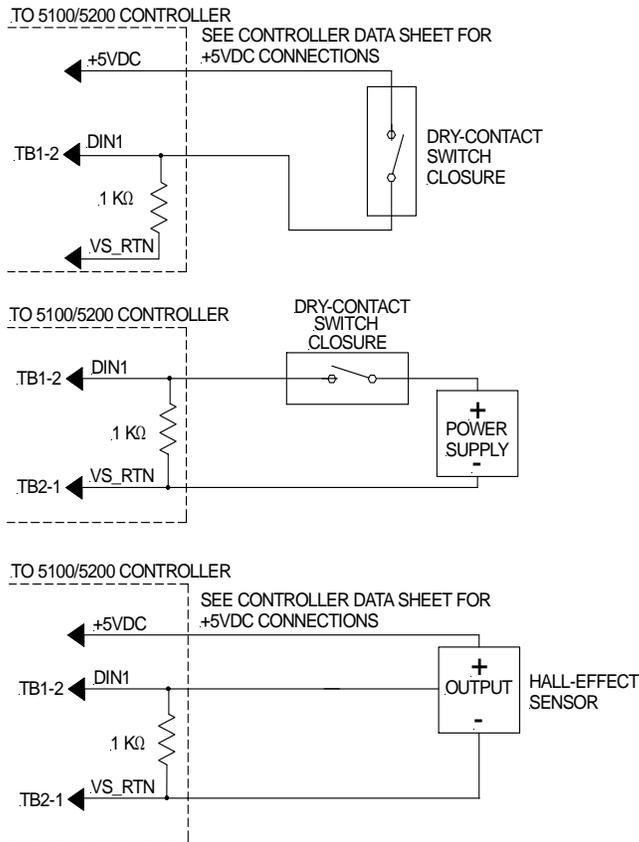
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	M

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

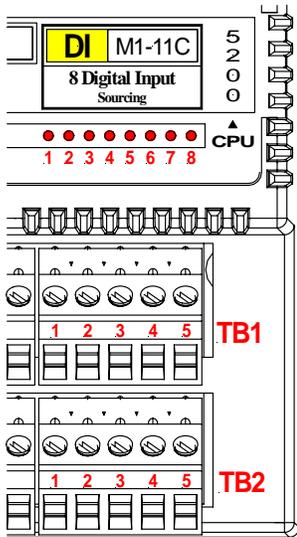
Parameter	Value
Input voltage (VS)	4.5 – 5.5 VDC
Max voltage	32 VDC
Nominal voltage (VN)	5 VDC
Turn ON threshold	4.0 VDC
Turn OFF threshold	1.0 VDC
Min hysteresis voltage	2.5 VDC
Min input current	5.5 mA @ 5 VDC
Input resistance to VS_RTN	1 K Ω \pm 10%
Min ON current	5.4 mA
Max OFF current	1.1 mA
Hardware filter	< 1.8 msec

Typical Application



	5100	5200
Minimum hardware revision	0, A	0, A
Minimum firmware revision	N/A	N/A
Minimum operating system revision	4.04	5.06
Document number: 950-511107-0003		

Connections



I/O Terminations

TB1-1		VS_OUT
TB1-2	LED1	Din #1
TB1-3	LED3	Din #3
TB1-4	LED5	Din #5
TB1-5	LED7	Din #7
TB2-1		VS_RTN
TB2-2	LED2	Din #2
TB2-3	LED4	Din #4
TB2-4	LED6	Din #6
TB2-5	LED8	Din #8

Notes

- When a digital device is powered via an external power source, it may be necessary to tie the ground of this power source to the controller's voltage supply ground (VS_RTN).
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.

Digital input module

DI**M1-11D**

8 sinking inputs (+5 VDC)

- ▶ Wide input hysteresis voltage for solid switch points
- ▶ Individual channel status LEDs
- ▶ Optically isolated

General specifications

Inputs per module	8
Input type	VDC sinking
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Status indicator	One LED per input
Module size	1 controller bay

Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	N

1. Refer to the applicable controller datasheet for proper mounting instructions.

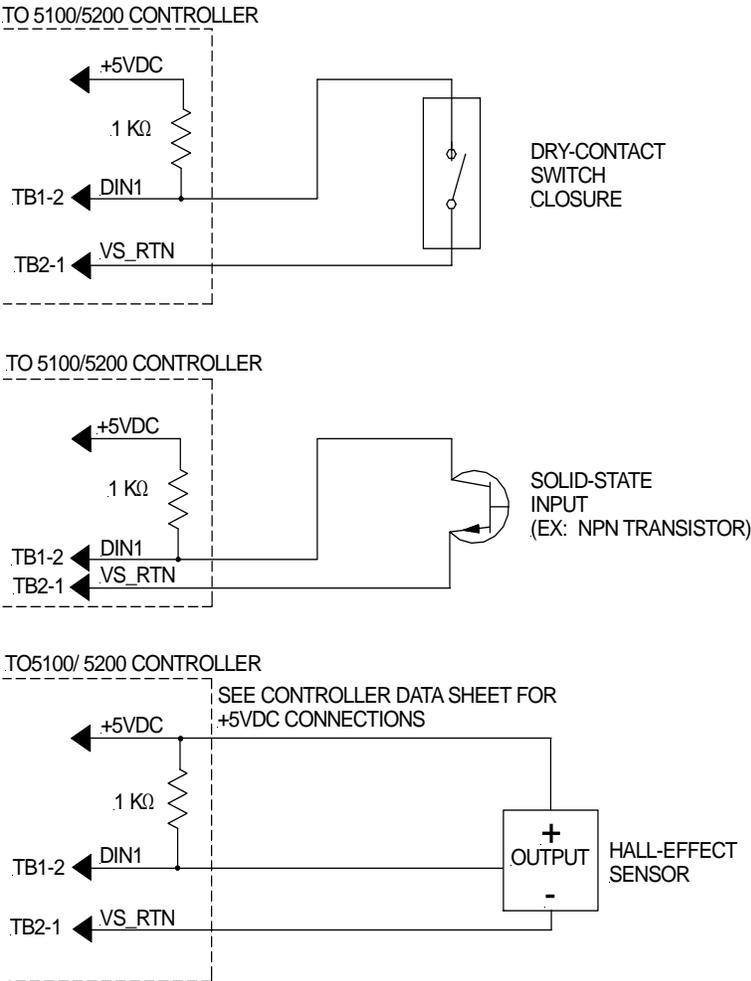
Performance specifications

Parameter	Value
Input voltage (VS)	4.5 – 5.5 VDC
Max voltage	32 VDC
Nominal voltage (VN)	5 VDC
Turn ON threshold	4.0 VDC
Turn OFF threshold	1.0 VDC
Min hysteresis voltage	2.5 VDC
Min input current	5.5 mA @ 0 VDC
Input resistance to VS_RTN	1 K Ω \pm 10%
Min ON current	5.4 mA
Max OFF current	1.1 mA
Hardware filter	< 1.8 msec

Digital input module

DI	M1-11D
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Typical Application

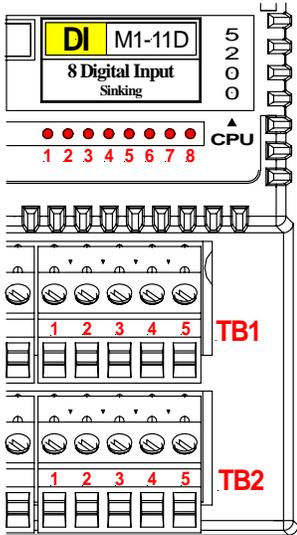


	5100	5200
Minimum hardware revision	0, A	0, A
Minimum firmware revision	N/A	N/A
Minimum operating system revision	4.04	5.06
Document number: 950-511108-0003		

Notes

- When a digital device is powered via an external power source, it may be necessary to tie the ground of this power source to the controller's voltage supply ground (VS_RTN).
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.

Connections



I/O Terminations		
TB1-1		VS_OUT
TB1-2	LED1	Din #1
TB1-3	LED3	Din #3
TB1-4	LED5	Din #5
TB1-5	LED7	Din #7
TB2-1		VS_RTN
TB2-2	LED2	Din #2
TB2-3	LED4	Din #4
TB2-4	LED6	Din #6
TB2-5	LED8	Din #8

Digital output module

DO

M1-20A

8 sourcing outputs (+VS VDC)

- ▶ Open emitter PNP to the controller's voltage supply
- ▶ High current: 375 mA per output / 3 A per module
- ▶ Individual LED status indicator for each output
- ▶ Optically isolated

General specifications

Outputs per module	8
Output type	Sourcing (PNP open collector)
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Status indicator	One LED per input
Module size	1 controller bay

Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	C

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Nominal voltage (VN)	24 VDC
Maximum ON voltage @:	
50 mA	VS – 0.7V
375 mA	VS – 1.4V
Maximum OFF voltage	Open emitter
Max channel current	375 mA
Max module current	3 ADC
Max controller current	
Model 5100	3 ADC
Model 5200	8 ADC
Max leak current/channel	100 μ ADC

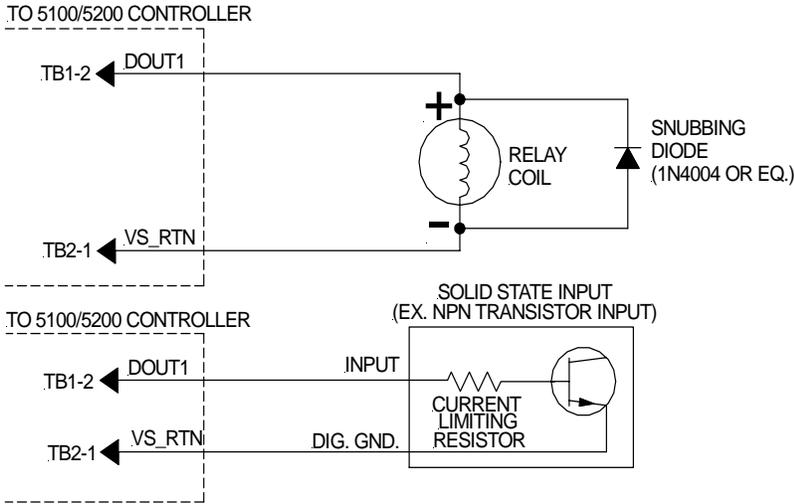
1. In the OFF state, the outputs are pulled internally low to VS_RTN via a 10 K Ω series resistor with an LED.

Digital output module

DO

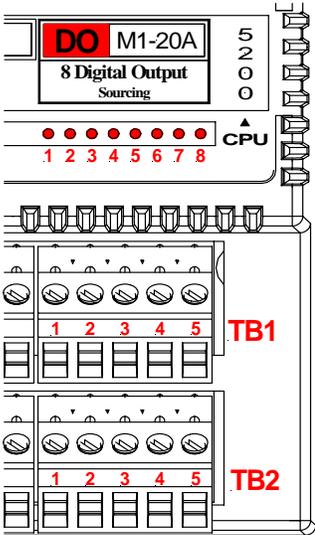
M1-20A

Typical Application



	5100	5200
Minimum hardware revision	B, C, D	B, C, D
Minimum firmware revision	N/A	N/A
Minimum operating system revision	4.04	5.06
Document number: 950-512003-0003		

Connections



I/O Terminations

TB1-1		VS_OUT
TB1-2	LED1	Dout #1
TB1-3	LED3	Dout #3
TB1-4	LED5	Dout #5
TB1-5	LED7	Dout #7
TB2-1		VS_RTN
TB2-2	LED2	Dout #2
TB2-3	LED4	Dout #4
TB2-4	LED6	Dout #6
TB2-5	LED8	Dout #8

Notes

1. Observe proper current limiting with transistor loads.
2. Use high-speed diode or equivalent to limit inductive load kicks.
3. When a digital device is powered via an external power source, it may be necessary to tie the ground of this power source to the controller's voltage supply return (VS_RTN).
4. For register and programming information, refer to the appropriate controller Applications Guide.
5. The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.

Digital output module

DO**M1-20B**

8 sourcing outputs (+5 VDC)

- ▶ Open emitter PNP transistor to the controller's internal +5 VDC supply
- ▶ High current: 375 mA per output / 3 A per module
- ▶ Individual LED status indicator for each output
- ▶ TTL compatible
- ▶ Optically isolated

General specifications

Outputs per module	8
Output type	Sourcing (PNP open collector)
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Status indicator	One LED per input
Module size	1 controller bay

Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	0

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Nominal voltage (VN)	5 VDC
Maximum ON voltage @:	
50 mA	4.5 VDC
375 mA	4.0 VDC
Maximum OFF voltage	Open emitter
Max channel current	375 mA
Max module current	3 ADC
Max controller current	
Model 5100	2 ADC
Model 5200	3 ADC
Max leak current/channel	100 µADC

1. In the OFF state, the outputs are pulled internally low to VS_RTN via a 1 KΩ series resistor with an LED.

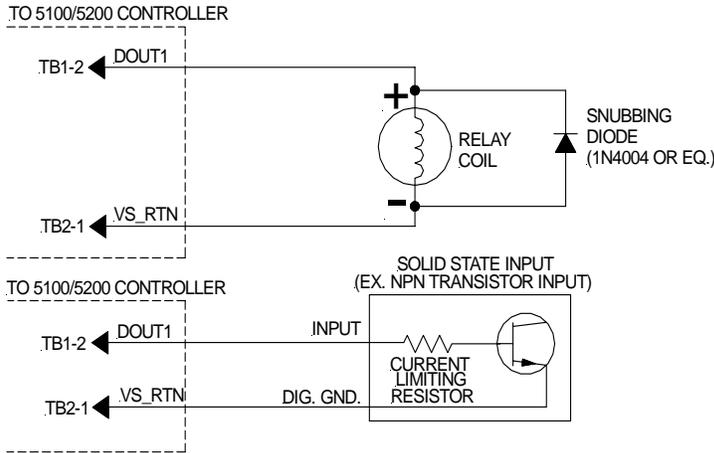
Digital output module

DO

M1-20B

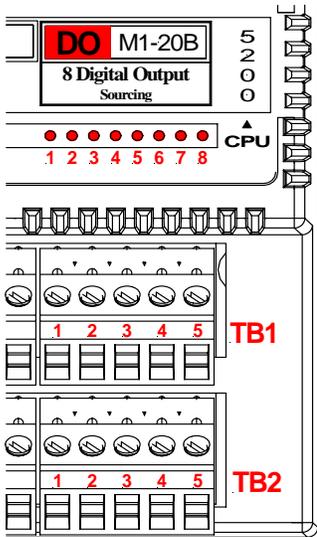
5100/5200

Typical Application



	5100	5200
Minimum hardware revision	B, C, D	B, C, D
Minimum firmware revision	N/A	N/A
Minimum operating system revision	4.04	5.06
Document number: 950-512004-0003		

Connections



I/O Terminations

TB1-1		VS_OUT
TB1-2	LED1	Dout #1
TB1-3	LED3	Dout #3
TB1-4	LED5	Dout #5
TB1-5	LED7	Dout #7
TB2-1		VS_RTN
TB2-2	LED2	Dout #2
TB2-3	LED4	Dout #4
TB2-4	LED6	Dout #6
TB2-5	LED8	Dout #8

Notes

1. Observe proper current limiting with transistor loads.
2. Use high-speed diode or equivalent to limit inductive load kicks.
3. When a digital device is powered via an external power source, it may be necessary to tie the ground of this power source to the controller's voltage supply return (VS_RTN).
4. For register and programming information, refer to the appropriate controller Applications Guide.
5. The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.

Digital output module

DO

M1-22A

8 sinking outputs (+VS VDC)

- ▶ Open collector NPN transistor to the controller's voltage supply return
- ▶ High current: 500 mA per output / 3A per module
- ▶ Individual LED status indicator for each output
- ▶ Optically isolated

Note: This module replaces the older P (for Model 5100) and M1-21A (for Model 5200) modules.

General specifications

Outputs per module	8
Output type	Sinking (NPN open collector)
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Status indicator	One LED per input
Module size	1 controller bay

Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	U

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Nominal voltage (VN)	VS
Max OFF voltage	Open collector
Max ON voltage @:	
50 mA	0.9 VDC
500 mA	1.4 VDC
Max channel current	500 mA
Max module current	3 ADC
Max controller current	
Model 5100	3 ADC
Model 5200	8 ADC
Max leak current/channel	200 µADC

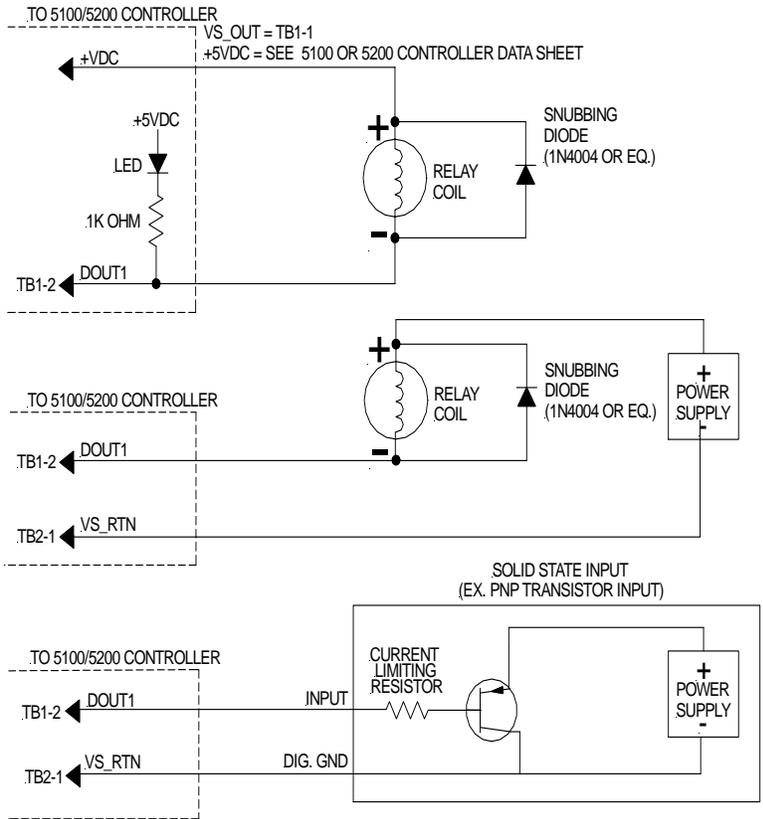
1. In the OFF state, the outputs are pulled internally high to +5 VDC via a 1KΩ series resistor with an LED.

Digital output module

DO

M1-22A

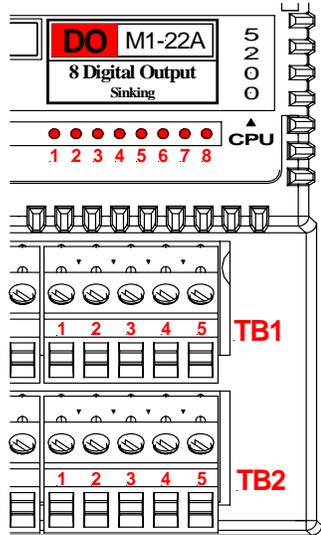
Typical Application



	5100	5200
Minimum hardware revision	0, A	0, A
Minimum firmware revision	N/A	N/A
Minimum operating system revision	4.04	5.06

Document number: 950-512202-0002

Connections



I/O Terminations

TB1-1		VS_OUT
TB1-2	LED1	Dout #1
TB1-3	LED3	Dout #3
TB1-4	LED5	Dout #5
TB1-5	LED7	Dout #7
TB2-1		VS_RTN
TB2-2	LED2	Dout #2
TB2-3	LED4	Dout #4
TB2-4	LED6	Dout #6
TB2-5	LED8	Dout #8

Notes

1. Observe proper current limiting with transistor loads.
2. Use high-speed diode or equivalent to limit inductive load kicks.
3. When a digital device is powered via an external power source, it may be necessary to tie the ground of this power source to the controller's voltage supply return (VS_RTN).
4. For register and programming information, refer to the appropriate controller Applications Guide.
5. The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.

Analog combo I/O module

AI/O

M1-30A

Analog combo 2 in, 2 out (± 10 VDC)

- ▶ 16-bit analog input converter
- ▶ Optically and electrically isolated
 - Each channel has an electrically isolated analog ground
 - Each channel is individually optically isolated
- ▶ Each channel has individually configurable digital filtering

General specifications

Inputs per module	2 (differential ended)
Outputs per module	2 (single ended)
Input type	Voltage, ± 10 VDC
Output type	Voltage, ± 10 VDC
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Module size	1 controller bay

Bus power required (5 VDC)	0.2 mA
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	A

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Input range	-10 V to 10 V
Output range	-10 V to 10 V
Input resolution	16-bit
Output resolution	16-bit
Input resistance	
+Ain to -Ain	$10^{12} \Omega$
+Ain to ACOM	$10^{12} \Omega$
-Ain to ACOM	1.5 M Ω
Max input voltage	± 15 VDC

Parameter	Value
Full range calibration error ^{1,2}	0.013% of range
Offset calibration error at 0 V ^{1,2}	0.013% of range
Linearity error (full range) ^{1,2}	0.037% of range
Digital input filter size (settable)	1 – 255 samples
Digital input filter rate	5 msec
Output slew rate (max)	10 V/ μ sec
Max output current	5 mA
Controller engineering units (channel configurable)	10 VDC = 10,000 or 10 VDC = 10,000,000

1. Errors are at 25°C.
2. Errors are double across full ambient temperature range of 0 – 50°C.

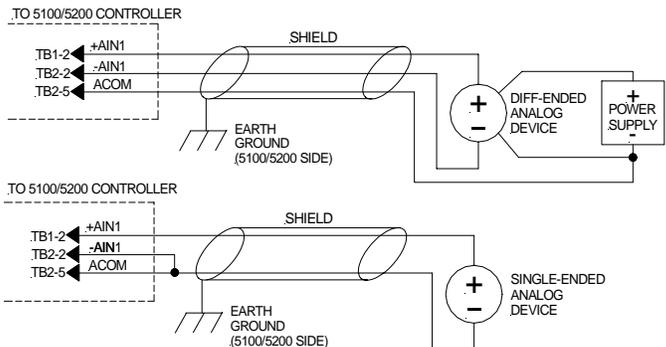
Analog combo I/O module

A/I/O

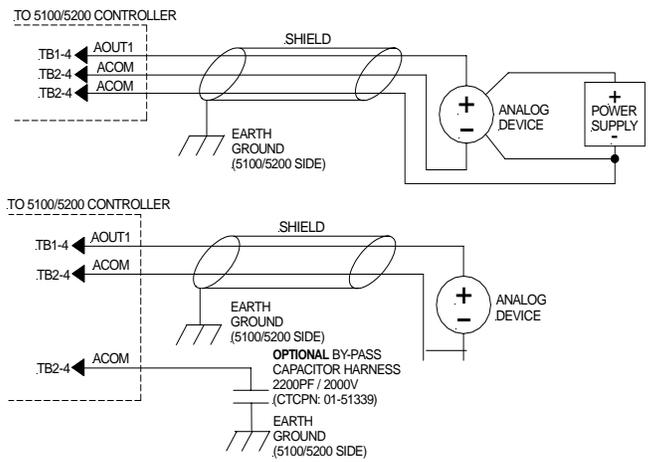
M1-30A

Typical Application

Analog Input Application

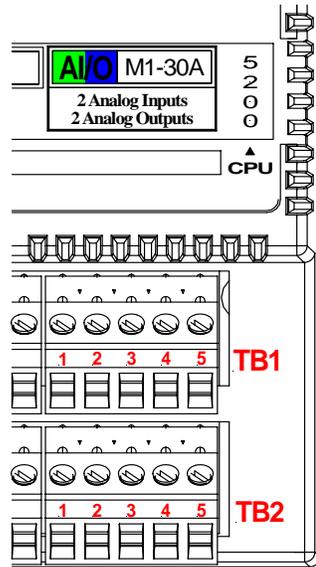


Analog Output Application



	5100	5200
Minimum hardware revision	B, C, D, E	B, C, D, E
Minimum firmware revision	1.07	1.07
Minimum operating system revision	4.04.12	5.06
Document number: 950-513005-0004		

Connections



I/O Terminations

TB1-1	VS_OUT
TB1-2	+Ain #1
TB1-3	+Ain #2
TB1-4	Aout #1
TB1-5	Aout #2
TB2-1	VS_RTN
TB2-2	-Ain #1
TB2-3	-Ain #2
TB2-4	ACOM
TB2-5	ACOM

Notes

- Shield grounds must be terminated on the controller side of the cable.
- When an analog device is powered via an external power source, it may be necessary to tie the ground of this power source to the module's analog common (ACOM) to limit common mode voltages.
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.
- VS refers to the voltage supply of the controller.

Analog combo I/O module

AI/O

M1-30C

Analog combo 2 in (4-20 mADC), 2 out (± 10 VDC)

- ▶ 16-bit input; 12-bit output analog converters
- ▶ Optically and electrically isolated
 - Each channel has an electrically isolated analog ground
 - Each channel is individually optically isolated
- ▶ Each channel has individually configurable digital filtering

General specifications

Inputs per module	2 (single ended)
Outputs per module	2 (single ended)
Input type	Current, 4 – 20 mADC
Output type	Voltage, ± 10 VDC
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Module size	1 controller bay

Bus power required (5 VDC)	0.2 mA
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	R

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

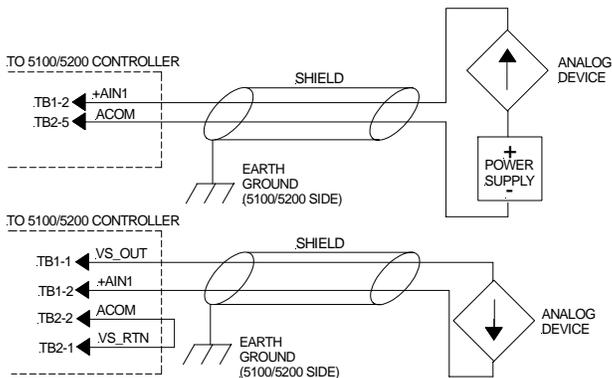
Parameter	Value
Input range	4 – 20 mA
Output range	-10 V to 10 V
Input resolution	16-bit
Output resolution	16-bit
Input resistance	
+Ain to ACOM (4 – 20 mA resistor)	500 Ω
Max input voltage	± 40 VDC

Parameter	Value
Full range calibration error ^{1,2}	0.013% of range
Offset calibration error at 0 V ^{1,2}	0.013% of range
Linearity error (full range) ^{1,2}	0.037% of range
Digital input filter size (settable)	1-255 samples
Digital input filter rate	5 msec
Output slew rate (max)	10 V/ μ sec
Max output current	5 mA
Controller engineering units (channel configurable)	20 mA = 10,000 or 20 mA = 20,000 or 20 mA = 10,000,000

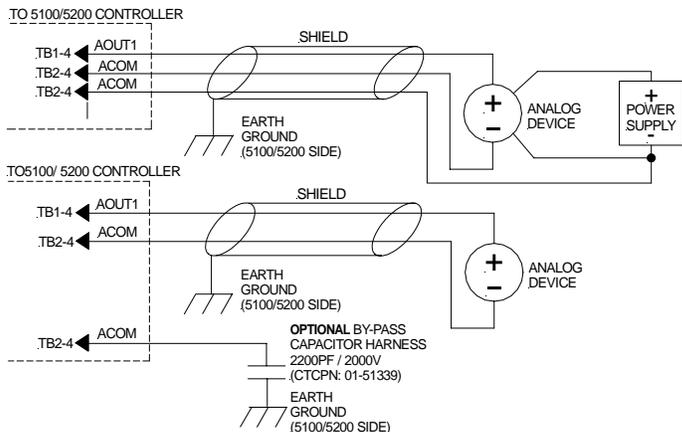
1. Errors are at 25°C.
2. Errors are double across full ambient temperature range of 0 – 50°C.

Typical Application

Analog Input Application



Analog Output Application

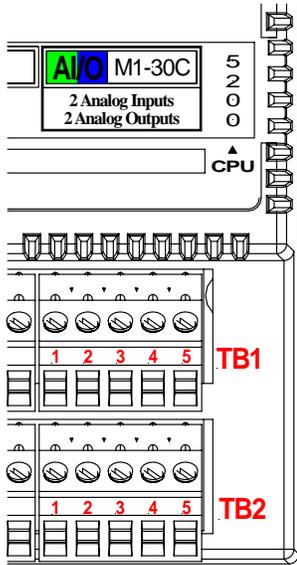


	5100	5200
Minimum hardware revision	E	E
Minimum firmware revision	1.07	1.07
Minimum operating system revision	4.04.12	5.06
Document number: 950-513007-0004		

Notes

- Shield grounds must be terminated on the controller side of the cable.
- When an analog device is powered via an external power source, it may be necessary to tie the ground of this power source to the module's analog common (ACOM) to limit common mode voltages.
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.
- VS refers to the voltage supply of the controller.

Connections



I/O Terminations

TB1-1	VS_OUT
TB1-2	+Ain #1
TB1-3	+Ain #2
TB1-4	Aout #1
TB1-5	Aout #2
TB2-1	VS_RTN
TB2-2	ACOM
TB2-3	ACOM
TB2-4	ACOM
TB2-5	ACOM

Analog input module

AI

M1-31A

4 analog inputs (± 10 VDC)

- ▶ 16-bit analog converter
- ▶ Optically and electrically isolated
 - Each channel has an electrically isolated analog ground
 - Each channel is individually optically isolated
- ▶ Each channel has individually configurable digital filtering

General specifications

Inputs per module	4 (3 differential ended, 1 single-ended)	Bus power required (5 VDC)	0.2 mA
Input type	Voltage, ± 10 VDC	Isolation rating	500 VDC
Connector	Removable	Operating temperature	
Connection type	Screw terminal	Horizontal installation ¹	0 - 50°C
Terminal wire size	14 - 22 AWG	Vertical installation ¹	0 - 45°C
Test point	All connections	Storage temperature	-25 - 85°C
Module size	1 controller bay	Humidity	5 - 95% non-condensing
		5100 equivalent part number	F

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Input range	-10 V to 10 V
Input resolution	16-bit
Input resistance	
+Ain to -Ain	$10^{12} \Omega$
+Ain to ACOM	$10^{12} \Omega$
-Ain to ACOM	1.5 M Ω
Max input voltage	± 40 VDC
Full range calibration error ^{1,2}	0.013% of range
Offset calibration error at 0 V ^{1,2}	0.013% of range
Linearity error (full range) ^{1,2}	0.037% of range
Digital input filter size (settable)	1 - 255 samples
Digital input filter rate	5 msec

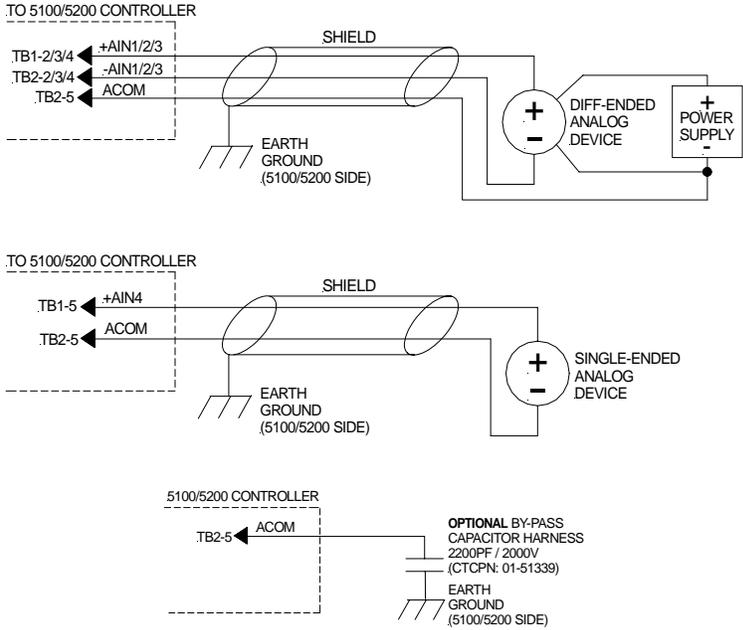
1. Errors are at 25°C.
2. Errors are double across full ambient temperature range of 0 - 50°C.

Analog input module

AI

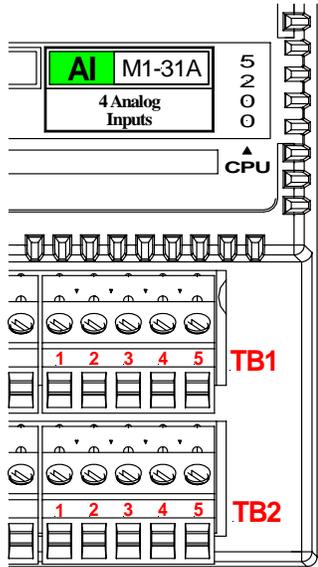
M1-31A

Typical Application



	5100	5200
Minimum hardware revision	A	A
Minimum firmware revision	1.01	1.01
Minimum operating system revision	4.04.12	5.06
Document number: 950-513105-0004		

Connections



I/O Terminations

TB1-1	VS_OUT
TB1-2	+Ain #1
TB1-3	+Ain #2
TB1-4	+Ain #3
TB1-5	+Ain #4 (S.E.)
TB2-1	VS_RTN
TB2-2	-Ain #1
TB2-3	-Ain #2
TB2-4	-Ain #3
TB2-5	ACOM

Notes

- Shield grounds must be terminated on the controller side of the cable.
- When an analog device is powered via an external power source, it may be necessary to tie the ground of this power source to the module's analog common (ACOM) to limit common mode voltages.
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.
- VS refers to the voltage supply of the controller.

Analog input module

AI

M1-31C

4 analog inputs (4-20 mA)

- ▶ 16-bit analog converter
- ▶ Optically and electrically isolated
 - Each channel has an electrically isolated analog ground
 - Each channel is individually optically isolated
- ▶ Each channel has individually configurable digital filtering

General specifications

Inputs per module	4 (single-ended)
Input type	Current, 4 – 20 mA
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Module size	1 controller bay

Bus power required (5 VDC)	0.2 mA
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	H

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Input range	4 – 20 mA DC
Input resolution	16-bit
Input resistance	
+Ain to –Ain	$10^{12} \Omega$
+Ain to ACOM	$10^{12} \Omega$
–Ain to ACOM	1.5 M Ω
Max input voltage	± 32 VDC
Full range calibration error ^{1,2}	0.013% of range
Offset calibration error at 0 V ^{1,2}	0.013% of range
Linearity error (full range) ^{1,2}	0.037% of range
Digital input filter size (settable)	1 – 255 samples
Digital input filter rate	5 msec

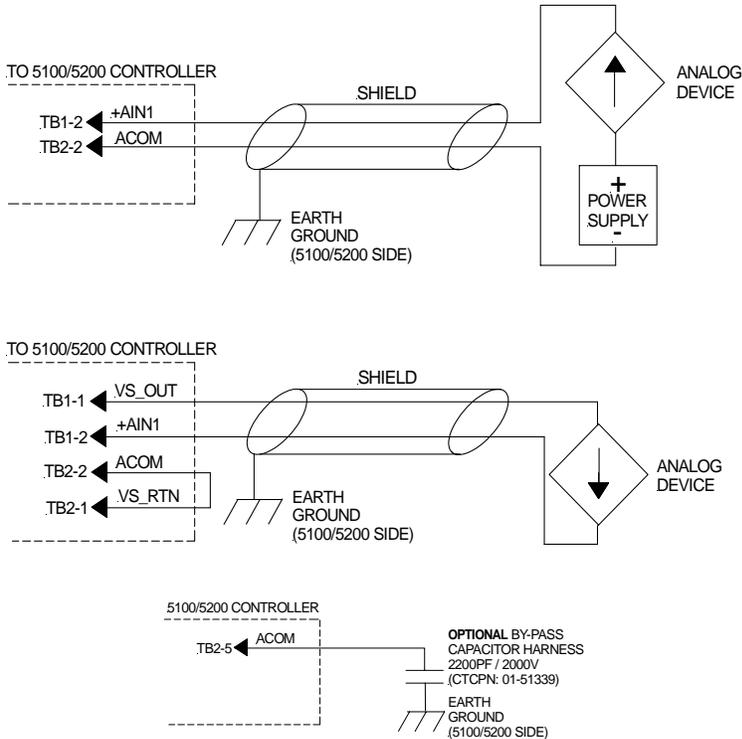
1. Errors are at 25°C.
2. Errors are double across full ambient temperature range of 0 – 50°C.

Analog input module

AI

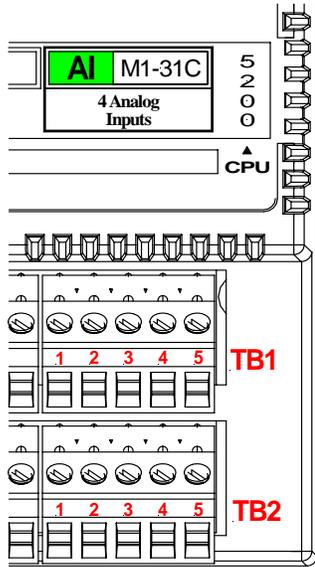
M1-31C

Typical Application



	5100	5200
Minimum hardware revision	A	A
Minimum firmware revision	1.01	1.01
Minimum operating system revision	4.04.12	5.06
Document number: 950-513107-0004		

Connections



I/O Terminations

TB1-1	VS_OUT
TB1-2	+Ain #1
TB1-3	+Ain #2
TB1-4	+Ain #3
TB1-5	+Ain #4
TB2-1	VS_RTN
TB2-2	ACOM
TB2-3	ACOM
TB2-4	ACOM
TB2-5	ACOM

Notes

- Shield grounds must be terminated on the controller side of the cable.
- When an analog device is powered via an external power source, it may be necessary to tie the ground of this power source to the module's analog common (ACOM) to limit common mode voltages.
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.
- VS refers to the voltage supply of the controller.

Analog output module

AO

M1-32A

6 analog outputs (± 10 VDC), fully isolated

- ▶ 16-bit analog converter
- ▶ Optically and electrically isolated
 - Each channel has an electrically isolated analog ground
 - Each channel is individually optically isolated

General specifications

Outputs per module	6
Output type	Voltage, ± 10 VDC (single ended)
Analog ground type	Isolated from digital I/O, CPU power
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Module size	1 controller bay

Bus power required (5 VDC)	.26 mA
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	D

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Output range	-10 V to 10 V
Output resolution	16-bit
Full range calibration error ^{1,2}	0.025% of range
Offset calibration error at 0 V ^{1,2}	0.025% of range
Linearity error (full range) ^{1,2}	0.073% of range
Output slew rate	10V/ μ sec
Max output current	5 mA

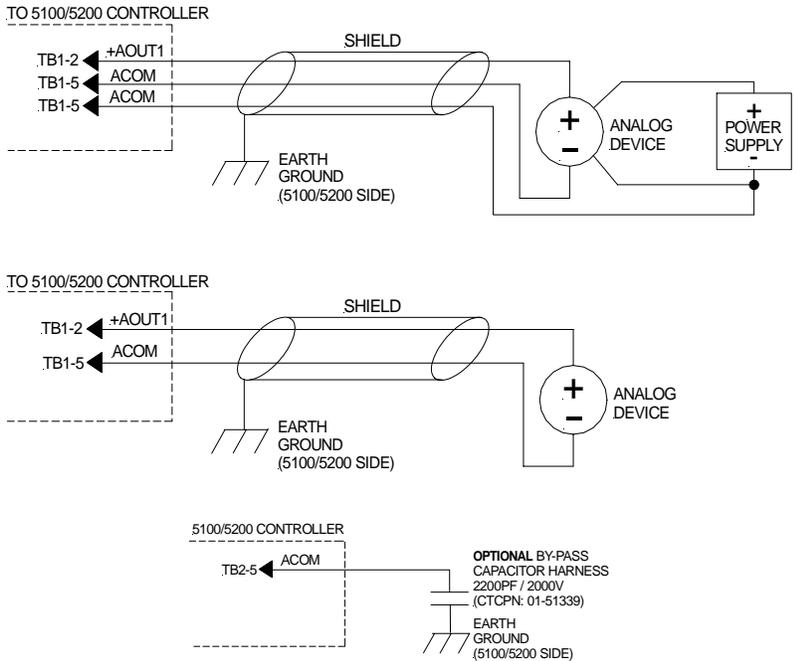
1. Errors are at 25°C.
2. Errors are double across full ambient temperature range of 0 – 50°C.

Analog output module

AO

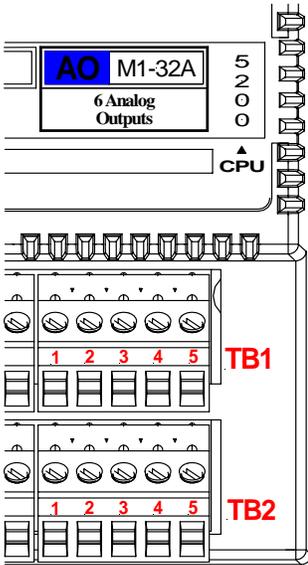
M1-32A

Typical Application



	5100	5200
Minimum hardware revision	A	A
Minimum firmware revision	N/A	N/A
Minimum operating system revision	4.04.15	5.06
Document number: 950-513203-0003		

Connections



I/O Terminations

TB1-1	VS_OUT
TB1-2	+Aout #1
TB1-3	+Aout #3
TB1-4	+Aout #5
TB1-5	ACOM
TB2-1	VS_RTN
TB2-2	+Aout #2
TB2-3	+Aout #4
TB2-4	+Aout #6
TB2-5	ACOM

Notes

- Shield grounds must be terminated on the controller side of the cable.
- When an analog device is powered via an external power source, it may be necessary to tie the ground of this power source to the module's analog common (ACOM) to limit common mode voltages.
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.
- VS refers to the voltage supply of the controller.

Analog output module

AO

M1-32B

8 analog outputs (± 10 VDC)

- ▶ 16-bit analog converter
- ▶ Each channel individually optically isolated

General specifications

Outputs per module	8
Output type	Voltage, ± 10 VDC (single ended)
Analog ground type	Isolated from CPU electronics
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Module size	1 controller bay

Bus power required (5 VDC)	.26 mA
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	E

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Output range	-10 V to 10 V
Output resolution	16-bit
Full range calibration error ^{1,2}	0.025% of range
Offset calibration error at 0 V ^{1,2}	0.025% of range
Linearity error (full range) ^{1,2}	0.073% of range
Output slew rate	10V/ μ sec
Max output current	5 mA

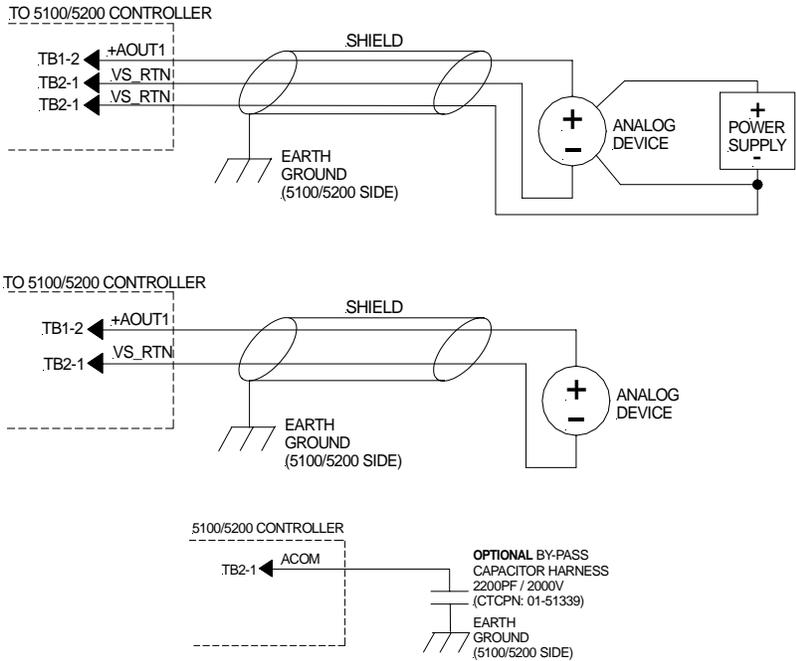
1. Errors are at 25°C.
2. Errors are double across full ambient temperature range of 0 – 50°C.

Analog output module

AO

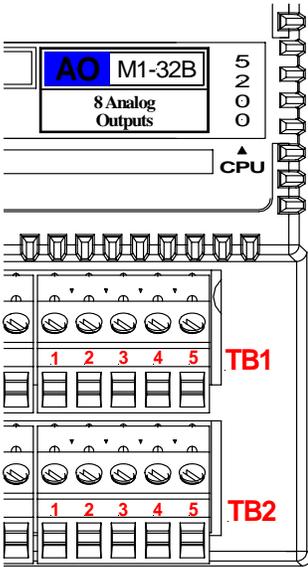
M1-32B

Typical Application



	5100	5200
Minimum hardware revision	A	A
Minimum firmware revision	1.02	1.02
Minimum operating system revision	4.04.15	5.06
Document number: 950-513204-0005		

Connections



I/O Terminations

TB1-1	VS_OUT
TB1-2	+Aout #1
TB1-3	+Aout #3
TB1-4	+Aout #5
TB1-5	+Aout #7
TB2-1	VS_RTN / ACOM
TB2-2	+Aout #2
TB2-3	+Aout #4
TB2-4	+Aout #6
TB2-5	+Aout #8

Notes

- Shield grounds must be terminated on the controller side of the cable.
- When an analog device is powered via an external power source, it may be necessary to tie the ground of this power source to the module's analog common (ACOM) to limit common mode voltages.
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.
- VS refers to the voltage supply of the controller.

Analog input module

AI

M1-33B

2 analog inputs (± 20 mVDC)

- ▶ 16-bit analog converters
- ▶ Optically and electrically isolated
 - Each channel has an electrically isolated analog ground
 - Each channel is individually optically isolated
- ▶ Each channel has individually configurable digital filtering

General specifications

Inputs per module	2 (differential ended)
Input type	Voltage, ± 20 mVDC
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Module size	1 controller bay

Bus power required (5 VDC)	0.2 mA
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	V

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Input range	-20 mV to 20 mV
Input resolution	16-bit
Input resistance	
+Ain to -Ain	$10^{12} \Omega$
+Ain to ACOM	$10^{12} \Omega$
-Ain to ACOM	1.5 M Ω
Max input voltage	± 32 VDC

Parameter	Value
Full range calibration error ^{1,2}	0.013% of range
Offset calibration error at 0 V ^{1,2}	0.013% of range
Linearity error (full range) ^{1,2}	0.037% of range
Digital input filter size (settable)	1-255 samples
Digital input filter rate	5 msec
Output slew rate (max)	10 V/ μ sec
Controller engineering units (channel configurable)	20 mVDC = 10,000 or 20 mVDC = 20,000 or 20 mVDC = 10,000,000

1. Errors are at 25°C.
2. Errors are double across full ambient temperature range of 0 – 50°C.

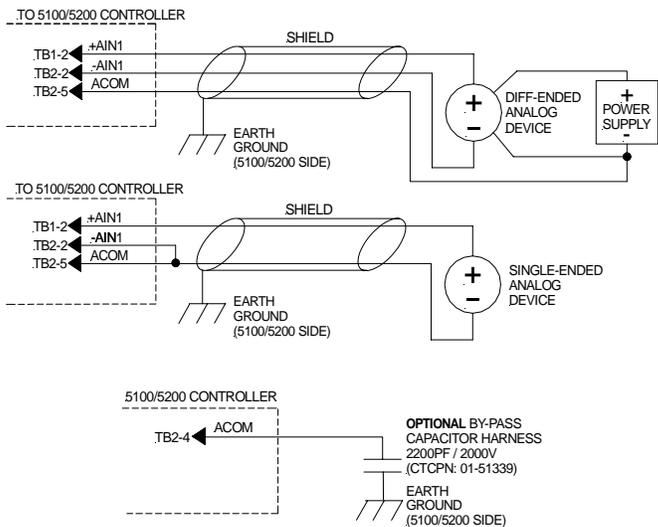
Analog input module

AI

M1-33B

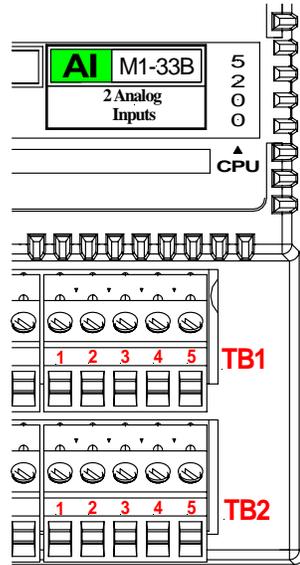
Typical Application

Analog Input Application



	5100	5200
Minimum hardware revision	E	E
Minimum firmware revision	1.07	1.07
Minimum operating system revision	4.04.12	5.06
Document number: 950-513306-0001		

Connections



I/O Terminations

TB1-1	VS_OUT
TB1-2	+Ain #1
TB1-3	+Ain #2
TB1-4	N/C
TB1-5	N/C
TB2-1	VS_RTN
TB2-2	-Ain #1
TB2-3	-Ain #2
TB2-4	ACOM
TB2-5	ACOM

Notes

- Shield grounds must be terminated on the controller side of the cable.
- When an analog device is powered via an external power source, it may be necessary to tie the ground of this power source to the module's analog common (ACOM) to limit common mode voltages.
- For register and programming information, refer to the appropriate controller Applications Guide.
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- VS refers to the voltage supply of the controller.

Analog input module

AI

M1-33D

2 thermocouple inputs / ± 100 mVDC

- ▶ Two 16-bit ± 100 mVDC analog inputs
- ▶ Optically and electrically isolated
 - Each channel has an electrically isolated analog ground
 - Each channel is individually optically isolated
- ▶ Two differential-ended inputs for use with both grounded or ungrounded tip thermocouples
- ▶ Thermocouple linearization algorithms: E, K, J, R, S, T
- ▶ Each channel has individually configurable digital filtering

General specifications

Inputs per module	2 differential-ended
Input type	Thermocouple (E, K, J, R, S, T) / ± 100 mVDC
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Module size	1 controller bay

Bus power required (5 VDC)	0.26 mA
Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	I

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Input range	Thermocouple (E, K, J, R, S, T) / ± 100 mVDC
Input resolution	16-bit
Input resistance	
+ <i>Ain</i> to – <i>Ain</i>	$10^{12} \Omega$
+ <i>Ain</i> to ACOM	$10^{12} \Omega$
– <i>Ain</i> to ACOM	$1.5 \text{ M}\Omega$
Max input voltage	± 40 VDC
Full range calibration error ^{1,2}	0.013% $\pm 1^\circ\text{C}$
Offset calibration error at 0 V ^{1,2}	0.013% $\pm 1^\circ\text{C}$

Parameter	Value
Linearity error (full range) ^{1,2}	0.037% $\pm 2^\circ\text{C}$
Digital input filter size (settable)	1 – 255 samples
Digital input filter rate	5 msec

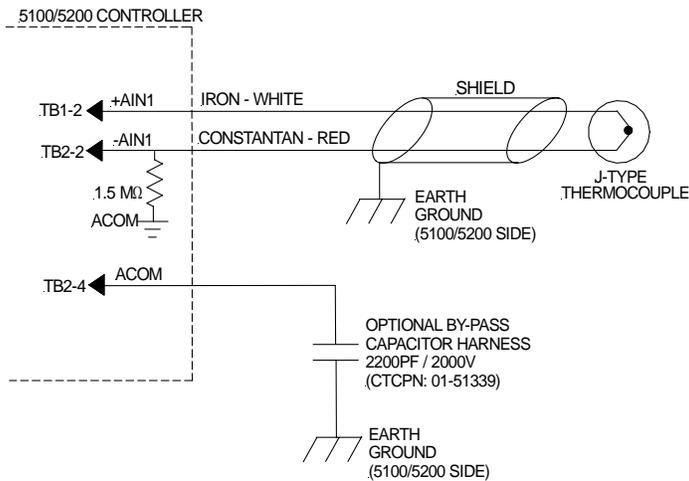
1. Errors are at 25°C.
2. Errors are double across full ambient temperature range of 0 – 50°C.

Analog input module

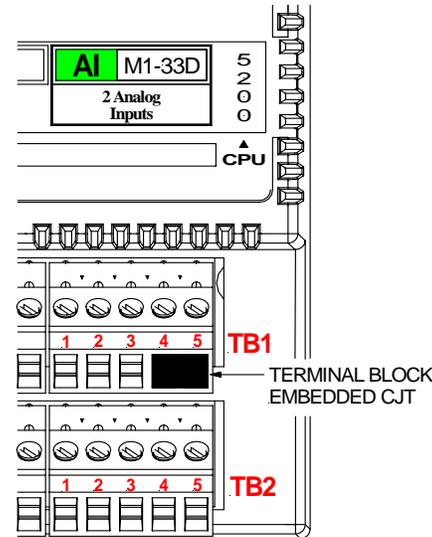
AI

M1-33D

Typical Application



Connections



Thermocouple Specifications

TYPE	+ AIN		- AIN		RANGE (°C)	
E	WHITE	CHROMEL	RED	CONSTANTAN	-250	980
J	WHITE	IRON	RED	CONSTANTAN	-190	1180
K	YELLOW	CHROMEL	RED	ALUMEL	-200	1360
R	BLACK	PLATINUM RHODIUM ^(13%)	RED	PLATINUM	-40	1740
S	BLACK	PLATINUM RHODIUM ^(10%)	RED	PLATINUM	-40	1750
T	BLUE	COPPER	RED	CONSTANTAN	-180	390

I/O Terminations

TB1-1	VS_OUT
TB1-2	+Ain #1
TB1-3	+Ain #2
TB1-4	Internal CJT device
TB1-5	Internal CJT device
TB2-1	VS_RTN
TB2-2	-Ain #1
TB2-3	-Ain #2
TB2-4	ACOM
TB2-5	N/C

	5100	5200
Minimum hardware revision	A	A
Minimum firmware revision	1.01	1.01
Minimum operating system revision	4.04.12	5.06
Document number: 950-513308-0003		

Notes

- Shield grounds must be terminated on the controller side of the cable.
- For register and programming information, refer to the appropriate controller Applications Guide.
- The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.
- For other thermocouple types, please contact Control Technology Corp.
- VS refers to the voltage supply of the controller. CJT refers to cold junction thermistor.

Dual axis servo module

SERVO

M1-40A

2 axes servo controller with high speed registration

- ▶ High-speed, 32-bit motion processor
- ▶ Optically and electrically isolated
 - Each channel has an electrically isolated analog ground
 - Each channel is individually optically isolated
- ▶ Precision 16-bit command signal
- ▶ Updates both position loops in 500 μ sec
- ▶ < 1 μ sec registration response

General specifications

Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Module size	2 controller bays

Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	SS

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Parameter	Value
Position range	$\pm 2,147,483,647$ counts
Velocity range	± 6 M counts/sec
Position resolution	± 1 count
Velocity resolution	± 1 count/sec
Max acceleration	130 M counts/sec ²
Position loop update	500 μ sec/2 axes
Command type	Analog torque or velocity
Command signal voltage	Bipolar single-ended ± 10 V (5mA max)
Command resolution	16-bit
Encoder feedback type	5 V - differential quadrature
Max input voltage	6 VDC

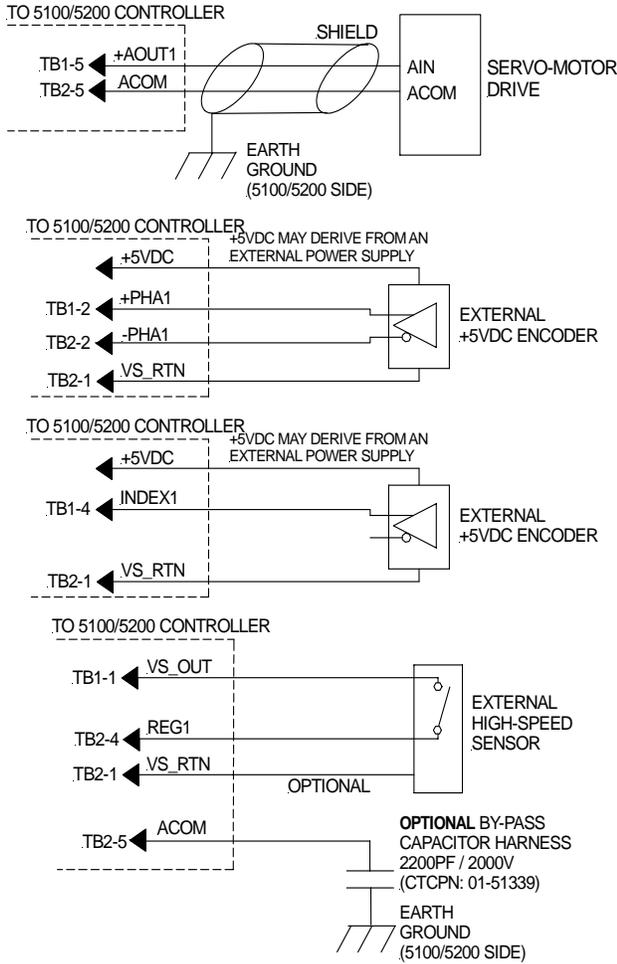
Parameter	Value
Encoder Turn ON threshold	3.0 VDC
Encoder Turn OFF threshold	0.125 VDC
Encoder termination resistor	220 Ω (10%)
Encoder index signal	5 VDC single-ended
Registration input type	VDC sourcing
Registration response	<1 μ sec
Registration Turn ON threshold	0.53* VS
Registration Turn OFF threshold	0.32* VS
Max registration voltage	VS
Max ON registration current	2.6 mA DC
Registration input resistance to VS_RTN	10 K Ω (10%)

Dual axis servo module

SERVO

M1-40A

Typical Applications

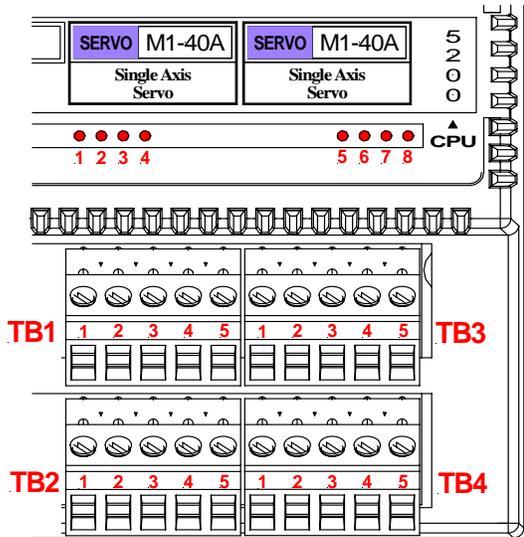


	5100	5200
Minimum hardware revision	A, B	A, B
Minimum firmware revision	4.18	4.18
Minimum operating system revision	4.04	5.06
Document number: 950-514002-0003		

Notes

1. Shields must be terminated on the controller side of the cable.
2. External power supply commons must be tied to the controller's supply voltage return (VS_RTN) and / or analog common (ACOM).
3. For register and programming information, refer to the M1-40A Applications Guide.
4. The information and illustrations contained herein are the property of Control Technology Corporation and are subject to change without notice. Data based on VS = 24VDC @ 25°C unless otherwise noted. For additional information and/or updates visit www.ctc-control.com.
5. VS refers to the voltage supply of the controller.

Connections



I/O Terminations

Axis 1		Axis 2	
TB1-1	VS_OUT	TB3-1	VS_OUT
TB1-2	LED1 +PHA1	TB3-2	LED5 +PHA2
TB1-3	LED2 +PHB1	TB3-3	LED6 +PHB2
TB1-4	LED3 INDEX1	TB3-4	LED7 INDEX2
TB1-5	+AOUT1	TB3-5	+AOUT2
TB2-1	VS_RTN	TB4-1	VS_RTN
TB2-2	-PHA1	TB4-2	-PHA2
TB2-3	-PHB1	TB4-3	-PHB2
TB2-4	LED4 REG1	TB4-4	LED8 REG2
TB2-5	ACOM	TB4-5	ACOM

Dual axis stepper module

STEPPER

M1-50A

2 axes microstepping controller

- ▶ High-speed 32-bit motion processor
- ▶ Step rates up to 1 million steps/sec
- ▶ Eight general purpose inputs

General specifications

Number of axes	2
Number of inputs	8
Connector	Removable
Connection type	Screw terminal
Terminal wire size	14 – 22 AWG
Test point	All connections
Status indicator	Step, dir, inputs
Module size	2 controller bays

Isolation rating	500 VDC
Operating temperature	
Horizontal installation ¹	0 – 50°C
Vertical installation ¹	0 – 45°C
Storage temperature	-25 – 85°C
Humidity	5 – 95% non-condensing
5100 equivalent part number	TT

1. Refer to the applicable controller datasheet for proper mounting instructions.

Performance specifications

Motion

Parameter	Value
Position range	±2,147,483,647 steps
Position resolution	±1 step
Velocity range	±1M steps/sec
Velocity resolution	±1 step/sec
Max acceleration	130 M steps/sec ²
Position loop update	500 µsec/2 axes
Command type	Step/directions
Command signal voltage ¹	
Open circuit (0 mA)	±5 V differential
Full load (±20 mA)	±200 mV
Leakage current	100 µA

1. RS-485 compliant.

Inputs

Parameter	Value
Minimal voltage (VN)	24 VDC
Turn ON threshold	0.73 * VS
Turn OFF threshold	0.61 * VS
Maximum current	1.2 mADC @ 24 VDC
Input resistance	20 KΩ ±10%
Hardware filter	1 mSec

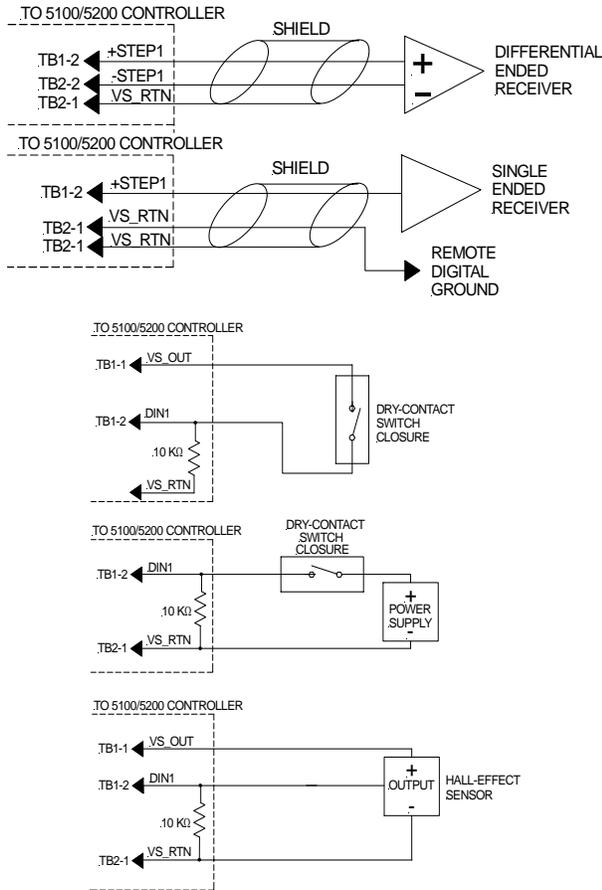
Dual axis stepper module

STEPPER

M1-50A

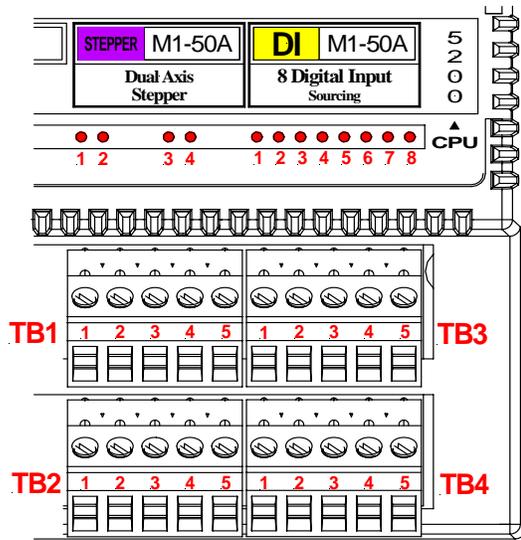
5100/5200

Typical Application



	5100	5200
Minimum hardware revision	B, C	B, C
Minimum firmware revision	4.18	4.18
Minimum operating system revision	4.04	5.06
Document number: 950-515002-0003		

Connections



I/O Terminations

TB1-1		VS_OUT	TB3-1		VS_OUT
TB1-2	LED1	+STEP1	TB3-2	LED1	Din #1
TB1-3	LED2	+DIR1	TB3-3	LED3	Din #3
TB1-4	LED3	+STEP2	TB3-4	LED5	Din #5
TB1-5	LED4	+DIR2	TB3-5	LED7	Din #7
TB2-1		VS_RTIN	TB4-1		VS_RTIN
TB2-2		-STEP1	TB4-2	LED2	Din #2
TB2-3		-DIR1	TB4-3	LED4	Din #4
TB2-4		-STEP2	TB4-4	LED6	Din #6
TB2-5		-DIR2	TB4-5	LED8	Din #8

Notes

- This is a double wide module, where TB1 and TB2 handle the stepper motion connections. TB3 and TB4 provide general purpose inputs.
- If an output is used to drive transistor loads, proper current limiting must be observed.
- When a digital device is powered via an external power source, it may be necessary to tie the ground of this power source to the controller's voltage supply return (VS_RTIN)
- For register and programming information, refer to the appropriate controller Applications Guide.
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- VS refers to the voltage supply of the controller.

Glossary

This glossary includes selected terms that are used in this catalog. Definitions apply to this catalog only.

ACOM – analog common, also known as analog ground

Bus power – +5 VDC power that is needed to power a given module

Calibration error:

Full range – the error between the measured input/output voltage and a true +10.000000 VDC.

Offset – the error between the measured input/output voltage and a true 0.000000 VDC

CJT – cold junction thermistor; the device that measures the internal temperature of a thermocouple's terminal block. After a minimum of 1 hour of continuous operation, this temperature is typically 5-10°C above the ambient temperature.

Digital input filter rate – the rate at which the analog input channels are sampled

Digital input filter size – the number of samples used in an input's average calculation

Hardware filter – digital filtering due to passive RC networks

Isolation rating – isolation voltage between the I/O signal and other sensitive controller circuitry

Linearity error (full range) – the maximum error in the measured input/output signal across the entire input/output range

Maximum channel current – the maximum current that any given I/O channel can sink or source

Maximum controller current – the maximum current that all the I/O on a single controller can sink or source at a given time

Maximum input current – the maximum current that any given input channel can sink or source

Maximum leakage current – the maximum OFF state leakage current

Maximum module current – the maximum current that all the outputs on a module can sink or source at a given time

Maximum OFF voltage – the maximum output voltage, at a given load, with the output in the OFF state

Maximum output current – the maximum current that a given output channel can sink or source

Minimum hysteresis voltage – the minimum input voltage between the ON and OFF states

Minimum ON voltage – the minimum output voltage, at a given load, with the output in the ON state

Output slew rate – the maximum slope of an output signal change (volts/second)

Registration – response time it takes to latch encoder position after registration ON threshold

Ta – ambient temperature; the steady-state temperature within 1" of any given side of the controller

TB – terminal block. Example: TB1-4 refers to terminal block 1, point 4

Turn OFF threshold – the maximum threshold voltage at which an input will change from an ON state to an OFF state

Turn ON threshold – the minimum threshold voltage at which an input will change from an OFF state to an ON state

VN – nominal voltage; normal operating voltage

VS – voltage supplied to the controller from an external DC power supply (connected to TB1-1)

VS_OUT – VS minus internal diode drops. Can be used to power external circuits.

VS_RTN – voltage supply return; voltage supply ground

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