CONTROL TECHNOLOGY CORPORATION

Model 5200 Application Reference Guide

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WARNING: Use of CTC Controllers and software is to be done only by experienced and qualified personnel who are responsible for the application and use of control equipment like the CTC controllers. These individuals must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and/or standards. The information in this document is given as a general guide and all examples are for illustrative purposes only and are not intended for use in the actual application of CTC product. CTC products are not designed, sold, or marketed for use in any particular application or installation; this responsibility resides solely with the user. CTC does not assume any responsibility or liability, intellectual or otherwise for the use of CTC products.

The information in this document is current as of the following Hardware and Firmware revision levels. Some features may not be supported in earlier revisions. See www.ctc-control.com for the availability of firmware updates or contact CTC Technical Support.

Model Number	Hardware Revision	Firmware Revision
5200	All Revisions	> 5.31

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CHAPTER

1

Introduction

Congratulations on your purchase of Control Technology Corporation's (CTC) Blue Fusion Model 5200 controller. Due to its multiprocessor architecture and extensive firmware and software features, the 5200 is among the most powerful programmable automation controllers available. To help you take full advantage of the many features built into the 5200 CTC has prepared this Application Reference Guide. This guide is a compilation of documents that covers the many firmware and software features of CTC's Model 5200 controllers. It is meant as a supplement to the main programming guides, *Quickstep™ User Guide* (Doc. No. MAN-1000-A) and *Quickstep Language and Programming Guide* (Doc. No. MAN-1010-A), which cover the basic techniques and features used when programming Control Technology Controllers. Details on hardware and connection information can be found in the *Model 5200 Controller Hardware Reference Guide (Doc. No. 950-520002)* and the Installation Guides for specific 5200 modules. Check for these documents as well as updated versions of the material in this guide in the documentation section of CTC's website: www.ctc-control.com.

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CHAPTER 2

Feature Summary

With the release of the 5200 firmware revision 5.01 and above, a number of significant features are available within the controller. These features have greatly expanded the capabilities of CTC controllers and added greater programming flexibility and system administration facilities. Additionally many existing capabilities have been improved or extended. A summary of the major new features is given below:

- **Flash Disk**

  The 5200 controllers have built-in non-volatile flash disk storage systems. The flash disk is analogous to a hard disk on a PC, however it is more suitable to industrial environments since it has no moving parts. Some of the capabilities offered by the 5200 flash disk are:

  - PC like file structure.
  - Support for multiple flash disks, up to 56M FLASH, 10M NV-RAM.
  - Virtual directory remapping, allows pseudo-names to be assigned to other directories and disks and mapped as sub-directories on another drive.
  - Automatic mounting of multiple drives for access, UNIX like mount/umount commands.
  - Ability to re-assign root directory to any drive.
  - Support for both FLASH and NV-RAM drives.
  - Structured support and storage for firmware flash updates.
  - Quickstep program storage and dynamic loading.
  - Large Recipe storage area.
  - Data Logging to NV-RAM drives.
  - Accessibility via Quickstep, FTP and/or Telnet
  - Standard disk drive utilities
  - Thermocouple table storage allowing for field updates of newly supported thermocouple devices.

- **Remote diagnostics and updates**

  New features have been added for better support of deployed controllers. These features are available for CTC support personnel as well as direct use by customers.

  - Full graphical administrative screens via WebMON 2.0 (951-520012) based on java applet technology.
  - Remote firmware updates via FTP and Telnet. All controller and module firmware is field upgradeable.
  - Firmware files support version naming conventions.
  - Module firmware can be stored to flash disk for later updates or to allow switching between different firmware levels.
  - Can remotely obtain 5200 module information via Telnet, e.g., version control.
  - Low level logging and debug functions for CTC remote field support.
  - User definable 'admin' password system for increased security

- **Communications**

  One of the most powerful features of CTC's Blue Fusion controllers has always been its web-enabled features and its ability to communicate with other devices and computers. These features have been significantly expanded in 5.01 and above:

  Serial Ports
  - 5200 supports up to 7 serial ports, 2 local and 5 virtual TCP to terminal servers or host applications.
  - The (2) local Serial ports support: CTNet Binary protocol, CTC ASCII Protocol, raw mode, and Modbus RTU/ASCII Master and Slave protocols.
  - COM1 and COM2 baud-rate (115KB max), stop bits, data bits, and parity are all configurable and restored to their defined settings at power-up.
  - COM2 may be optionally assembled for RS-485.

  Modbus
  - Modbus is fully supported over both the serial and Ethernet ports
  - ASCII or RTU mode selectable on both COM1 and COM2 ports
  - Serial Master or Slave support .
  - Ethernet Modbus/TCP RTU Master and Slave support.
  - Each port can have its own unique Modbus station number.
  - Supports up to 65,000 addresses.
  - Chained register write / single read commands via the ASCII Serial Protocol.

  Ethernet
  - Built-in Web Server, HTTP, partial 1.1 implementation.
  - Telnet Server for remote administration interface.
  - FTP Client and Server.

- UDP Peer to Peer.
- UDP 'C' Programmable User custom protocols.
- TCP client/server raw socket interface, bidirectional.
- DHCP support for automatic IP network address assignment.
- DNS name registration via DHCP supports addressing controllers by name (e.g. 'Widget Machine Controller' instead of '195.34.143.205').
- SNTP Time Server synchronization for real time clock.
- CTNet Binary protocol.

Other Features

- Configurable communication connection throttling to enhance overall system performance.
- String formatted output messages with embedded register values from within Quickstep (printf format).

Expansion

The 5200 is field expandable with up to (3) additional chassis when purchased with the bus expansion connector.

- Optional module expansion units (max 3), 6 modules per assembly for a total of 24 modules under control of a single 5200, direct bus interface.
- Optional memory expansion boards, up to (2) supported with a mix of FLASH and NV-RAM devices.

Quickstep Programming Enhancements

Quickstep on the 5200 has several new control and debugging features. Many of these have been implemented as new registers. See the updated 5200 Quick Reference Register guide for details.

- Network load balancing registers
- Fault task handler, which allows trapping of problems and branching to a specific Quickstep instruction when soft faults occur.
- Script language integration
- "C" Language and Quickstep integration (see "C" User Programming)
- Motion Registration support.

Script language

The script language supported on the 5200 controllers is a powerful macro level programming language. The script language provides higher level administrative capabilities to the controller, allowing automation of tasks that were previously not possible, or only possible via manual intervention. Some key features are highlighted below:

- Select, Load, and Run a new Quickstep program from the flash disk
- Powerful commands to initialize registers or programs, or configure the system.

- Save and Restore sets of registers to the flash disk.
- Update / change firmware .
- Flash Disk commands.
- Optionally executes as separate thread, sleeping and waking as required.

There are several ways that a script can be used:

- Executable from within a Quickstep program
- Executable from a Telnet or FTP command line
- Executable at 5200 power up or reset for initialization
- Executable from within other script files

▪ Multi-Tasking 'C' User Programming

To better address advanced applications support for multi-tasking, 'C' program support is available. There is a new dedicated 2 MB memory space that has been set up for 'C' programs. The 'C' program has full access to all of the resources (I/O and registers) in the controller and it can run independently and concurrently with Quickstep programs. Advanced users can now elect to use a combination of Quickstep and 'C' in the controller. The 'C' content can be as little as a simple conversion function, or at the other end of the spectrum the entire application can be written in the 'C' language. Some key features are highlighted below:

- Loadable, compiled 'C' program modules to enhance features.
- Create custom communication protocols, including serial port and UDP networking.
- Virtual function hooks for
  - Communications protocols
  - User background threads
  - Full register and 5200 resource interface
  - Quickstep tasking control
- Complex string and algorithm functions
- Run 'C' functions as Quickstep tasks
- Installable register/resource data filters/conversion for Quickstep access
- Ideal for automatic user unit conversions
- Full floating point support.
- Runs completely in parallel and transparent to Quickstep, thereby enhancing its capabilities.

CHAPTER

3

Documentation

For simplification this Guide is a collection of several related documents. A description of these documents is given below. This approach provides easy access to the appropriate information and makes updates easier to maintain (be sure to check www.ctc-control.com often to be sure you have the latest updates). It is recommended that you review each of the documents in detail prior to beginning a programming task on the 5200 to achieve a full understanding of its potential and flexibility.

5100/5200 Quick Reference Register Guide

The 5100/5200 Quick Reference Register Guide provides a fast way to determine the functionality of most registers used by the 5100 and 5200 controllers. All known registers that can be used by an application program are included. For further detailed programming information refer to the appropriate programming guide, below. *(Document # 951-520006).*

WebMON 2.0 User's Guide

The WebMON 2.0 User's Guide introduces the complete graphical environment within which administrative and diagnostic functions can be conducted on a 5200 controller. WebMON is a java applet which resides on the flash disk and is invoked via HTTP, allowing a browser based interface. . *(Document # 951-520012).*

Model 5200 Remote Administration Guide

The Remote Administration Guide reviews the use of FTP and Telnet while interacting with the 5200, in addition to a resident flash disk. FTP can be used to transfer files, update firmware revisions, and provide administrative functions. Telnet provides full remote administration allowing an administrator to access registers within the controller, check firmware revisions, perform advanced diagnostics, check error logs, and execute any of the Script Language commands from a command line interface. *(Document # 951-520001).*

Model 5200 Communications Guide

The Communications Guide reviews many of the extensive features available within the 5200 and how to enable and interact with them from a programming perspective. Some of these features include raw TCP sockets, Virtual IO, Modbus TCP and ASCII/RTU Serial Master/Slave, peer to peer interaction, SNTP, SMTP, POP3 email, configuring DHCP, serial ports, IP addresses, and Fault Task Handlers. *(Document # 951-520002).*

Model 5200 Script Language Guide

The Script Language Guide reviews an administrative command language that is available for execution by a batch resident on the flash disk and/or the Telnet command line. This command language allows you to store register contents to a file to be loaded back later, view administrative settings and modify them, modify registers, perform low level diagnostics, load and run different programs, including those of both Quickstep and 'C', among many other features. (Document # 951-520003).

Model 5200 Analog Modules Application Guide

The Analog Modules Application Guide provides information on how to access the numerous module features from within a Quickstep program and/or through register access. Details of available modules, both analog input and output, along with the use of supported thermocouples, are included. *(Document # 951-520007).*

Model 5200 Motion Modules Applications Guide

The Motion Modules Applications Guide reviews how to write Quickstep programs for 5200 series controllers containing Model SS, Dual Servo Motor Controllers, and/or Model TT, Dual Stepper Motor Controllers. *(Document # 951-520011).*

Model 5200 'C' Users Programming Guide

The 'C' Users Programming Guide reviews the low level API available to a 'C' programmer to run tasks programmed in 'C' parallel to Quickstep tasks. 'C' programs can interact with Quickstep or run independently. Features such as data filters, automatic data conversion, PID loops, among many others may be implemented. Instructions on installing the MicroCross GNU 'C' compiler are also included. *(Document # 951-520004).*

Model 5200 Logging and FTP Client Applications Guide

The Logging and FTP Client Applications Guide provides information on how to implement Data Logging to an NV-RAM disk drive as well as initiate FTP Client sessions with a remote host to transfer that data. Advanced Script commands to implement data logging, alarm functions, and conditional branch operations are also introduced. *(Document # 951-520015).*

CHAPTER

4

Related Documentation

(Not included in this document).

Model 5200 Controller Hardware Reference Guide

This document includes detailed data sheets covering all of the hardware characteristics as well as suggested interface circuitry and wiring configurations for the 5200 controllers and modules. (Document #950-520002)

Quickstep™ User Guide

Introduction to CTC's Quickstep logic control programming environment. Quickstep is an easy to use state-based language that simplifies application design. (Document # MAN-1000-A)

Quickstep Language and Programming Guide

Detailed programmer's reference guide for Quickstep. This document covers the Quickstep functions, syntax and usage. (Document # MAN-1010-A)