



# S200 Position Node User's Guide

*Installation Manual*

M-SS-S2B-11

Revision D April 13, 2012

Keep all product manuals as a product component during the life span of the servo amplifier.

***Pass all product manuals to future users/owners of the servo amplifier.***

**KOLLMORGEN**®

*Because Motion Matters™*



## Record of Revisions

Date	Issue	Description
9/28/07	A	Broke apart Installation and Users – Rewrite
10/23/07	B	Grammar Issues and minor additions
03/10/11	C	Correct error code, correct Modbus address, add motion task example
04/13/12	D	Updated Branding, removed no encoder output

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## Safety Symbols



WARNING

**Warnings alert users to potential physical danger or harm. Failure to follow warning notices could result in personal injury or death.**



CAUTION

**Cautions direct attention to general precautions which, if not followed, could result in personal injury and/or equipment damage.**



NOTE

**Notes highlight information critical to your understanding or use of the product.**

## Safety



WARNING

**READ these instructions before connecting power. Damage can result from MISWIRING at the power terminals.**

**DANGEROUS voltages are present on power input and motor output terminals.**

Only qualified personnel are permitted to transport, assemble, commission, and maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, commissioning and operation of motors, and who have the appropriate qualifications for their jobs.

Read all available documentation before assembling and using. Incorrect handling of products described in this manual can result in injury and damage to people and/or machinery. Strictly adhere to the technical information regarding installation requirements.

- Keep all covers and cabinet doors shut during operation.
- Be aware that during operation, the product has electrically charged components and hot surfaces. Control and power cables can carry a high voltage, even when the motor is not rotating.
- Never disconnect or connect the product while the power source is energized.
- After removing the power source from the equipment, wait at least 5 minutes before touching or disconnecting sections of the equipment that normally carry electrical charges (e.g., capacitors, contacts, screw connections). To be safe, measure the electrical contact points to each other and to electrical safety earth with a meter before touching the equipment.

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# 1.0 PRODUCT DOCUMENTATION

The S200 Position node system documentation contains information broken into several manuals and documents. Not all documents are required but no document stands alone. The documents are:

## **Hardware Installation Manual**

This document includes all aspects of product specifications and installation procedures. Wiring diagrams, mounting dimensions and recommendations, and physical properties can be found here. It is required to properly mount and wire the S200 Position Node product.

## **User's Operation Manual**

This document provides all information required to get an S200 Position Node product set up and configured for operation in the application. It includes functional descriptions, interface details, and troubleshooting information. Information regarding serial communications using Modbus is also provided in this document.

## **S200 Position Node with CANopen Reference Manual**

This document provides reference material and examples for communicating to the S200 Position Node over the CANopen field bus protocol.

## **S200 Position Node with DeviceNet Reference Manual**

This document provides reference material and examples for communicating to the S200 Position Node over the DeviceNet field bus protocol.

## **Support materials**

There may be a number of supporting documents located at our web site. Please check for the latest information.

## **Locating Support Materials**

All support materials are posted on the Kollmorgen website at [www.Kollmorgen.com](http://www.Kollmorgen.com). These files can be found under Drives \ AC Servo Drives \ S200.

## **Firmware and Software Updates**

A good general practice remains: If it's not broken, don't fix it. There are times when firmware and software upgrade is required. These files can also be found at [www.Kollmorgen.com](http://www.Kollmorgen.com). Procedures can be found in this document.

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## 2.0 PRODUCT OVERVIEW

The S200 Position Node with CANopen/DeviceNet™ brings greater flexibility to the S200 drive platform by adding profile generation and field bus capabilities. It also brings added I/O, Digital Oscilloscope emulation, and the ability to use an incremental encoder with commutation tracks (ComCoder) for motor feedback.

The S200 Position Node brushless servo drives with CANopen push high performance servo technology into lower power applications than was previously possible without having to compromise on reliability or package size. Couple a S200 position node drive with an AKM servo motor for a complete servo control solution designed to excel in applications such as semiconductor fabrication, electronic assembly, packaging, medical, and woodworking equipment.

The S200 position node servo drives with CANopen communication are the first all digital industrial drives with a velocity loop bandwidth up to 400 Hz offering unmatched system throughput and simplified tuning. High resolution (24 bit) feedback and high performance 3-5 kHz current loop bandwidth provide smooth motion and rapid start and stop action to optimize machine performance. Smart feedback and industry leading high bandwidth deliver fast and accurate commissioning by eliminating the need for servo loop tuning in most applications.

A separate "keep alive" power input allows rapid recovery from emergency stop conditions. Optically isolated inputs/outputs, positive locking connectors and full fault protection promise long machine life and immunity to accidental damage. A single motor power/feedback cable simplifies connectivity. All connectors and LED status indicators are easily accessible from the front of the drive.

### Highlights

- DC or AC input voltage:  
DC type: 20 V ... 90 V  
AC type: 110 V ... 240 V, 1Ø or 3Ø, 50/60 Hz
- Highest performance all digital servo in the industry
- Operation and Setup via a PC using the S200 OC Tools setup software
- Easy set up and tuning with Smart Feedback Device
- Optimized performance with Kollmorgen AKM motors
- Rugged optically isolated I/O
- UL508C recognition, CE (EN50178, EN61800-3)
- Very compact footprint
- Full fault protection
- Velocity, Position, and Electronic Gearing, Step and Direction control
- Indexing - 180 unique motion tasks can be defined and initiated via the serial port, Can Port, or discrete inputs
- Jogs, Relative, Absolute, Simple Registration, and Home motion tasks can be easily setup and executed
- Individual motion tasks can be linked or blended with each other
- Digital Oscilloscope Functions
- Built-in CANopen / DeviceNet Communication bus
- Incremental Encoder Input port allows ComCoder motor feedback for position loop control.

## Increased Machine Throughput & Longer Life

- Servo system performance is synonymous with machine throughput. The S200 POSITION NODE family takes servo performance to new heights.
- Industry-leading current loop bandwidth up to 5 kHz and velocity loop bandwidth up to 400 Hz means machine throughput can be increased by as much as 2 to 3 times.
- Robust design including full fault protection, locking connectors and optical isolation promise greater machine “up-time”.
- Smooth motion, a benefit of sinusoidal current control and high resolution (24 bit) feedback minimizes harsh torque disturbances that can cut short the life of mechanical components.
- Both the AC and the DC input drives are equipped with separate control power input to speed recovery from “E-Stop” conditions.
- CANopen Field Bus or DeviceNet communications

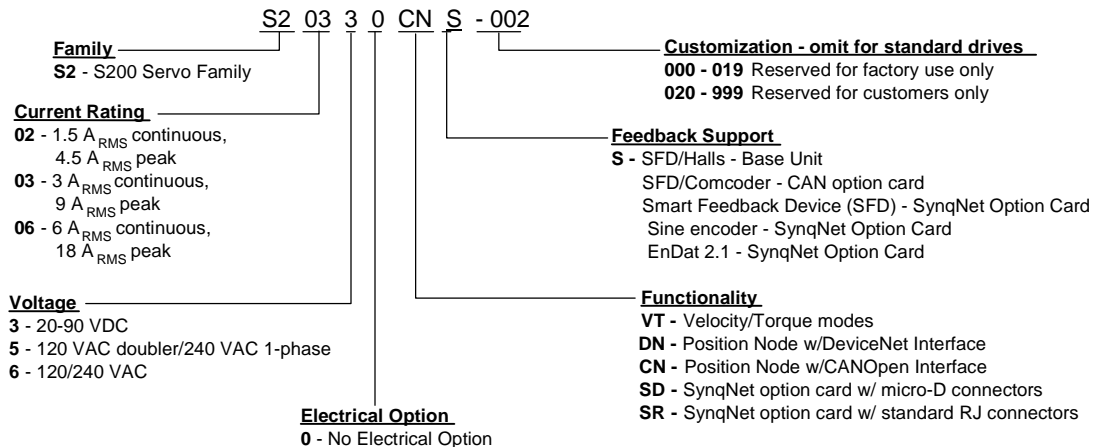
## Reduced Engineering & Support Time

- Simplified tuning, friendly Graphical User Interface and shared components with Stepper products.
- Windows-based Graphical User Interface models the tree format found in Explorer so learning is quick and easy.
- Digital Oscilloscope emulator for easier setup.
- Easy to debug with full fault diagnostics reduces engineering support time.
- Field bus connectivity.

## CE- / UL- Conformity

- The S200 position node with CANopen meets all relevant standards:
- EMC Directive 89/336/EWG, standard used ENG61800-3
- Low Voltage Directive 73/23/EWG, standard used 50178
- UL / cUL 508C recognized

## 2.1 MODEL NUMBER SCHEME





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## 2.1.1 Valid Drive Model Numbers for the S200 Position Node

### DC Input Power Drive Models

S20330-CNS: 90 V<sub>DC</sub>, 3/9 A<sub>RMS</sub> Base Unit, Profile Node with CanOpen

S20330-DNS: 90 V<sub>DC</sub>, 3/9 A<sub>RMS</sub> Base Unit, Profile Node with DeviceNet

S20630-CNS: 90 V<sub>DC</sub>, 6/18 A<sub>RMS</sub> Base Unit, Profile Node with CanOpen

S20630-DNS: 90 V<sub>DC</sub>, 6/18 A<sub>RMS</sub> Base Unit, Profile Node with DeviceNet

### AC Input Power Drive Models

S20250-CNS: 120VAC doubler/240VAC, 1 phase, 1.5/4.5 ARMS Base Unit, Profile Node with CanOpen

S20250-DNS: 120VAC doubler/240VAC, 1 phase, 1.5/4.5 ARMS Base Unit, Profile Node with DeviceNet

S20260-CNS: 120/240 VAC, 1/3-phase, 1.5/4.5 ARMS Base Unit, Profile Node with CanOpen

S20260-DNS: 120/240 VAC, 1/3-phase, 1.5/4.5 ARMS Base Unit, Profile Node with DeviceNet

S20350-CNS: 120VAC doubler/240VAC, 1 phase, 3/9 ARMS Base Unit, Profile Node with CanOpen

S20350-DNS: 120VAC doubler/240VAC, 1 phase, 3/9 ARMS Base Unit, Profile Node with DeviceNet

S20360-CNS: 120/240 VAC, 1/3-phase, 3/9 ARMS Base Unit, Profile Node with CanOpen

S20360-DNS: 120/240 VAC, 1/3-phase, 3/9 ARMS Base Unit, Profile Node with DeviceNet

S20650-CNS: 120VAC doubler/240VAC, 6/18 ARMS Base Unit, Profile Node with CanOpen

S20650-DNS: 120VAC doubler/240VAC, 6/18 ARMS Base Unit, Profile Node with DeviceNet

S20660-CNS: 120/240 VAC, 1/3-phase 6/18 ARMS Base Unit, Profile Node with CanOpen

S20660-DNS: 120/240 VAC, 1/3-phase 6/18 ARMS Base Unit, Profile Node with DeviceNet

S21260-CNS: 120/240 VAC, 1/3-phase 12/30 ARMS Base Unit, Profile Node with CanOpen

S21260-DNS: 120/240 VAC, 1/3-phase 12/30 ARMS Base Unit, Profile Node with DeviceNet

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## 2.2 HOW TO USE THIS MANUAL

The S200 Position Node product is a very flexible servo motor drive system. This manual assumes that the user has installed, wired, and started up the drive system. The system is now ready to configure.



### NOTE

#### Important Notice:

Major changes to the S200 Position Node product have taken place with a major upgrade change occurring in October of 2007. This manual was created to document all the new features. Older GUI and software may not support all features. Firmware and software can be upgraded. All functions in the older product remain correctly documented here.

There are several topics covered in this manual that blend together in the final ability configure and apply and support the product.

- 1.) Understanding how to apply the product and what the product can do.
- 2.) Understanding the switches available to the user.
- 3.) Understanding the S200 OC Tools Graphical Interface (GUI) program.
- 4.) Understanding fault messages and trouble shooting strategies.
- 5.) Firmware / Software updates

This document presents each topic in order. It is recommended that the reader overview the document at a high level and then revisit the topics of main interest.

## 2.3 SOFTWARE AND FIRMWARE VERSION NOTES

Drive firmware version is displayed in the S200 OC Tools status screen. S200 OC Tools version can be found using the Help>About menu. This document is based on features available at 2.0.0 and above for both firmware and software. S200 hardware has been extremely stable and there are no issues with any product upgrading to these new versions of firmware / software. Care has been taken to be backward compatible. The user is advised to check backward compatibility to assure to his own satisfaction for the given application. A section at the end of this guide provides instructions for upgrading firmware.

## 2.4 TERMINOLOGY DISCUSSION

We use the word '**configurable**' in contrast to '**programmable**' to differentiate the concept of a user simply being required to set up some variables in the drive versus having to write a program in some language. The S200 PN is a configurable device that is easy to setup by a novice without programming skills. The trade-off is that the S200 PN does not offer the flexibility of a programming language capable of making 'decisions'

**Operational Mode** is abbreviated as **OPMODE**. The S200 Position Node drive has a very important core setting for its mode of operation: Motion Tasks, Electronic Gearing (Master/Slave), or Digital Velocity command. Making this selection allows the drive to configure its command registers and control loops correctly for the application.

When using the S200 PN as a configurable indexer or positioner the user defines moves in a table whose entries can be selected by several means. This configured table is referred to as the **Motion Task** Table. Motion tasks and the Motion Tasking table are described in this chapter.

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The following data could be categorized as; those requiring motion tasking setup and those that do not. As a velocity controller, gear follower, or step and direction controller: no motion tasks are required. Most other modes will require Motion Tasking configuration.

**Ramp** control is the control of acceleration and deceleration rates. Motion Tasking allows each profile to have its own acceleration and deceleration rates. Acceleration of Jog and Homing moves uses a separate velocity acceleration rate that applies globally. A 'Stop Command' uses yet another acceleration rate that can be set to a more aggressive value.

**Homing** is the process of calibrating the S200 Position Nodes motor position to the required reference point on a machine. Absolute position data always references the home position. Homing is always required on the S200 PN but there is a method to configure the S200 PN so that the process is automatic and transparent. See the section on Homing, below.

**Discrete inputs** and **digital inputs** are synonymous and may be used interchangeably throughout this document. A discrete input is used cause the S200 execute a function.

**Clockwise (CW)** and **Counterclockwise (CCW)** are mentioned in this document as one would view the motor shaft looking at the shaft and motor-mounting plate.

A **fault** is a condition detected by the S200 Position Node drive that results in the drive automatically disabling the power stage, turning off the fault output (Normally closed for fail-safe operation), and annunciating the fault code in the displays. An example of a fault is a motor over temperature detection (F13).

A **Warning** is a condition that is annunciated as the result of an ignored command. An example of a warning is attempting to move before the home reference point has been established (n03).

**Electronic gearing, line-shafting, Master/Slave** are all used synonymous throughout this document. These refer to the S200 PN's motor being controlled by an external master signal, pulse-for-pulse although the ratio of movement per pulse can be adjusted by the user.

**Step and Direction** and **Pulse and Direction** are used synonymous. Both refer to a method of feeding a position command to the S200 Position node via a pulse train command.

A **profile generator** is the device (usually software) that generates the desired position or velocity for any moment in time. The profile generator is sometimes called the command generator. It maintains the correct position for any instant of time. The profile generator is not a servo loop but rather feeds the command into the position control loop.

**Tuning** refers to the process of adjusting the S200 PN loop compensation for the desired motor performance with a given load. The S200 PN may require tuning in the velocity loop and the position loop, depending on the application. Tuning of the current loop is automatic upon entering the motor inductance.

**BCD** is short for Binary Coded Decimal. 0 to 8 input switches can be assigned as BCD Select functions. BCD is a base-2 numbering system common in digital circuits which represent numbers with a series of switches (bits) that can only be in an on or off state. A BCD code (Base 2 number) can be presented to these inputs whose function is simply to point to a Motion Task (Base 10) number.

**Comcoder** is a term used to describe an incremental encoder that has commutation tracks, sometimes called Hall Emulation tracks. These encoders provide coarse absolute position information sufficient to properly commutate the motor. Comcoders hall tracks must have the correct cycles/rev to match the motor's pole-pair count.

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**SFD** stands for **Smart Feedback Device**. This is a Kollmorgen feedback device available on the AKM series motor. It communicates feedback position over a high-speed serial link with minimum number of wires. It also contains information about the motor that allows the motor and S200 Position Node to be virtually 'plug and play'.

**OIT** or **HMI** means Operator Interface Terminal or Human Machine Interface. Both refer to a keypad / display connected to a controller for simple data entry or manipulation.

**S200 PN** Is short hand notation for the S200 Position Node product.

'**x**' A lower case x may be used to signify a 'don't care' character in a string, number, or model number.

**GUI** Graphical User Interface also called S200 OC Tools.

**PE** Protective Earth Ground

**REGEN** is short for regenerated energy from a back-driven motor pumping energy back into the drive.

**REGEN Resistor**. An external power resistor attached to the drive that allows the drive a means to dissapate excessive REGENerated energy.

**Hall Channel** is a term used for a motor feedback signal that provides coarse absolute positioning information. Three channels provide 1-part-in-6 resolution per motor electrical cycle.

**Bus** is Short for Main Internal DC Bus Power Supply that is the DC voltage source for motor power.

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## 3.0 DRIVE MEMORY AND FILE DISCUSSION

The S200 Position Node has the ability to store or obtain data from different locations.

The operating system, or drive firmware, is resident in flash memory and may be upgraded using the S200 OC Tools GUI program. A portion of this program is called the Boot Loader and is not updated at the time of firmware load. When the Boot-loader executes an 'I' is put in the seven segment display.

User settings, or configuration, during run-time is stored in internal Random Access Memory (RAM) that is subject to data loss at power cycling. All communications between the drive and the GUI read or modify variables in RAM.

The S200 has Electrically Erasable Programmable Read Only Memory (EEPROM) to store the user configuration, or settings. EEPROMs save data through power cycle and are called non-volatile. The S200 Position Node will not automatically save the user settings to EEPROM. The only time that the settings are written EEPROM are under the command of the user by either the menu Utility 'Save Drive Parameters to Permanent Memory (NVSAVE)', or the associated mouse button  or by a COLDSTART which all transfer the contents of the RAM variables to the EEPROM memory.

EEPROM Memory is transferred to RAM memory automatically upon power up initialization. The user can also force this function through the S200 OC Tools Utility: Upload Drive Parameters From Permanent Memory (NVLOAD).

The S200 Position Node is designed to be used mainly with Kollmorgen's AKM series of motors which are offered with Smart Feedback Devices (SFD). The SFD motors contain the motor-specific data within the SFD itself. The S200 Position Node powers up and looks at the state of the 'Use SFD Parameters Setting'. If true, the drive will upload the motor settings from the drive and overwrite those in RAM. If false, the parameters loaded into RAM from power up initialization are used.

Since the user can configure many variables within the S200 Position Node we desire a way to return all these variables back to a known beginning state. The Utility 'Reset to factory defaults' can be used for this purpose – it resets the users settings to factory default values. The function works with RAM variables only and does not save to NVMEM.

There are several hardware switches on the S200 PN. These are a form of memory. These are only read at the time of power up initialization. The user wishing to change switch settings will not notice them taking affect until power is cycled. An exception to that rule is during the firmware load process where the operator is instructed to open S13-4.

The memory associated with remembering the baud rate (RS232.Baudrate) acts like the switches mentioned above. To change the baud rate the user would change the value of RS232.Baudrate, save to NVMEM and then cycle power. This method allows the drive to continue to communicate at the present baud setting to complete the process in an orderly fashion.

The S200 Position Node has a motor data base provided with it. Users of SFD feedback devices would only need to access the database if the drive is set up for 'Do not use SFD Parameters' This allows the user to configure something different than the default values of the applied AKM motor. Users wishing to have Comcoder feedback will need to use the Motor Database and/or Motor Database editor.

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If the motor to be used already exists in the database then it will be selectable by the user with the GUI Motor and Mechanical Setup\Motor screen. Motor selection is a drop-down box of all motors in the database resident on the computer running the GUI. If the motor is not present then the user must create a new motor configuration record.

To create a New Motor configuration record in the database the user will select, under the Utility Menu, 'Motor Database Editor. The user will press the 'New Motor' button and populate this table. Clicking the 'Add' button completes editing. Press Exit and the new motor name will be available in the Motor Selection drop down box.

S200 OC Tools allows the user to save the drive configuration to the computer storage. It also allows the stored configuration to be loaded into the drive. The files are saved, at a location directed by the user, with the file extension CNS. Files are saved using the menu File\ Save. The files can be downloaded to the drive by using File \ Open.

The File\Open will put the saved file in a tree on the left hand-side of the GUI screen. At this point the settings have not been transferred to the drive but are available for viewing. There are two ways to do send the data to the drive. The Configuration Summary tab has a button 'Downlaod Configuration to Drive'. Alternately, a right mouse button click on any of the file tree branches will pop up an operation to download the file to the drive. The data is loaded into RAM and would require an NVSAVE to be stored permanently.

The S200 Position Node has an internal section of executable code that it creates itself after the user configures the drive. By compiling its own executable motion code based on the configuration set by the user the S200 PN can execute commands much quicker than interpreted code that other controllers use. This is all transparent to the user with one exception – the COLDSTART process. It is the COLDSTART process that causes the S200 to rebuild this compiled code. A Coldstart is required after changing of some variables only – typically an input function. The need for execution of the COLDSTART is prompted by the S200 OC Tools and by a status bar at the bottom of the GUI. Modifying some variables within the configuration and NOT allowing a COLDSTART to take place prevents those changes from being compiled, and hence, result in no changes to the drive's performance or functionality.

And finally, data captured by the digital oscilloscope functions can be saved for future viewing, printing, or further analysis. Scope data can be saved to a printable file in the Metafile (WMF), Bitmap (BMP), JPEG (JPG), PNG, and text formats using the 'Save Plot' button. Data can be saved to a comma separated variable (.CSV) file using the 'Save Data' button. The CSV file can easily be imported into spread sheet programs for formatting, calculating, and analyzed. A very handy feature!

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## 4.0 S200 POSITION NODE APPLICATIONS

The S200 Position Node product is simple and intuitive to setup and use. This section of the user's guide discusses operation of the S200 Position Node controller in several common applications.

### 4.1 VELOCITY CONTROLLER

There are two basic methods to use the S200 position node as a velocity loop controller. The obvious way is to use serial communication commands to control the motor velocity. The second way is to setup discrete inputs to control the velocity. Either method provides excellent velocity control regulation. Serial communications methods can initiate or modify velocity over the RS232 Modbus RTU connection or over the can bus port using CANopen or DeviceNet protocol.

To use discrete inputs the user has up to nine inputs that can be assigned as jog functions. The S200 Position Node is set up to operate in Motion Task mode. DINP1 is the hardware enable line. This input must be asserted to get power to the motor. DINP2-DINP10 can then be assigned such that each has a different speed. The arithmetic sign of the jog speed controls direction of travel.

For serial command velocity the drive is setup in Digital Velocity mode. The applications using the MODbus serial communications modifies the velocity controlled by the 'J' parameter = PDID 1934 = Modbus Address 3868. There is an example in the section dedicated to Modbus.

For CANopen control the drive is setup to operate in Digital Velocity mode and the user would typically configure a PDO / SDO for velocity command and feedback on a periodic basis. There are examples in the CANopen Reference Guide document.

To setup the S200 Position node for Digital Velocity:

- Drive Setup\Drive Setup; Mode of Operation: Digital Velocity Command
- Profile Setup; Homing: Auto home, or as desired.
- Accel / Decel: As desired
- I/O Setup: As desired
- Other settings: As desired

### 4.2 ELECTRONIC GEAR BOX / LINE SHAFT

Electronic line shafting, electronic gearing, and Step and Direction (Next section) control are all very similar. In these modes of operation the drive is configured to follow an incoming pulse stream. The S200 Position Node's digital control loops are extremely accurate at following any of these pulse streams.

Unlike the typical step and direction control, many electronic line shafting or gearing applications require the ability to 'lock' onto a moving master signal. Once this lock signal occurs the position loop control follows an arithmetically perfect track losing no position information. The 'lock' command is provided to the S200 Position Node typically by a discrete input on the S200PN.

In these applications the master signal is typically provided in the form of quadrature encoder signal commands. An encoder can be mounted on the machine's main synchronization shaft and the signals feed into the S200 Position Node. Sometimes the application may allow the main line-shaft motor's drive to feed emulated encoder pulses to the S200 Position Node.

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Locking onto the master signal typically takes one-of-three forms. The simplest form just locks the signals when the master is at rest. As the master begins to move the S200 Position Node is a slave motor controller that then follows the master per the defined 'gear ratio'. Applications that require locking onto a moving master can have one-of-two different needs. The first method is a simple 'velocity' lock. Under this method the drive has been configured to have a discrete input assigned as the 'lock' (Gearing w/o correction) function. When the input is asserted the drive will accelerate to the velocity of the moving master and then switch to a full position-mode lock (pulse-for-pulse) mode. These applications require the velocity of the slave as the main requirement. The final locking method is slightly more complicated and is used in applications where the positional relationship to the master signal is as important as the velocity following. A discrete input is assigned to lock onto the master (Gearing w/ correction). When the input is asserted the S200 Position Node registers the position of the master and begins accelerating to the master's velocity but will overshoot the target velocity to 'catch up' to match the position of the master at the time in which the lock signal was asserted. The S200PN motor overshoots the master velocity and then decelerates once the lost position was 'made up'. Mathematically speaking, on a velocity vs time chart, the area under the overshoot velocity equals the area lost during the initial acceleration.

Acceleration and deceleration control in these applications can be a little tricky if the master speed fluctuates. When locking onto a master at rest you can defeat (set to maximum value) the ramp control on the S200PN. Locking onto a moving master requires the use of reasonable acc/dec limits. If the speed of the master can change nearly as quickly as the limits set in the S200PN then strange results can occur with the slave's lagging response.

To setup the S200 Position node for Gearing:

- Drive Setup\Drive Setup; Mode of Operation: Electronic Gearing
- Drive Setup \ Gearing; Gearing Type: Quad Encoder
- Drive Setup \ Gearing; Electronic Gearing Command Ratio: As desired
- Profile Setup; Homing: Auto home, or as desired.
- Accel / Decel: As desired but should be set to maximum
- I/O Setup \ Digital Inputs: Gearing Active w/ (w/o) Correction
- Other settings: As desired

### **4.3 STEP / PULSE AND DIRECTION DRIVE**

Step and direction control is common in the stepper motor market. Some CNC products (such as MACH2) also use step and direction command. Some PLCs have step and direction outputs. The S200 Position Node can make an excellent servo replacement for stepper systems with many advantages.

Step and direction controllers are motor shaft positioning devices controlled by two signals. One signal provides the travel direction (An inactive high signal moves the motor clockwise while the active state moves the motor counter clockwise. More precisely, this signal does not actually move the motor at all. The second channel called the pulse (or step) channel is the one that commands motor motion. Each pulse on this channel causes the motor to move one 'pulse' of motion in the direction commanded by the direction channel. The reason that the motors' movement of 'pulse' is in quotes is because the actual angular distance of the motor can be configured by the user. The finer the pulse resolution the smoother the motion and the better the positioning resolution can be. The S200 Position Node receives the command pulses in on the A channel and the direction on the B channel of the external encoder input on J12.

It is valuable to bring a mental conceptual view to these applications. The device that generates the step and direction pulses is a profile generator whose outputs are sent to the S200 PN that receives these commands into a command position register. It is the S200 PN that contains and



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closes the position loop. It is usually not advisable to insert any acceleration or deceleration control in these applications. The lagging response created by acc/dec limits can cause some strange response performance.

To setup the S200 Position node for Step and Direction:

Drive Setup\Drive Setup; Mode of Operation: Electronic Gearing  
Drive Setup \ Gearing; Gearing Type: Pulse / Direction  
Drive Setup \ Gearing; Electronic Gearing Command Ratio: As desired  
Profile Setup; Homing: Auto home, or as desired.  
Accel / Decel: As desired but should be set to maximum  
I/O Setup \ Digital Inputs: Gearing Active w/ (w/o) Correction  
Other settings: As desired



## NOTE

The following descriptions for Indexer, Positioner, and Registration index are provided here in description text because of the decidedly different needs in the application. In reality, the S200 Position Node combines all three of these features into the same group of Motion Tasks and does not differentiate these as Operation Modes – all three control types can be combined into a single motion task list.

## 4.4 INDEXER

The term 'Indexer' is synonymous with 'Feeder' in the motion control industry. These applications are incremental. A typical application is a 'cut to length' machine that feeds material into a shear to be cut off over and over again. Each move concerns itself only with the position at which the feed (index) begins. It has no concern about any other position information.

The S200 PN provides extremely flexible options in indexing applications. Up to 180 index moves can be defined in the 'Motion Tasking Table'. The S200 Motion Tasking table can combine indexing and positioning and can offer 'registration indexing' or 'automatic' moves and dwells. Data for the move can be modified over the CAN bus or the Modbus interface allowing flexibility for the overall machine design.

To setup the S200 Position node for Indexing:

Drive Setup\Drive Setup; Mode of Operation: Motion Tasks  
Profile Setup; Homing: Auto home, or as desired.  
Accel / Decel: Affects homing and jog rates only  
I/O Setup \ Digital Inputs: Assign as required which may include BCD select, start move, and in-position output.  
Profile Setup \ Motion List; Up to 180 defined moves.  
Other settings: As desired

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## **4.5 CONFIGURABLE POSITIONER**

The S200 PN has a very versatile feature called 'Motion Tasks' allowing great flexibility in motion profiles. Up to 180 moves can be stored and selected for execution. Execution methods include discrete inputs, BCD Select, and automatic start (after completion of a prior move).

A positioner differentiates itself from an indexer in that it always remembers where the motor is at and must be 'homed' or calibrated upon power up. Commanded positions are always relative to that home location. The S200 PN must always be homed but there are ways around this that will be described later in this chapter.

The S200 PN product doesn't force the user into choosing just positioning or just indexing. The Motion Tasking table can be filled with a variety of move types. Moves can be 'blended' (meaning that the motor does not have to stop before the next move begins) allowing multiple velocity profiling. Registration moves can also be made but more on registration will follow.

To setup the S200 Position node for Positioning:

Drive Setup\Drive Setup; Mode of Operation: Motion Tasks

Profile Setup; Homing: Auto home, or as desired.

Accel / Decel: Affects homing and jog rates only

I/O Setup \ Digital Inputs: Assign as required which may include BCD select, start move, and in-position output.

Profile Setup \ Motion List; Up to 180 defined moves.

Other settings: As desired

## **4.6 REGISTRATION INDEXER**

Registration indexing is required when the actual feed length is uncertain. Such is the case with printed web material that is subject to expansion and contraction. In the printed web example the printing process prints a mark on the edge of the web that a photo detector can identify. The photo detector is wired to a discrete input to the S200 PN, DINP 2 (the only valid registration input). The S200 is set up with an indexing (Relative Move) motion task whose feed length is slightly more than the maximum length ever required to feed one product length into the cutters. Another motion tasking move is defined Registration Move (with ether latch) with a short distance and triggered by the registration mark detector. The machine is ready to operate as follows: The larger Relative Move is executed, the detector triggers the Registration Move DURING the Relative Move, the motor comes to rest the distance defined by the Registration Move motion task AFTER the detector fired. If the detector never trigger the motion comes to stop as defined by the Relative Move distance. The Registration Move distance should be at least enough to include the deceleration distance.

The S200 PN allows configuring Registration indexes in its Motion Tasking Table.

To setup the S200 Position node for Registration:

Drive Setup\Drive Setup; Mode of Operation: Motion Tasks

Profile Setup; Homing: Auto home, or as desired.

Accel / Decel: Affects homing and jog rates only

I/O Setup \ Digital Inputs: Assign as required which may include BCD select, start move, and in-position output.

Profile Setup \ Motion List; Up to 180 defined moves.

Other settings: As desired

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## 5.0 S200 POSITION NODE THEORY OF OPERATION

This section adds detail to the prior section discussing some basic functions that may be allowed in each of the above-described applications. It also adds a great deal of background information and insight on the products internal operation and logic behind it.



### NOTE

**This section does not attempt to describe all features of the drive. Other features may be disclosed in the S200 OC Tools section of the manual. Please read that section as well.**

### 5.1 S200 OC TOOLS

The use of S200 OC Tools is described in detail later in this manual. S2000 OC Tools GUI is a simple translator program that converts data between the drive and the user screens. The user is presented data in a form that is useful and easy to understand. He can modify drive settings and view drive settings in graphical or English language representation. The GUI communicates to the drive over Modbus RTU is a more efficient, but cryptic, drive command variable and command set. The drive's command and variable set is presented by the GUI on organized screens. The user can view or change the data. The GUI then queries or sets the proper variables in the drive. The drive variables are listed in the Section under Modbus. The GUI is designed, whenever possible, such that holding the mouse on a variable entry box causes a flag to pop up indicating the variable command name in the drive's variable set. The drive variables can be viewed or modified directly, working around the standard GUI windows, using the Variable Browser or Variable Editor functions. When working with the CAN bus or MODbus each variable can be accessed by a register, according to the protocol.

### 5.2 DRIVE ENABLE

The S200 Position Node has a power stage enabling logic that includes 3 main sources that must be correct to get the drive to enable the power stage. (CANopen is more complex and is covered in the CANopen reference document). First, the drive must be fault free. Any fault will cause an internal software disable that cannot be reset without the fault condition reset. There is a dedicated hardware enable input, Digital Input 1 that must be asserted (on) to enable the power stage. Lastly there is a Software enable that must be active to enable the power stage. All three conditions must exist to enable the power stage; No Fault, Hardware Enable Asserted, Software Enabled.

The software enable bit powers up Enabled according to the S200 Position Nodes Default settings. The user can change the default power up state to Software Disabled under the Drive Setup \ Drive Setup\ Software Enable setting. (Variable name is AENA).

### 5.3 SETTING POSITION UNITS

The S200 Position Node allows the user to set the number of counts desired in a revolution. This can be handy when entering positional and index length information in units more meaningful to the application. The units are provide in a numerator / denominator fashion that allows the user to select units that are scalable in a manor that will not loose any counts if the desired ratio can be

expressed as a rational number. The default settings provide the finest resolution possible; 1 part in 65536. The User Units apply to the distance entries in the Motion Task List. It is important to note that the distance entries in the Motion Task List are integer values only so the setting of the User Units must take this into consideration.

## 5.4 DISCRETE / DIGITAL INPUTS

There are 10 digital inputs on the S200 Position Node for customer use. Digital input 1 is assigned as a hardware enable and must be asserted to enable the power stage. The other 9 inputs can be configured by the user for specific functions. Not all inputs can be assigned to all functions. The following table shows the allowable assignments as well as the 'Reset to Factory Default' assignments. Areas in red (or shaded) are not allowed.

Function	DINP1	DINP2	DINP3	DINP4	DINP5	DINP6	DINP7	DINP8	DINP9	DINP10
Hardware Enable	<b>Only Function</b>									
No Function		√	√	√	Default	Default	Default	Default	Default	Default
Clockwise Inhibit			√	√	√					
Counter Clockwise Inhibit			√	√	√					
Fault Reset		√	√	√	√	√	√	√	√	√
Gearing Active w/ Correction		√	√	√	√	√	√	√	√	√
Gearing Active w/o Correction		√	√	√	√	√	√	√	√	√
Home Switch		Default	√	√	√	√	√	√	√	√
Start Move BCD		√	Default	√	√	√	√	√	√	√
Move Select Bit		√	√	Default	√	√	√	√	√	√
Start Move (Discrete-Level)		√	√	√	√	√	√	√	√	√
Start Move (Discrete-Edge)		√	√	√	√	√	√	√	√	√
Registration		√	√							
Clear Following Error		√	√	√	√	√	√	√	√	√
Stop		√	√	√	√	√	√	√	√	√
Additional Hardware Enable		√	√	√	√	√	√	√	√	√
Jog Move		√	√	√	√	√	√	√	√	√

Inputs are assigned by the user according to his requirements under the Drive Setup\ Digital Input (Base Unit) menu for inputs 1-5 (physically connected at J4) and the Drive Setup \ Digital Inputs (Option Card) menu for inputs 6-10 (physically located at J12).

The following table provides a description of each of the Digital Input Functions:

Function	Description
Hardware Enable	An active input (on) enables the drive power stage (motor output power) if the software enable is active.
No Function	Unassigned Input
Clockwise Inhibit	If this input is assigned and the input is inactive (off) then no further motion is allowed in the CW direction. Power stage remains enabled. Warning n10 is annunciated. Motion in the CCW direction is allowed.
Counter Clockwise Inhibit	If this input is assigned and the input is inactive (off) then no further motion is allowed in the CCW direction. Power stage remains enabled. Warning n11 is annunciated. Motion in the CW direction is allowed.

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Fault Reset	An Active signal (off-to-on) causes the drive to reset faults. Some fault resets may require the COLDSTART process that is initiated by this input automatically. The Coldstart process requires several seconds to complete.
Gearing Active w/ Correction	Pertains only to Operational mode: Electronic Gearing. If selected as this function, the input must be active (on) to allow the S200 PN motor to lock onto the master gearing signal. Any loss of position between the Master position, at the time this signal is asserted, and the S200 PN's motor due to acceleration limits is 'made up' with a velocity overshoot.
Gearing Active w/o Correction	Pertains only to Operational mode: Electronic Gearing. If selected as this function, the input must be active (on) to allow the S200 PN motor to lock onto the master gearing signal. Any loss of position between the Master position, at the time this signal is asserted, and the S200 PN's motor due to acceleration limits is lost.
Home Switch	This function sets the S200 PN to look for this input to become active (on) when the homing process is invoked. The off-to-on transition latches the actual motor position and causes the S200 PN to recalibrate that position as absolute 0 position.
Start Move BCD	Assertion of this input causes motor Motion as defined by the Motion Task called out by any assigned Move (BCD) Select inputs. This input is monitored and will cause motion to stop if it is removed.
Move Select Bit	Inputs assigned to Move Select Bits are those assigned to set a BCD code to be used as a pointer into the Motion Task table that will be executed when the Start Move BCD input is energized.
Start Move (Discrete-Level)	This input function assignment is used when an input is desired to move a defined Motion Task Function. The input is assigned to a Motion Task when completing the Motion Task List. This function can eliminate the need for designing systems with BCD selection logic to access Motion Tasks. This input mode is level-sensitive and removing the signal will stop motor motion.
Start Move (Discrete-Edge)	This input function assignment is used when an input is desired to move a defined Motion Task Function. The input is assigned to a Motion Task when completing the Motion Task List. This function can eliminate the need for designing systems with BCD selection logic to access Motion Tasks. This input mode is off-to-on sensitive and motion will continue even if the input signal is removed.
Registration	Input 2 is the only assignable input for registration. A photo-detector or other sensor is wired into input 2 and this function is assigned for systems using registration indexing.
Clear Following Error	This function causes the S200 Position Node to make its Position Command Register equal to its feedback's actual position thus nulling any position error. This input is not a reset fault input.
Stop	An input assigned to Stop becomes Active Low. An active signal (on) allows motor motion. Removing the input signal (off) causes the motor to decelerate to 0 speed and hold position. The power stage remains enabled. The deceleration rate can be set to a different rate than other functions to allow an aggressive stop (DECSTOP).
Additional Hardware Enable	An input assigned this function will provide AND logic to the hardware enable input, Input 1 to allow the power stage to be enabled.
Jog Move	Assigning an input as a jog pops up a velocity window. The user enters the desired speed (signed direction). Activation of this input causes the motor go run at the given speed and direction until the input is deactivated.

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## 5.5 DISCRETE / DIGITAL OUTPUTS

The S200 Position Node provides 3 digital outputs for the user. Two of these are dedicated and the function cannot be changed: The Fault and Run outputs.

The fault output, DOUT1, is normally closed and will open to indicate a fault condition sensed within the S200 PN. It will remain open until the fault condition is reset.

The RUN output, DOUT2, is representative of the Power Stage Enable control. Anytime that the power stage is enabled this output will be closed. Anytime that the power stage is disabled this output will be open. This is the normally required logic to control a motor's holding brake.

The 3<sup>rd</sup> output, DOUT3, is user configurable. The user configures the output under the Drive Setup \ Digital Outputs screen. The following table shows the allowable choices and describes them.

Function	Description
No Function	The output is unassigned.
Motor Velocity < Threshold	Output will turn on if the actual motor velocity is less than the threshold setting. (Threshold is set in box below O3 Function).
Motor Velocity > Threshold	Output will turn on if the actual motor velocity is greater than the threshold setting. (Threshold is set in box below O3 Function).
Position > Threshold	Output will turn on if the absolute motor position is greater than the threshold setting. (Threshold is set in box below O3 Function).
Excessive Position Error	Output will come on if the difference between the motor's commanded position and the following error limit (defined on Drive Setup screen) is exceeded: A following Error Fault
In Position	Output comes on when the Motion Task, included blended or next tasks, are all completed. The output is turned on when the actual motor position is at the final target position with a tolerance specified by the user in the In-Position Window.
In Position (Linked Tasks)	Output comes on at the completion of every-other motion task segment of a blended move task or linked move sequence..
DC Bus < Threshold	Output will turn on if the DC Bus voltage falls below the level set by the threshold. The Threshold level is set in the following box.
DC Bus > Threshold	Output will turn on if the DC Bus voltage is greater than the threshold. The threshold value I set in the following box.
Home Complete	The output powers up in the off state and remains off until a homing process has been completed at which time the output turns on.

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Logical OR: DRVSTAT + O3TRIG	Output comes on of the logical OR of the drive status word, DRVSTAT, and the OR Mask, O3TIRG evaluates to TRUE. O3 TRIG is the masking word that can be entered in the window below this choice.
Logical AND: DRVSTAT * O3TRIG	Output comes on of the logical AND of the drive status word, DRVSTAT, and the AND Mask, O3TIRG evaluates to TRUE. O3 TRIG is the masking word that can be entered in the window below this choice.
All others in list	For factory use only

## 5.6 HOMING ROUTINES

Homing is simply a term used to refer to calibrating the S200 PN to determine the machine position after power is applied. The idea becomes obvious in an application that drives a ball screw or other limited-motion applications. Power can be shut down at anytime so the motor position is uncertain at power up. A method to 'calibrate' the S200 to an absolute position on the lead screw is required. This is called Homing.

As stated earlier, the S200 PN always requires homing regardless of the Operational Mode selected. Any motion command without prior homing of the drive after the last power cycle will cause a warning and not perform motion. There are times when an application, in and of itself, would not require homing. To accomplish homing in these cases the S200 PN can be configured (Under the Profile Setup \ Homing Tab) to 'Auto-home upon Enabling the Drive' with 'Set current position as Home'.

When homing is a machine requirement the S200 PN offers a few common methods:

1. The present motor position can be assigned as the home position.
2. The S200 can be commanded to move to a home limit switch and stop. The position at which the home limit switch was activated is the home, or reference position.
3. The S200 can be commanded to move to a home limit switch. The position at which the home limit switch was activated is the home, or reference position. The motor moves back to the home position.

The user can adjust ramp, speed, and direction for the homing process.

For systems implementing methods 2 or 3 the mechanical activation of the home limit switch must be designed such that the home limit switch is active at any possible position that the motor could be at that is considered beyond the home position. If the S200 is commanded, under these methods, to move home The S200 PN will first look to see if the home limit switch is active. If the home limit switch is active the motor will go in the opposite direction that it was programmed to seek home at until the limit switch becomes inactive. At that point the S200 PN will act as stated in 2 and 3, above. Failure to design a home limit switch system that is maintained when the machine is past home will not invoke the reversal process and possibly cause a machine crash.

The Home move (execute homing) is always the first motion task – Motion Task 0. This is not something that the user can change. Execute the homing task can be set as 'Automatic upon enabling the drive' or not. If the user chooses to not Auto-Home then the Motion Task 0 must be executed. A digital Input must be assigned as 'Start Move BCD'. When BCD code 0 is applied and the Start Move BCD is activated the homing process will begin. If the user has no other need for BCD Select inputs then no inputs need to be assigned for that function as the code will default to 0 and allow the single Start Move BCD to execute the homing process. Being a Start Move BCD the input is level-sensitive so the input must be maintained during the process. If the input is removed the homing process will be stopped.

Related Drive Settings:  
I/O Setup\ Digital Inputs: Home Limit, Start Move BCD

## 5.7 ANALOG OUTPUTS

The S200 Position Node provides two configurable analog outputs for customer use. Detailed hardware information is available in the S200 Position Node Installation guide. These outputs can be configured according to the drop-down list in the I/O Setup\Analog output screen. This screen also provides the scaling and offset information when the function is selected.

### 5.7.1 DACMON1 FUNCTIONS

Parameter Value	Definition
Position Feedback (Coarse)	Actual Position scaled .25Revs/Volt
Idfb	D-Axis Current Scaled $0.8474 * \text{DiPeak } A_{\text{rms}}/V$
Velocity Feedback (Medium)	Medium resolution velocity scaled 2288 RPM/Volt
Velocity Feedback (Coarse)	Coarse resolution Velocity Feedback scaled 9155 RPM/V
VdCmd	Q-Axis Voltage Command Scaled 134.5 V / Volt for AC Models Scaled $33.6^*V / \text{Volt}$ for DC Models
Position Feedback (Fine)	Position Feedback Scaled 0.000244 Revs/V

### 5.7.2 DACMON2 FUNCTIONS

Parameter Value	Definition
Bus Voltage	DC Bus Voltage Scaled $380 * V / \text{Volt}$ for AC Models Scaled $95^*V / \text{Volt}$ for DC Models
Current Feedback	Actual motor current scaled $0.8474 * \text{DiPeak } A_{\text{rms}}/V$
Velocity Feedback (Fine)	Fine Resolution Velocity feedback scaled 1144 RPM/V
I2TFilt	$I^*I^*t$ filtered value Scaled $0.7152^*\text{DiPeak}^2 A^2/V$
VU	U phase line-to-Neutral Voltage Command Scaled 812V/V for AC Models Scaled 203 V/V for DC Models
VqCmd	Q-Axis Voltage Command Scaled 134.5 V/V for AC Models Scaled 33.6 V/V for DC Models
Current Command	Current Command scaled $0.8474 * \text{DiPeak } A_{\text{rms}}/V$

## 5.8 END TRAVEL LIMITS

End limit travels can be useful on machines that have limited capability for motion in both directions, such as a linear slide. Hardware switches are set up so that they are activated by the slide (or traverse saddle) and can be wired into digital inputs (only inputs 3,4,and 5 can be assigned as end travel limits). The digital inputs are configured for Clockwise Inhibit and Counter Clockwise Inhibit. The activation of these inputs halts motion in that direction but not in the opposite direction. The power stage is not disabled. A warning (n01) is annunciated in the 7-segment display.



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When a digital input is assigned as a CW/CCW limit it automatic takes the invert state. This is to say that the input **MUST BE** active (input on) to allow travel in that direction. This provides fail-safe logic should a switch fail.

It is worth noting for applications using electronic gearing that the CW / CCW limits do not stop the position command register from accumulating position due to incoming pulses. ( An input configured for Gearing Active will do that). What this means is that a release of the CW/CCW Inhibit input will cause the motor to move to its commanded position. This is not a common application issue as most Electronic Gearing applications need an absolute position lock and the fact that the Gearing Active Input can be used.

## 5.9 STOP

The S200 Position Node allows assignment of digital inputs to Stop. The function causes the drive to bring the motor to 0 speed at a controlled rate and maintain the motor at standstill. The Stop Command is not an Emergency Stop. It is intended for use in applications where a quick halt of motion is desired. It is not intended to be a Machine System Emergency Stop.



**The Stop function is not to be confused or construed to be sufficient for any machine application Emergency Stop. The Machine Builder is responsible to provide appropriate controls for the safety of personnel and equipment according to industry standards, local and national codes, or industry specific codes.**

## 5.10 ENCODER FEEDBACK

The S200 Position node has an auxiliary encoder feedback channel that can be used for the motor shaft position feedback device instead of the SFD. The main encoder data channels are incremental devices meaning that they power up with no information about how they are aligned to the motor shaft. This is not compatible with brushless permanent magnet servo motors. For this reason the encoder wiring must include commutation tracks. Sometimes these commutation tracks are integrated into the encoder and may be called 'hall emulation' tracks. We refer to these types of encoders as Comcoders. Other motor systems may have actual discrete hall effect devices built into the motor.



Selecting Encoder Feedback on the S200 Position Node automatically sets a related setting: Use SFD Parameters (Under Drive Setup Menu) to not use data from an SFD. Should the user go back to using an SFD feedback device after having configured the S200 PN for encoder feedback the Use SFD Parameters setting is not automatically changed and must be changed by the user.

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The encoder line count is received and multiplied by a factor of 4 for internal use. So the position resolution within the S200 PN is 4 times the line count of the encoder. The line count is entered on the Motor and Mechanical \ Feedback screen.

The Advanced button shows the ability to adjust an offset for encoders. This offset is a commutation offset that can compensate for encoders that are not correctly aligned so that the Halls align with the motor BEMF. There is more detail on that subject in the S200 Position Node Installation Manual.

Since the Comcoder that will be used does not have the ability to store motor data parameters in it the user wishing to have an encoder feedback system must define the motor to be used, as well. The Motor setup screen has a pull down menu to select the motor to be used. The database contains only Kollmorgen's AKM series. If the applied motor is in the database it can simply be selected. If the motor is not present then the user will need to create a database entry for that motor: See the section on Using Motors not in the Database.

Related Drive Settings:

Motor and Mechanical Setup\ Feedback: Type, Encoder counts per motor Rev, and possibly Advanced \ Offset.

Motor Database Editor

## **5.11 TRIGGERING MOTION TASK MOVES**

A move, regardless of type, can be executed in a number of ways with the S200 Position Node. The user has a choice to directly link an input to a single motion task, assign inputs as a BCD pointer and execute, command over the serial or CAN bus ports, or tasks can be automatically executed as the result of the completion of another move event. To use digital inputs as motion triggers the user first sets up the input function under the I/O Setup tab of S200 OC Tools and then assigns the I/O to tasks under the Profile\Task Lists menu. This section discusses the choices for the I/O setup form

**Start Move Discrete (Level)** is an edge-sensitive trigger but level sensitive termination. The motion task associated with this input on the Motion Task List is executed upon the off-to-on transition of the digital input. The input signal must be maintained to complete the move. Motion will be terminated if the input is removed during the move.

**Start Move Discrete (Edge)** is an edge-sensitive trigger. The motion task associated with this input on the Motion Task List is executed upon the off-to-on transition of the digital input. The input signal may be removed and motion will not be terminate as a result of the removal.

**Start Move BCD** is an edge-sensitive trigger but level sensitive termination. The motion task is executed upon the off-to-on transition of the digital input. The input signal must be maintained to complete the move. Motion will be terminated if the input is removed during the move. The motion task that will be executed is selected within Motion Task List by the Move Select bit (BCD) codes.

**Move Select Bit (BCD)** is not an input that causes motion but needs to be discussed at this point. Any number of inputs can be assigned as Move Select Bit (BCD) and used to point to a Motion Task that can then be executed using the Start Move BCD input. Motion tasks are numbered in the Motion Task List from 0 to 180. The user assigns as many Move Select BCD inputs as required for the number of desired Motion Tasks. A binary code (Base 2 number) is applied to the Move Select Inputs which represents the number

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of the motion task desired to be executed. The Start Move BCD can be activated to execute the move. A couple of finer points to be noted:

- The user does not need to assign any inputs as Move Select Bit (BCD). In this case the S200 PN will always execute Motion Task 0 (Homing) when the Start Move BCD input is executed.
- The Move Select bit weight is assigned with the lower number input have the least significance. (Input 2 would have to be the LSB while input 10 would have to be the MSB).
- It does not matter where the user chooses to begin the Move Select Bit BCD inputs.



The level-sensitive input modes are subject to issues resulting from switch contact bounce. The S200 Position Node has limited ability to debounce the switch as any attempt to do so would add an inherent delay penalizing some applications. Switch Contact bounce can cause erratic motion for both indexing and positioning moves. Contact bounce can cause unpredicted feed distances when used with indexing moves.

The S200 Position Node can also trigger moves automatically. Auto-Homing upon enable is one example of a move starting automatically. A Motion Task can be set to trigger automatically after the completion of a homing sequence. In addition, the Motion Task table allows the user to configure either a 'Begin next Motion Task as Blended Move' or a 'Next Motion Task'. A blended move is the execution of two motion tasks where the first move does not come to 0 speed before executing the next move. Rather the first move completes its assigned distance, at speed, and the ramps into the following move. Setting the End of Task Condition to 'None' still allows the user to select another Motion Task as the 'Next Motion Task' for automatic execution for which the customer may insert a dwell time between the execution of the two moves. Any number of moves can be linked to start automatically and the moves do not have to reside contiguously in the Motion Tasking Table.

## 5.12 MOVE TYPES

In the Motion Task List and form the user can select the type of move for the Motion Task. Possible Move Types are Relative Move with or without memory), absolute move, or registration move. This section explains each of these move types.

**Relative Move w/o Memory** is an index. The distance entered in the Motion Task is incremental (relative to where the starting position was). Activating the assigned input will cause the Motion Task to begin execution. If the input type is selected to be either Start Move Discrete (Level) or Start Move BCD then motion will terminate should the input be removed during the motion. Re-energizing the assigned execution input will cause the same move to be executed, as defined in the distance entry of the Motion Task.

**Move Discrete w/ Memory** is an index. The distance entered in the Motion Task is incremental (relative to where the starting position was). Activating the assigned input will cause the Motion Task to begin execution. If the input type is selected to be either Start Move Discrete (Level) or Start Move BCD then motion will terminate should the input be removed during the motion. If the input remains on for the complete cycle the index distance is exactly as configured for the Motion Task. If the input is terminated early then

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the next execution will index the motor the sum of the configured distance Plus the 'lost' distance on the last move.

**Absolute Move** is a positioning move. The distance in the Motion Task entry is an absolute position relative to the home (zero) position. The actual distance traveled may vary because the task is to move the motor to a specific position. Early termination of a position command followed by re-execution logically moves the motor to the absolute commanded position.

**Relative Reg Move (+Latch)** is a part of an index move. The concept of registration is explained elsewhere in this document. Selecting this move type allows the user to configure the distance **AFTER** the registration mark is detected before the motor comes to stop. +Latch means that the registration input, Digital Input 2, triggers the move on the rising edge of the input.

**Relative Reg Move (-Latch)** is a part of an index move. The concept of registration is explained elsewhere in this document. Selecting this move type allows the user to configure the distance **AFTER** the registration mark is detected before the motor comes to stop. -Latch means that the registration input, Digital Input 2, triggers the move on the falling edge of the input.

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## **5.13 WITH MODBUS RTU INTERFACE**

The S200 position Node talks to a computer hosting the user interface program, S200 OC Tools, via serial communications over RS232. The format of the communications is a well-known standard called Modbus RTU. Any function that the S200 OC Tools GUI performs can be emulated via the Modbus system with the exception of the digital oscilloscope functions which are not supported with documentation.

Modbus RTU is an open protocol that supports addressing. Addressed communications allows multiple devices to be connected on one serial port line and each Modbus node accepts messages only addressed to it. The Modbus address is set via the rotary dipperswitches on the front of the product – S12 and S13.

The S200 PN supports only RS232 physical layer which is not a multiple device design. Systems wishing to talk to multiple S200 PN devices (or other devices on the same bus) would typically require external conversion hardware such as an RS485-to-RS232 converter.

## **5.14 OPERATOR INTERFACE TERMINAL**

There are many companies who make operator interface terminals (OIT) for industrial markets. There are also many application needs with varying demand for OIT capability. Kollmorgen does not presently offer OITs nor do we have recommendations for the user. It is not the intent of this section to explain OIT program design but rather to simply provide some basic guideline information.

To choose an OIT you must understand what the intent is. It more likely than not is going to be to allow the user to modify some S200 PN settings. Whichever OIT is chosen the screen capability and keypad must be sufficient to allow those adjustments. Beyond this, the only requirements for an OIT are basic. First, there must be some method to provide the required RS232 physical layer protocol at 9600, 19.2k, or 38.4k baud rates. Next, it must support Modbus RTU communications in both long-integer (32 Bit) and floating point formats. Often times it is convenient to choose an OIT device that has capability to perform simple arithmetic functions so that units can be adjusted between what the machine operator may want and what the S200 PN requires.

## **5.15 AS A CAN BUS PERIPHERAL**

The S200 PN offers resident CAN bus port. It is normally configured to use a protocol called CANopen but is available with a DeviceNet option. Each protocol requires a lot of documentation to explain and is available in auxiliary support documents. The protocols include physical and application layer details and are not explained here.

There are different ways of approaching a field bus system design. On the simple side the S200 PN can be pre-configured using the S200 OC Tools GUI and the field bus can be used to execute moves, modify move data, and keep a pulse on system status. A more complex system may rely on no previous setups by the user and rely on all drive data settings to be configured over the CANbus.

There are a few points worth mentioning on this topic in this document. First, there is only one set of address switches on the S200 PN; S12 and S13 providing 1-of-100 address possibilities. Whatever the CANbus address is so will be the Modbus address and vice-versa. Baud rate choices are available – see the section on DIP switch settings. More important to this topic is the idea of drive enable.

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The S200 PN has a dedicated hardware enable input. There a software enable. TO get power to the power stage, and motor, both must be enabled. The S200 has the ability to allow the user to set the default state of the software enable at power up. A variable named AENA (Auto Enable) defaults to '1' (Logic true) when the drive is set to factory default values. The user can modify the state of this variable (Auto enable = 0) to allow the drive to not software enable at power up. This feature is most often used with field bus controllers. Most system designers will choose when to enable the drive over the serial port versus the hardware input. The hardware input is still required to be active but may be hard-wired on or placed in some machine safety chain.

## **5.16 RAMP CONTROL**

Ramp control refers the acceleration (accel) and deceleration (decal) rates the motor will have. The S200 PN has many settings for ramp control. Each motion task can be defined with its own accel and decal rates. Homing can be set to have its own accel and decal rate. And a Stop, or Emergency Stop command can have its own deceleration rate. All velocity moves, such as Digital Velocity mode and Jogs use the accel and decel settings established for the homing procedure.

## **5.17 REVERSING DIRECTION**

Occasionally the system may be better served if the direction of motor operation was reversed. This makes sense when the machine operator thinks in positive numbers but the desired direction would take negative numbers. Although direction change is not directly supported in the GUI it is possible to reverse the direction using the Online Variable Editor. The DIR variable is normally set to a value of 21 by default. Modifying the value to 0 will change the direction of reference for Motion Tasking moves. Reference change only affects the position loop data. CW/CCW inhibits and jogs stay referenced to CW/CCW always.

## **5.18 CONTROL LOOPS**

**Current Loop:** The S200 Position Node closes the current loop at 1.6 MHz for extremely good performance. The current loop is automatically tuned after receiving the motor inductance value. No further adjustments are required.

**Velocity Loop:** The S200 Position Node closes the velocity loop at the rate of 16kHz allowing extremely good velocity loop control with very little phase lag.

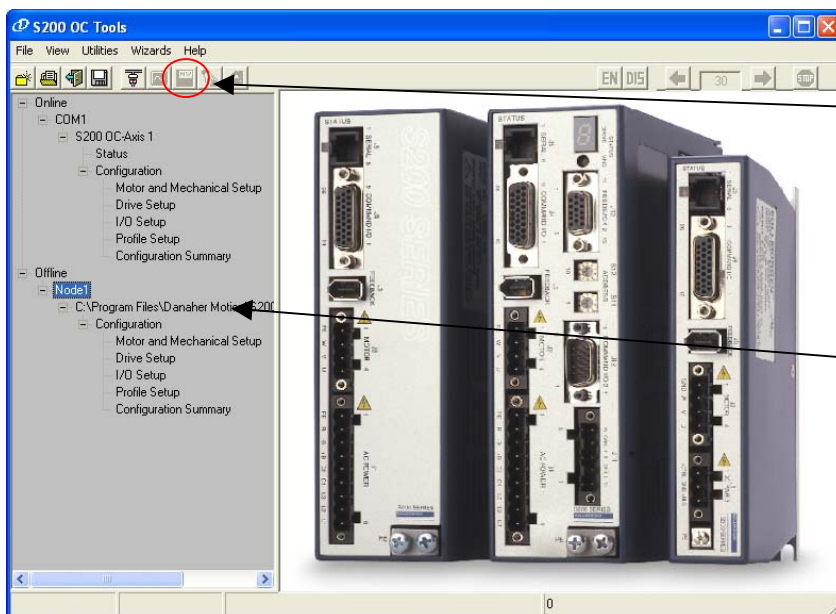
**Position Loop:** The S200 Position Node closes the Potion Loop at the rate of 4 kHz allowing extremely good performance.

## **5.19 FAULT DETECTION NOTES**

The S200 Position Node has internal fault diagnostics. Many are self-explanatory and the last section in this document provides information about the faults. In general it is often times better to trap faults that occur. The S200 Position Node defaults to disable under voltage detection. The user is advised to set the under voltage detection level to a reasonable level.

## 5.20 CONFIGURING DRIVE FROM EXISTING FILE

It is often desirable to configure a drive exactly like another one. This is often the case when reproducing a machine design or changing out a drive on an existing machine. S200 OC TOOLS User Interface Software is used to configure the connected drive. The file must first be loaded into S200 OC TOOLS by using the file menu 'File / Open'. Locate and select the desired configuration file. It will be loaded into S200 OC TOOLS 'folder- side' as though there was a second drive talking to the software noted as 'Off Line'. The tree structure will show the file as 'Offline' and normally as Node1. The full filename, with path, will be under Node 1. Select this filename with a single click of the left mouse button. The file can be sent to the connected drive by a right-click of the mouse button and selecting 'Download offline Configuration to an Online drive. Save the configuration to Non Volatile memory.



Save configuration to Non-Volatile Memory. (Drive must be selected to have this function available).

Right-Click on Node 1 and select Download Off Line Configuration to On Line Drive.

## 5.21 USING MOTORS NOT IN THE DATABASE.

The S200 Position Node requires information about the motor connected to it. When applied to a motor with an SFD that information is automatically transferred to the drive from the SFD and nothing more need be done. There are times when this is inappropriate or not even possible. For these situations the S200 OC Tools allows the user to enter his own data. This is required anytime the S200 Position Node is set to 'Do Not Use SFD Parameters'.



## NOTE

Selecting a non-SFD motor automatically sets a related setting: Use SFD Parameters (Under Drive Setup Menu) to 'Do Not Use SFD Parameters'. Should the user go back to using an SFD supported motor the 'Use SFD Parameters' setting is not automatically changed and should be changed by the user.

When the SFD parameters are not to be used the user must select the motor under the Motor Setup menu. If the motor is not present in the motor data base the user must enter it into the database. The Utilities Menu \ Motor Database editor is used. Run the database editor, Select 'New Motor', fill out the data sheet, press 'Add' and exit. The new motor will appear as a choice in the Motor Selection Combo box.

**Motor Database Editor**

Motor Name	<input type="text"/>	Motor Type	<input type="text" value="Rotary"/>		
Ke	<input type="text"/>	Vrms/krpm	Pole Pairs	<input type="text"/>	
Kt	<input type="text"/>	N-m/Arms	Ics	<input type="text"/>	Arms
Inertia	<input type="text"/>	kg-cm2	Ipeak	<input type="text"/>	Arms
Inductance	<input type="text"/>	mH	Thermal Time	<input type="text"/>	min
Resistance	<input type="text"/>	Ohms	Max Bus Voltage	<input type="text"/>	V
		Comm Offset	<input type="text"/>	degrees	

To be clear, the above table represents the data stored in an SFD device. If 'Do Not Use SFD Parameters' is selected in the Drive Setup screen the customer's entered data will be used. If 'Use SFD Parameters' is selected this data will be over-written with the data in the SFD.



## 5.22 I<sup>2</sup>T FOLDBACK

The S200 incorporates an RMS output current protection algorithms sometimes called Foldback or I<sup>2</sup>t (I-squared-t). There are two algorithms; One to protect the motor and one to protect the drive. The purpose of the Foldback algorithm is to prevent excessive rms current from being delivered which could cause damage to the motor or the drive.

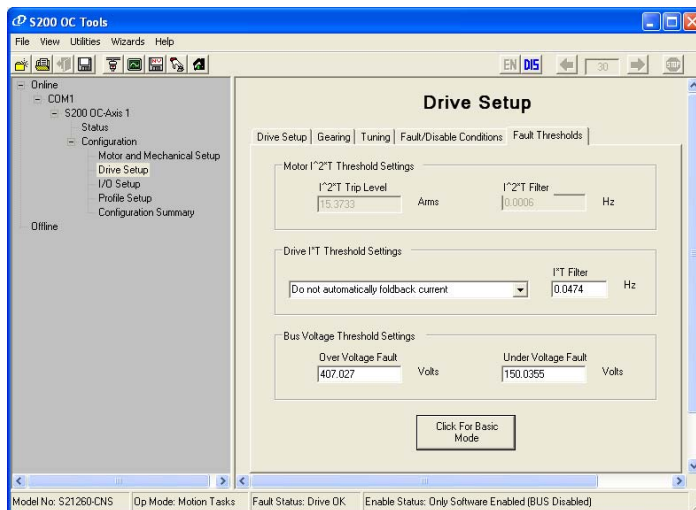
The motor's I<sup>2</sup>T Filter sets the break frequency in Hz for the I<sup>2</sup>T filter used to protect the motor from transient thermal overload caused by very high peak currents compared to the motor's continuous current capability. Typically set to between 4 and 10 times faster than the motor's bulk thermal time constant published in the data sheet. Given a desired time constant set the I<sup>2</sup>T Filer (I2TF0) value to:

$$I2TF0 = 1/[(2\pi) * (\text{Motor Thermal Time Constant in sec})]$$

The user can lower the value but not raise it above this calculation.

The I<sup>2</sup>T algorithm monitors the current delivered over time. In the event that the RMS value is exceeded the S200 Position Node will take action. The Drive I<sup>2</sup>T condition can be configured to take one-of-two actions. First, and by default, the I<sup>2</sup>T detection will shut down the drive and announce the fault condition. An F20b03 on the 7-Segment display while the Base Unit Led will flash a code of 3 for Drive exceeded ratings. For the Motor I<sup>2</sup>T a code of F20b04 will be on the 7-segment display while the base unit will flash a code of 4. Alternately, the user can configure the action to be a reduction in output current versus an actual fault. Under this condition the drive will automatically clamp the current level of 2/3 DiPeak. It may be obvious that if the current limits are not set to greater than 67% there can never be an I<sup>2</sup>T fault.

This can be configured in the Drive Setup\Fault Thresholds tab.



### NOTE

Version 2.0.2 and early S200 OC Tools is recognized to have an error in its construction. The Drive I<sup>2</sup>T should not be configurable by the user while the Motor I<sup>2</sup>t should be. The GUI is reverse. Please do not change the Drive I<sup>2</sup>t Filter value. A new GUI will be posted at Kollmorgen.com with the fix.

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## 6.0 SWITCH SETTINGS

The S200 Position Node has 5 switches that can be adjusted for the user to configure functions. Each is described in this section. All switches are read at power-up only. Changing of a switch setting requires power cycling to have the new setting take effect.

**Switch Number: S1**

Location: Top of Product

Type: 10-Position Rotary Switch

Function: Set Encoder Equivalent Output Resolution

S1	
Position	Encoder Pulse / Revolution
0	Defined by S200 OC Tools
1	512 Lines Per Rev
2	1000 Lines Per Rev
3	1024 Lines Per Rev
4	2000 Lines Per Rev
5	2048 Lines Per Rev
6	4096 Lines Per Rev
7	5000 Lines Per Rev
8	8192 Lines Per Rev
9	10,000 Lines Per Rev

**Switch Number: S2**

Location: Top of Product

Switch Type: 4 Position Piano Switch

Function: No function: All switches should be down

**Switch Number: S11**

Location Front of Product

Switch Type: 10-Position Rotary

Function: Sets the LS part of Modbus, CANopen or DeviceNet communication address. Used in conjunction with S12 allows address to be 0-99. Must be '2' for firmware download.

**Switch Number: S12**

Location Front of Product

Switch Type: 10-Position Rotary

Function: Sets the MS part of Modbus, CANopen or DeviceNet communication address. Used in conjunction with S11 allows address to be 0-99. Must be '0' for firmware download.

**Switch Number: S13**

Location: Top of Product

Switch Type: 4-Position Rotary

Function: According to table below, CAN bus baud rate.

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<b>S13 Switch Functions</b>
S13-1 Can Baud Rate Select 1
S13-2 Can Baud Rate Select 2
S13-3 Up: Odd Parity, Down is Even Parity on RS232
S13-4 Flash Protect: Keep Up until firmware download procedure requests change

CAN bus baud rate is established according to the following switch settings:

<b>CAN baud Rate</b>	<b>S13-1</b>	<b>S13-2</b>
125 kbps	Down	Down
250 kbps	Up	Down
500 kbps	Down	Up
1 Mbps	Up	Up

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## 7.0 SETUP SOFTWARE

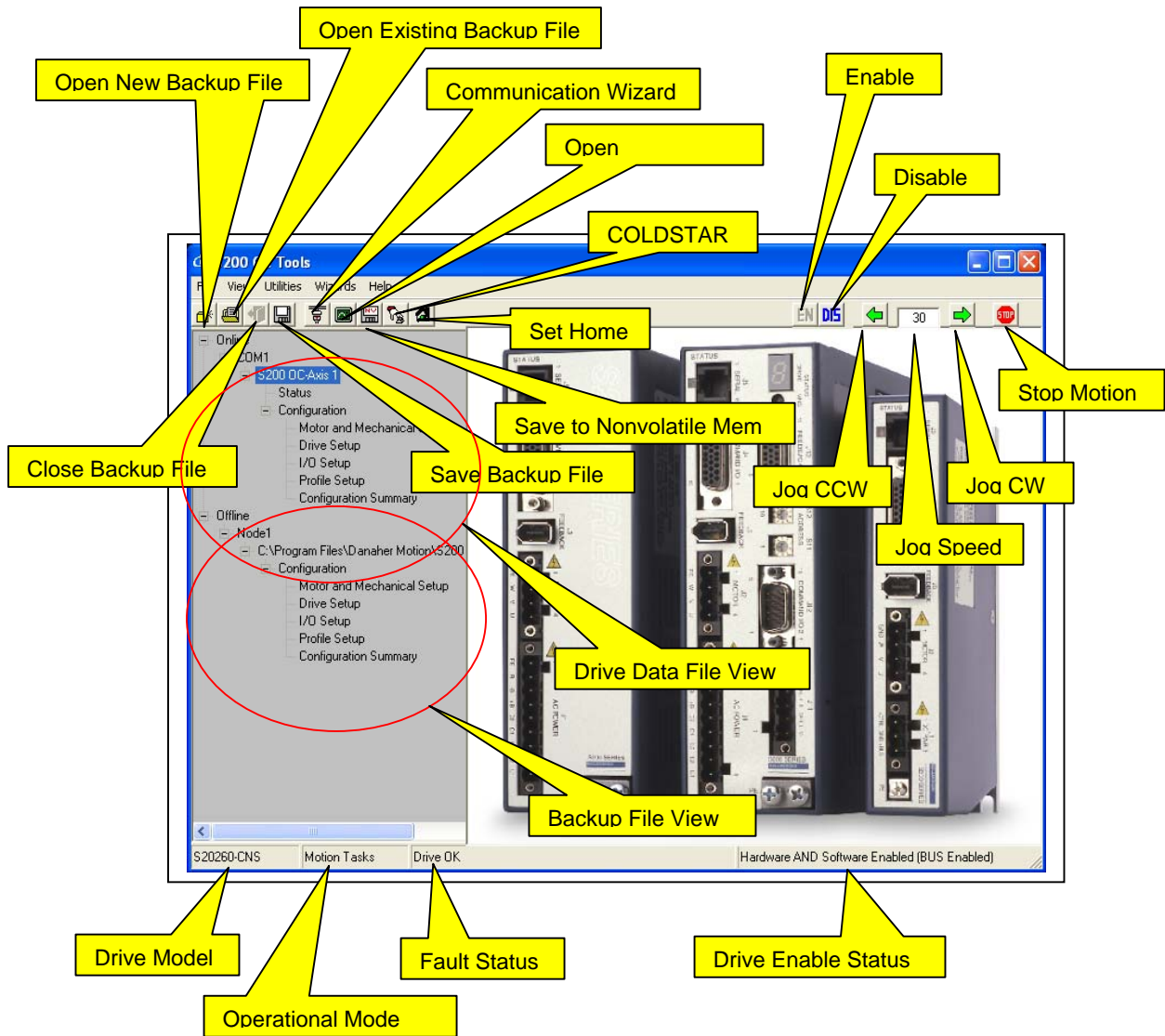
The User Interface software package is called S200 OC TOOLS. Begin by installing the **S200OCTools** software. Follow the prompts. Once the software is installed, connect the computer's RS232 port to the wired and powered drive and motor. Double-click on the S200OCTools icon to open the software. The software, when opened for the first time, will automatically invoke a startup wizard that will take the user through a guided setup tour meant to bring attention to some of the basic setup requirements. The wizard can be defeated by checking the 'Do not show this wizard again' box. It can be invoked anytime using the 'Utilities / Full Setup Configuration Utility' menu bar. While there are many options this section of the manual will guide the reader through some basic setup parameters. After going through this section the software should be easy to understand and the drive ready to run. The user should be comfortable enough to proceed without further guidance.

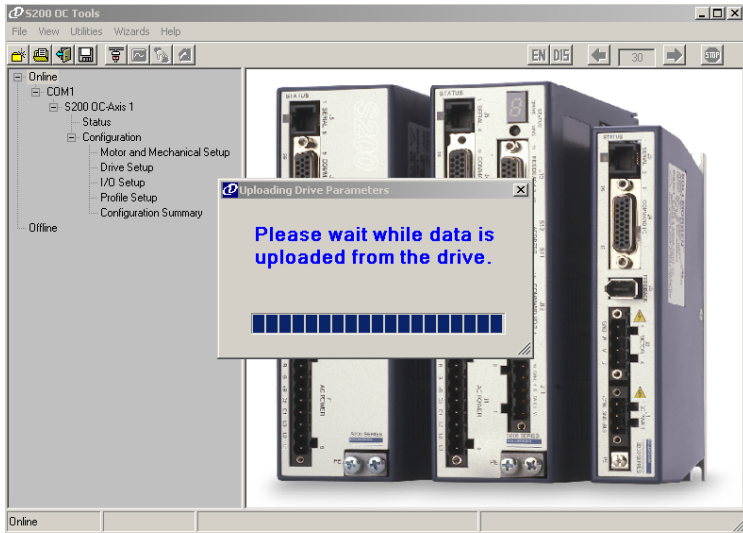


It is important to understand that any change made to the drive is not saved in non-volatile memory until the NVSAVE function is executed either through the Utilities Menu or the NV save button

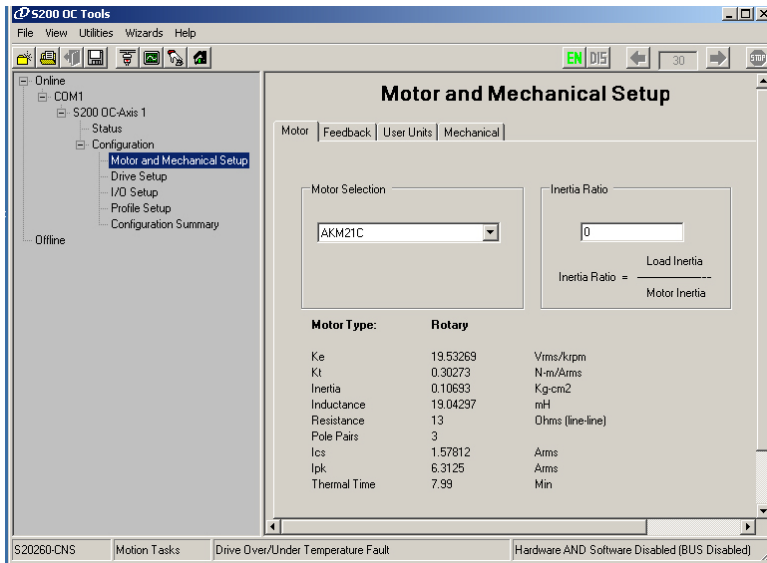
## 7.1 BASIC GUI DESCRIPTION

The left-side of the screen is the 'Folder-side'. The folder side shows what drives is connected and any open backup files. Some until the drive is selected by clicking on the appropriate folder.

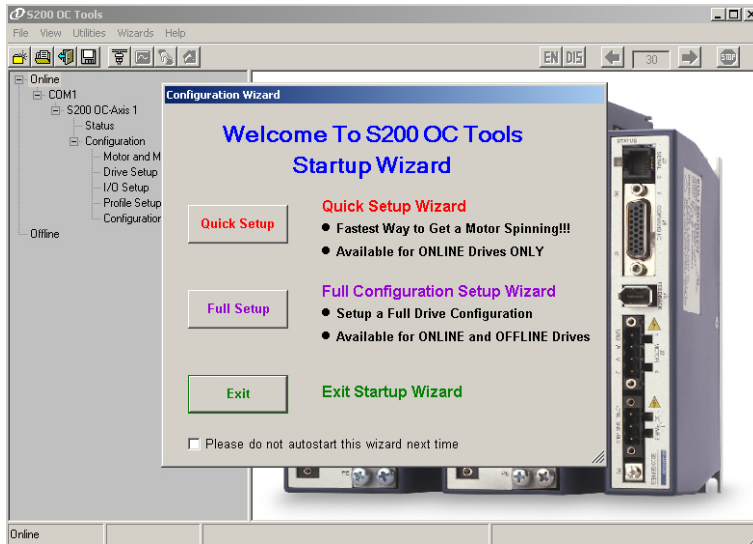




Once invoked, S200 OC TOOLS will need to retrieve the data from the drive. If no drive is connected S200 OCTOOLS cannot be navigated unless you open an existing drive back up file to work offline.

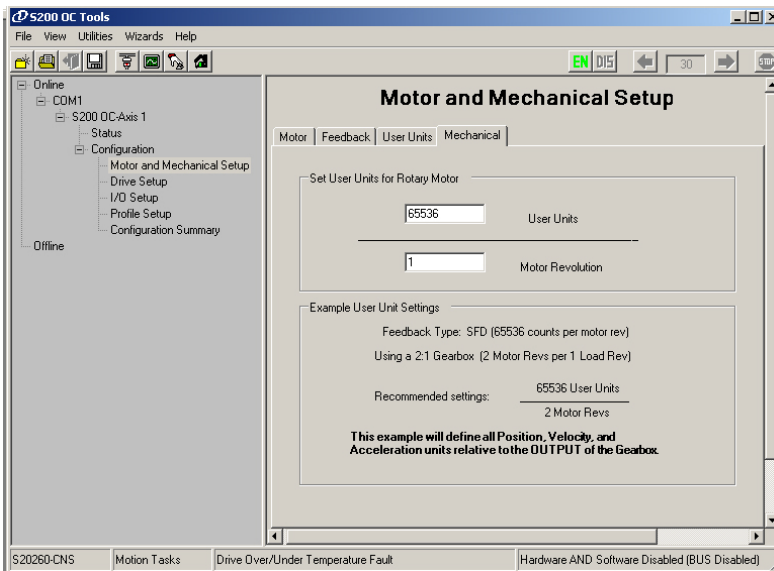


Once the data upload is complete, the wizard screen will appear. (Or can be invoked using 'Utilities / Full Setup Configuration Utility' The wizard will guide you through the necessarily steps to complete the drive configuration.

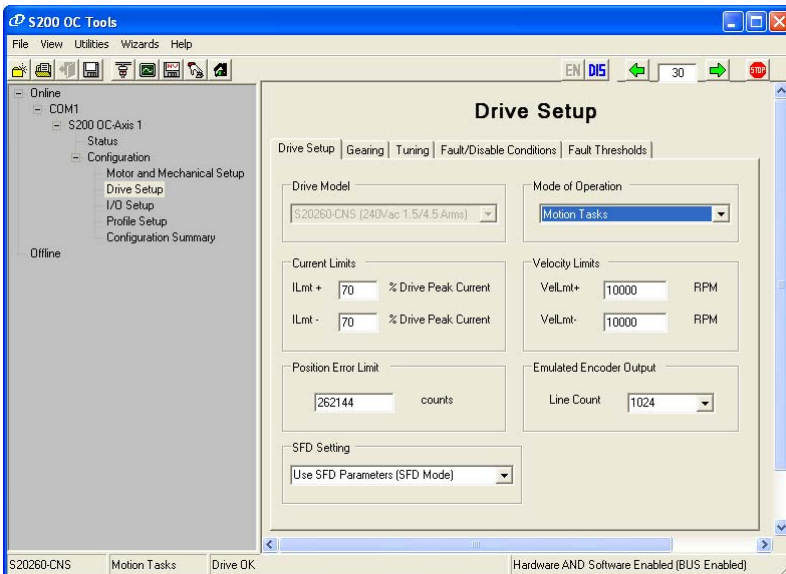


The first step is to confirm that the drive is configured for the motor being used. This information is automatically gathered from a system using an 'SFD-Equipped' AKM-Series motor.

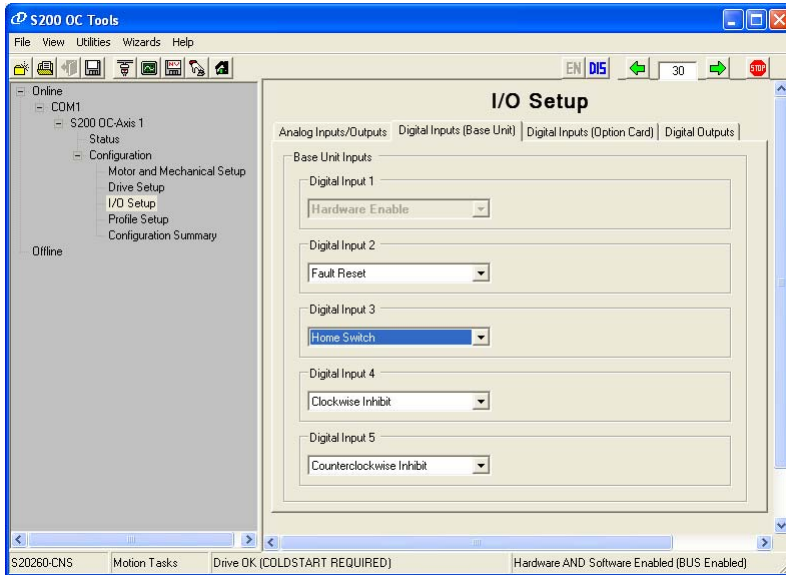
This system is using an AKM21C motor with SFD. Enter the load-to-motor inertia ratio. You can set the Inertia Ratio or select a different motor.



The user can elect to set the drive up to use customized position units. Set the desired mechanical user units by clicking on the Mechanical tab. Specify how many units per motor revolution. Here we have the drive set up for 65536 counts per motor revolution.

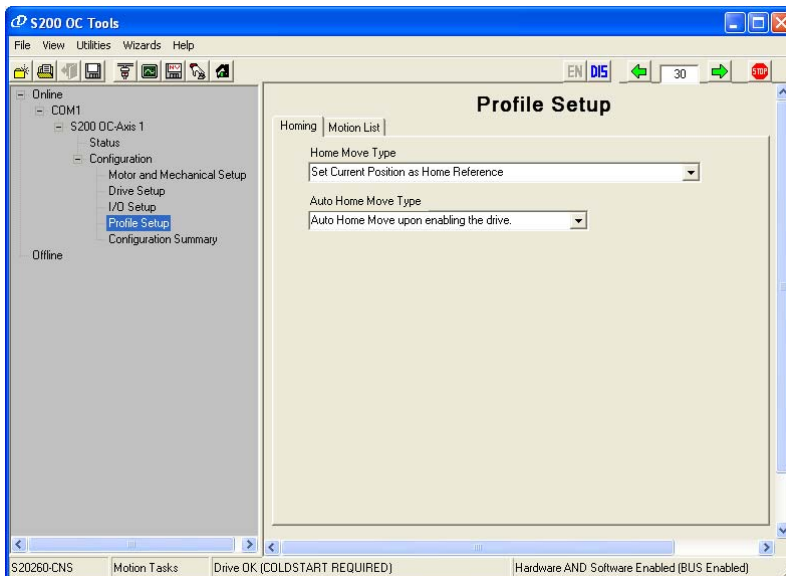


The Drive Setup tab is where the drive's mode of operation is set for Digital Velocity, Electronic Gearing or Motion tasks. This example has selected Motion Tasks that will allow indexing and absolute positioning. Additional boxes and tabs for gearing, tuning, faults, and thresholds and other system limits should be explored.



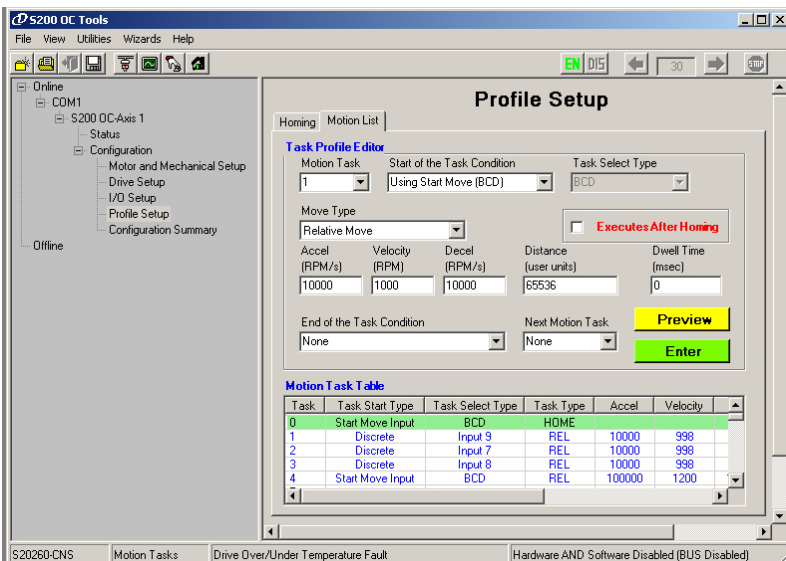
The I/O Setup tabs provide an easy and convenient way to link inputs and outputs to execute moves and report status. Not all inputs can serve all functions. Pull down the menus and browse around. Set up inputs for both the base unit and the option card functions.

**Note: When inputs are changed a ColdStart is required.**



The Profile Setup menu allows you to set homing and motion tasks. This screen shows a handy method to set home when the system doesn't really need to have a home reference. Homing always has to be done. Shown above is a method to home without ever having to know that you homed. You can not change motion task 0. It follows then that executing a BCD code of 0 executes a homing routine.

For systems requiring homing to a switch there are options to simply find the switch and stop or to find the switch, stop, and move back to home.



Set up motion tasks as required. Motion task 0 will always be a homing routine. The task number is the binary code if BCD select is used. See section 4 about more information on inputs and move types.



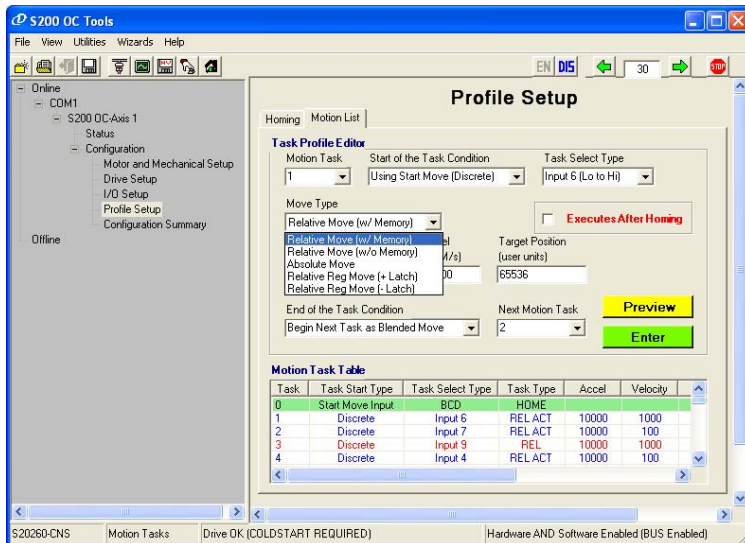
End of Task condition can be a blended move. A Blended move concatenates two moves together without having to go to zero speed to begin the second move. The actual index distance will be the sum of the blended move distances. Distance move is based on actual motor position, not commanded motor position.

Next Motion Task can set the motion task that will be blended to the present move (if blended move is selected) or can be used to automatically start another move without the need for an additional input signal; the 'next motion task' will be executed upon completion of the present move. A 'Next Motion Task' of 'none' places a '0' in the table but does not mean to execute a home (motion task 0); it is interpreted as 'do nothing'. An In-Position output will not come on until all moves are complete.

A Dwell Time can be added which occurs at the end of the move. The dwell time's purpose is to add a delay to moves linked with Next Motion Task (not blended moves). If there is no Next Motion Task then the dwell timer performs no function.

The check box 'Executes after home' is simply a means of making an equivalent function of 'Next Motion Task' after 'Homing' available. (There is no other way to do that since you can not directly edit Motion Task 0).

Coldstart is a process whereby the firmware generates custom internal code (compiles) for extremely fast execution. It is good practice to hit the Coldstart button after changing motion tasks and I/O assignments. Without it you may get results that indicate that your changes did not take affect.

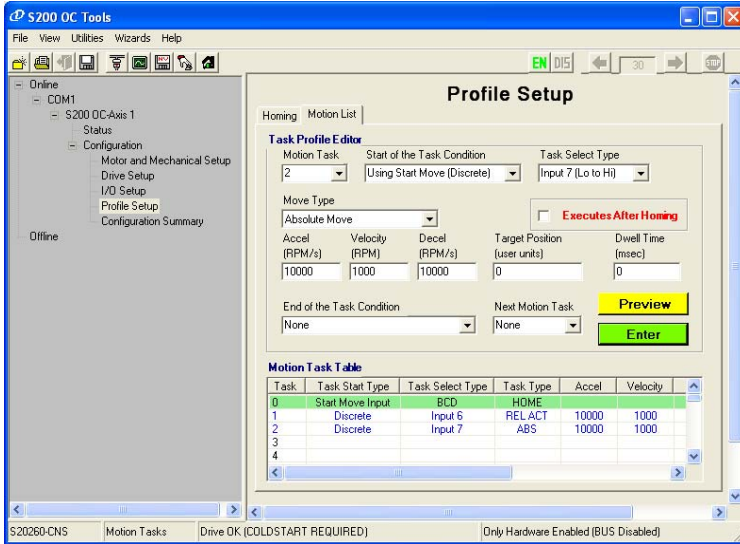


Move types include:  
Relative move with Memory: When indexing (relative moves) an early termination of prior moves is remembered. Choosing this Move Type calculates the next move distance as the sum of the entered move distance PLUS the distance that did not get made in earlier moves due to early termination of the index.

Relative Move Without Memory: When indexing (relative moves) this input cause the index distance in the associated motion task to be executed. There is no reference to earlier lost motion.

Absolute Move: Moves to an absolute position relative to the home location.

Relative Registration Moves: Index length can be 'trimmed' by registration input signal.



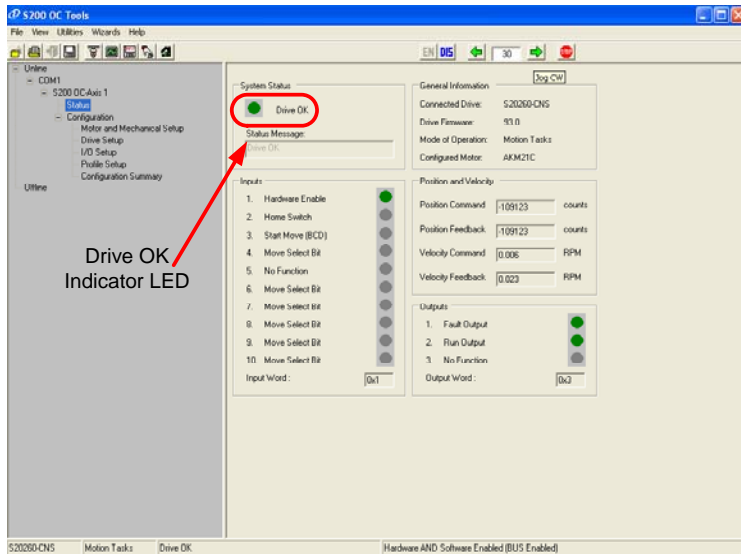
For demonstration purposes; the system shown on the left will index one motor turn (User Units are set to 65536 counts per rev) each time input 6 is turned on. Input 7 will cause the motor to turn back to its original locations.

Always remember to hit the Save to Non-volatile memory to save your configuration.

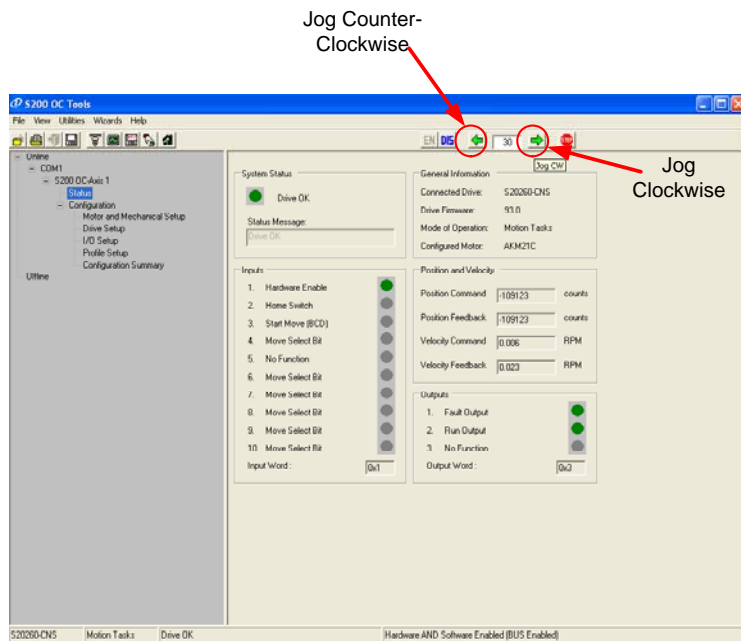
## 7.2 SYSTEM TOOLS

### 7.2.1 Status Screen

The Status screen can be helpful to understand system operation. Drive Status should read 'OK'. If not then a meaningful fault code will be shown. General information about drive size and firmware version is shown.



Energizing a drive input causes the green 'Virtual LED' to illuminate. If an output is on then it's Virtual LED will illuminate. Position and velocity information can be monitored.

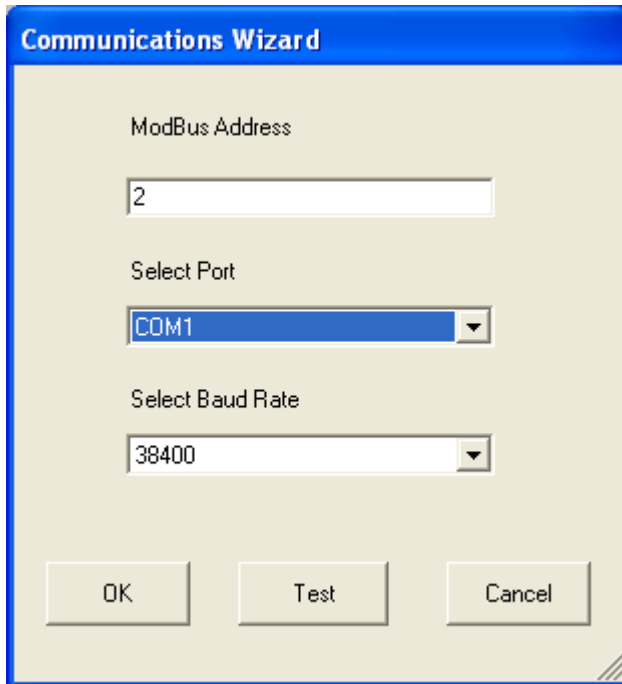


If the system is safe to accept motion then the motor can be jogged from the status screen.

---

## 7.2.2 Communication Wizard

A communications wizard can be found under the Utilities menu. This allows you to select the RS232 communications port for the computer, Modbus address of the unit to communicate to (S11 And S12), and the baud rate (Default to 38400). A simple test of communications. Other port parameters are automatically set by S200 OC TOOLS.



The screenshot shows a dialog box titled "Communications Wizard" with a blue header. It contains three input fields: "ModBus Address" with the value "2", "Select Port" with a dropdown menu showing "COM1", and "Select Baud Rate" with a dropdown menu showing "38400". At the bottom, there are three buttons: "OK", "Test", and "Cancel".

## 7.2.3 Mouse Flags

Hovering the mouse pointer over data locations on the GUI will cause the name of the associated variable to show. The Variable browser or On-Line Variable editor can then be used with knowledge of the association.

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## 7.2.4 Variable Editor

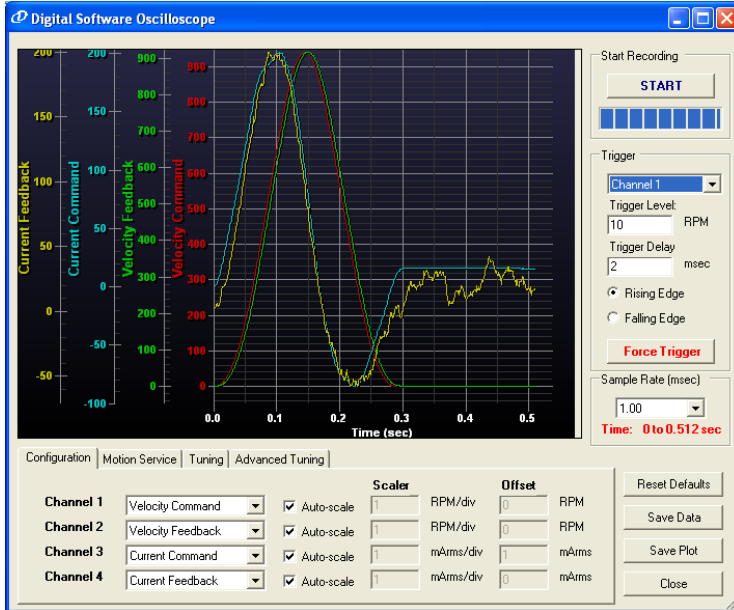
Although the variables available in the S200 Position Node product are not well documented there may be a reason that a user wants to view or change them. The Utilities/Edit Variables On-Line tool brings up this box which can be used to monitor or modify up to 8 variables at a time.

The screenshot shows a dialog box titled "Online Variable Editor" with a blue header. It contains eight rows of variable editing controls. Each row consists of a dropdown menu for the variable name, a text input field for the current value, and a "Change" button. At the bottom of the dialog are two buttons: "STOP POLLING" and "Close".

Variable Name	Current Value	Action
AVGTIME	0	Change
Position.Command	131092	Change
CURRENT.COMMAND	0.024669 Arms	Change
ACTFAULT	1	Change
STATUS	0xa00	Change
ACCR	300000	Change
DECR	300000	Change
STAT	0x460	Change

Buttons at the bottom: **STOP POLLING** and **Close**

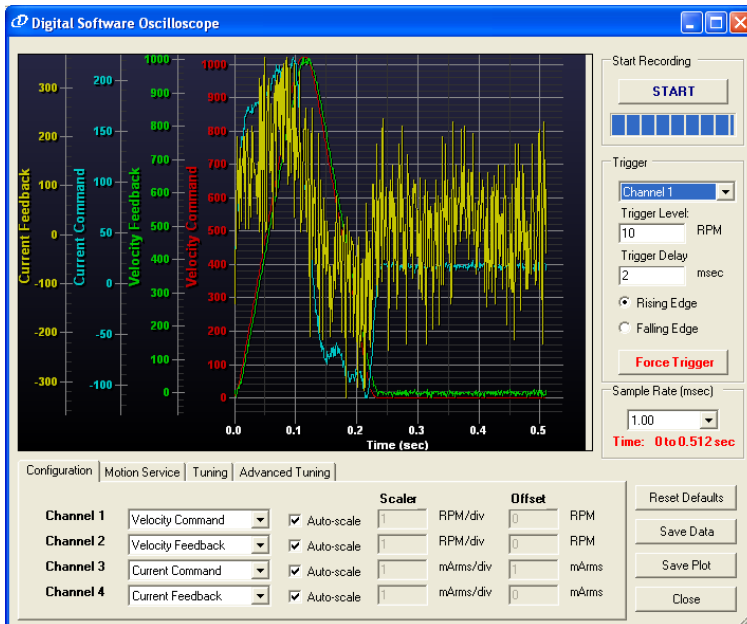
## 7.2.5 Digital Oscilloscope



plot to the left has AVGTIME set to 64.

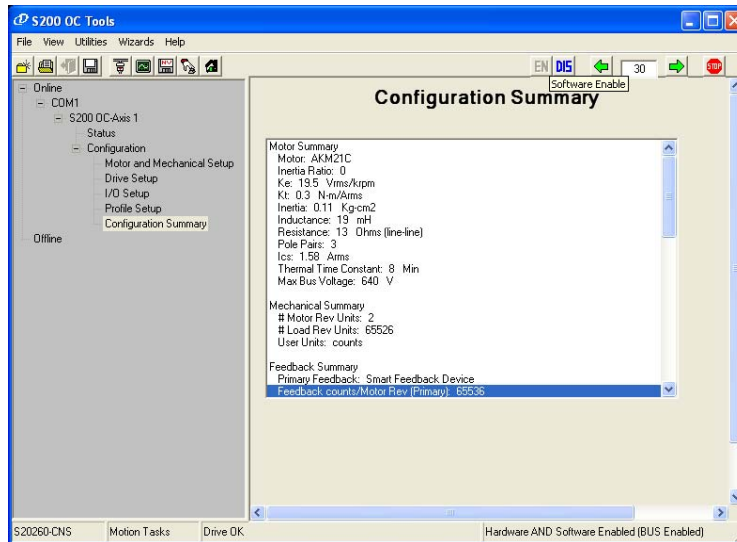
Up to 4 channels of data can be recorded simultaneously. Set the channels for the desired data, the sample rate for an appropriate buffer size, and a trigger level suitable for the capture. Press Start. The scope data plots will be presented after the trigger occurs. It is important to note that each plot has an independent vertical axis scalar.

A variable called AVGTIME can be changed using the above-mentioned variable editor. AVGTIME will allow averaging of data to make it more presentable form. The



The plot to the left has AVGTIME set to 0. The effect of having AVGTIME set to a value is smoothing but setting AVGTIME to a large number can sometimes prevent the data from showing proper detail and relationship – as any low pass filter would. AVGTIME is the number of reads summed in the average calculation.

## 7.2.6 Configuration Summary Screen



The configuration Summary screen allows the user to see all the drive settings in one location without having to navigate through each possible GUI menu.

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## 8.0 TROUBLESHOOTING

This section provides tips on some common problems that may occur when trying to get the S200 Position Node up and running.

### 8.1 DRIVE WILL NOT COMMUNICATE WITH GUI

Communications problems are usually set-up issues. If we assume that the drive is connected to the computer's RS232 port correctly then there are some obvious reasons for communication problems:

#### 8.1.1 Device Address

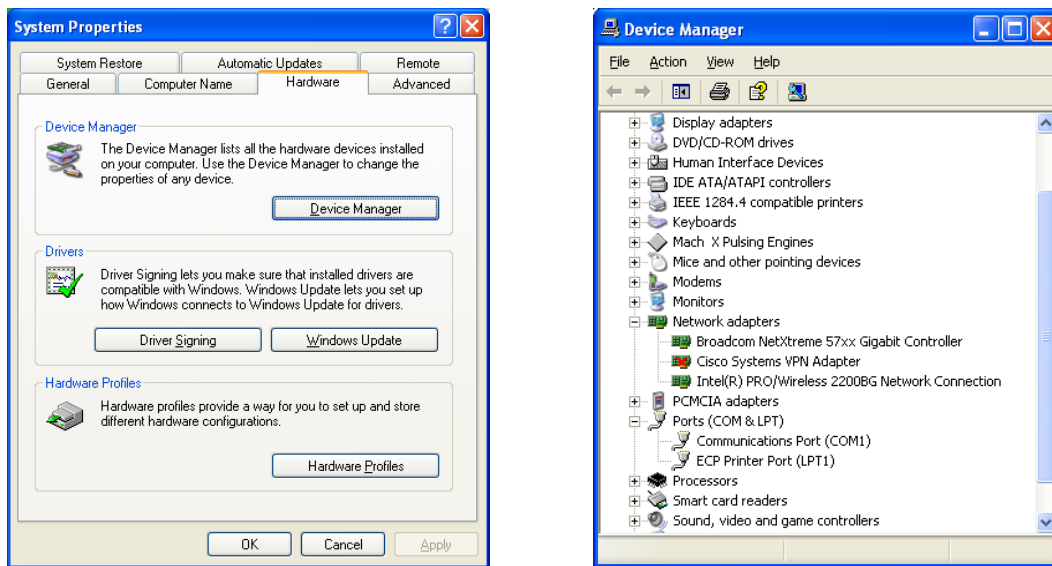
The rotary dip switches on the front of the S200 Position Node set the address of the S200 PN. Switch 12 and 13 are the MS and LS address settings – 0 through 99, respectively. The Communication Wizard in the S200 OC Tools GUI program has an address setting of the device it is supposed to talk to. These two settings must match.

#### 8.1.2 Baud Rate

The serial communication baud rate of the computer must match the serial communication baud rate of the drive. The drive defaults to 38,400 baud. Be sure the GUI is set for this. If the baud rate of the drive was changed to 19,200 or 9600 baud then the only way to determine this is to try to set the GUI for these rates and see if it will communicate.

#### 8.1.3 COM Port

The Communication Wizard will allow the user to direct the GUI to use a particular com port on the computer. This Wizard allows the user to set COM1-COM5 but it does not check if these ports are actually available. To see what ports are available on the computer look at the computer operating system under System Properties / Hardware/Device Manager: On XP systems you can right click on the My Computer Icon and select properties.



This computer only has 1 com port – COM1.



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### **8.1.4 Parity Setting**

Dip switch S13-3 sets the drive parity. It should be in the up position for operation with S200 OC Tools.

## **8.2 MISCELLANEOUS PROBLEMS**

This section contains information about more common issues that users have experienced in the past.

### **8.2.1 Changes in settings don't take affect**

The drive requires a COLDSTART. Changing motion or I/O assignments without doing a COLDSTART (Saying 'No' to the pop-up box) will not re-compile the changes and make it look like your changes did nothing.

### **8.2.2 Motor Settings Seem Incorrect**

When using AKM Motors with the SFD feedback please check the drive setup screen to be sure that the selection 'Use SFD Parameters' is selected. This box automatically gets unchecked when setting the feedback for incremental encoders but does not get reset when you select SFD as the feedback device.

### **8.2.3 Can't modify motor parameters**

If motor name-plate parameters need to be changed then you must use the Motor Database Editor to create and name a new motor. If the motor has an SFD be sure to go to the drive setup screen and set the drive for 'Do Not Use SFD Parameters'.

### **8.2.4 Motor appears to move more than the Motion Task Setting**

As stated in this manual, using 'Start Move – Level' or Start Move BCD (Will have a –Level appendix in the future versions) as motion execution input types is subject to issues with switch contact bounce. This problem is caused either by that or slipping couplings on the motor shaft.

### **8.2.5 Motor Moves Upon Drive Enable**

In the Profile Setup Tab under Homing there is the option to have 'Auto Home upon Enable' this feature is activated.

### **8.2.6 Outputs are always on**

The Outputs will show off in the Status Screen but the load is always on. The outputs are 'uncommitted' meaning that they have both the collector and emitter of an opto coupler device for field wiring. The polarity of these outputs is wired incorrectly and the back-diode on the opto coupler is driving the load. Reverse the polarity of the wiring.

### **8.2.7 In Position Output is unreliable**

The In Position output uses the actual motor position compared to the commanded motor target position +/- an allowable window. This allowable wind is adjustable in the Digital Output screen under I/O Setup. The motor is not coming to the correct position. The user can widen the window, increase the position loop gain or integrator, or the load may have too much friction for the gain settings to come into position.

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### **8.2.8 The Display shows an 'I'**

The display 'I'dle indicator means that there is no core program executing in the S200 Position Node. There are two ways that this can happen: Switch S13-4 is down or an error occurred in the firmware download. If S13-4 is in the correct position then please contact customer support for further instructions.

### **8.2.9 Firmware Will Not Load**

S200 OC Tools version 2.0.0 has a known shortcoming where the Firmware Download code initializes the COM port to 38,400 Baud. This problem is most likely to occur as a result of a Baud Rate change in the drive. You must reset the drive (RS232.BAUDRATE) to 38400, do an NV Save and power cycle the drive.

Also, GUI Versions up to and including 2.0.x will not support firmware download from a drive whose root directory is write-protected. To overcome this, place the firmware to be downloaded on the local hard drive.

### **8.2.10 Communication 'MNS' LED is Red**

The MNS LED becomes a steady red when a DeviceNet unit (-DNS Suffix) is not connected to an active DeviceNet bus.

### **8.2.11 GUI Reports 'Communication Lost'**

This problem exhibited itself with S200 OC Tools prior to version 2.0.0. Please go to [Danahermotion.com](http://Danahermotion.com) and download a newer version.

### **8.2.12 I/O Is not functioning**

The Status screen on the GUI has emulated LEDs showing the status of each input and can be used to debug I/O wiring. An external supply voltage is required and the inputs must see current flow to be on. Check field wiring.

### **8.2.13 Scope Traces seem incorrect**

GUI Versions up to, and including, 2.0.0 plot independent 'Y' Axis variables. We have had issues with some customers miss-interpreting the data due to multiple Y-axis scales.

### **8.2.14 System is Noisy**

Although this problem can occur as the result of tuning the gains too high the S200 Position Node does exhibit some current loop hash noise. This is normal and does not affect operation. Check user-settable gains.

### **8.2.15 Fault Output does not capture all faults**

This shortcoming existed in firmware versions prior to 2.0.0. Please upgrade the firmware.

---

## 8.3 COMMON ERROR CODE NODES

Although the following tables describe common error codes it is worth noting a few here in more detail.

### 8.3.1 F20n031

This warning occurs after new firmware is loaded into the drive. It is merely an announcement that the firmware has been changed and that the user is strongly advised to reload the configuration file into the drive as the non-volatile memory may be corrupt. The only way to get rid of this error is to cycle power – it is a one-shot warning to the user.

### 8.3.2 F09

This is a non-volatile memory checksum error and is common after loading new firmware. The user is advised to 'Reset to Factory Defaults', Save, Coldstart, and then load his configuration file, Save and Coldstart again.

### 8.3.3 n10 and n11

These two warnings are announcing that either the CW or CCW end travel limits are inactive. These two inputs are fail-safe. This means that the input must be ON to signal that there is no over travel limit. All motion in the associated direction of travel will be suppressed while this warning is displayed. If need be – the user can reassign the associated digital input to 'No Function' to work around temporary issues and inconveniences.

## 8.4 FAULTS AND ERRORS

The S200 Position Node product has internal fault and error monitoring systems. Constructed of a base-unit drive and a position controller board the product actually has two monitoring systems and three annunciation systems. The Base Unit is the drive-portion of the product and is an S200 Series AC Motor Drive with a single green status LED that signals status of the base unit. The position controller card has a seven segment status display used to indicate faults. Finally, the CAN bus firmware has access to a separate MNS bi-color LED to signal bus status. This section provides information about these 3 status indicators, the faults they represent, the conditions that can cause the faults, and how to recover from the faults.

Faults can occur with primary detection by the drive base-unit. These faults are called 'b-faults' ('b' is for Base Unit'). Faults that are primarily detected by the position controller card are called 'F-faults' ('F' for fault') or 'o-faults' (letter O). Base unit errors are detected by the position controller card and become F20 faults by definition. The position controller card annunciates these with an 'F20' in the seven segment display followed by the 'b-code' (base unit) fault. The user interface software, S200 OC Tools, displays drive status information on the Status Menu real-time. The status block will indicate both a Position Card Fault and the Base-unit fault, if applicable.

### 8.4.1 MNS LED Status Indicator

The MNS status indicator's function operates differently on CANopen units (-CNS) than on DeviceNet Units (-DNS). For Device Net it is guided by the rules and definitions of the DeviceNet interface standards.

<b>MNS LED State indicator Table for CNS product</b>		
LED state	Bus Communication State	Indication
OFF	Off-line	Drive not on line
Solid RED	Failed	Critical failure on drive or Communication failure (bus off) Drive may need to be replaced.
Solid Green	Drive is enabled.	Drive is enabled, no fault on Bus
Blinking RED	Faulted	The drive has faulted or a time out has occurred.
Blinking Green	Drive Disabled	Drive is disabled, no bus fault

### 8.4.2 Base Unit Status LED

The green status LED on the Base Unit will flash at a constant (2 times per second) rate if the drive is disabled and there is no base-unit fault condition. The green status LED will remain illuminated if the drive is enabled and there is no base-unit fault condition. At anytime a base-unit fault condition exists this LED will flash a code. The code is signaled by a 2 second LED off-time followed by a series of flashes. Counting the number of flashes indicates the numerical fault code.

### 8.4.3 7-Segment Display

The 7-segment display is under control of the position loop controller. The decimal point is always on and has no meaning. The display will flash a series of numbers on power-up indicating the drive model number. The display then goes into normal operation. Power-up indicator may flash b-S-2-0-3-6 indicating that the base unit drive model is 'S2036(0 implied)' model. Under normal operation the 7-segment display simply displays a 'd' for disabled without faults or an 'E' for enabled without faults. Anytime that a fault condition is detected by the position controller card the display will flash code sequence. The Status display displays drive state, fault code, or warning condition.

### 8.4.4 Clearing Fault Conditions

There may be several ways to clear any given fault. The tables located below will provide more information directed at explaining the recovery method for a particular fault. There are a couple of guidelines that should be noted. To clear a fault the condition that caused the fault must no longer exist. (i.e.: short circuit of motor leads has been cleared). All faults can be reset with a power cycle of the logic control power. The GUI executing a Coldstart procedure can clear all faults. The product can be configured to have an input serve a 'Clear Fault' input. The Clear Fault input is limited as to what faults it can actually reset. Details of the Clear Fault input are listed in the below tables. Definition of these codes can be found below.

### 8.4.5 Conditional Settings

It is possible that the actions of some 'less fatal' fault conditions have conditional settings configurable within the User Interface Software. The following tables do not explain conditional occurrences rather only the default actions.

### 8.4.6 S200 Position Controller Faults

Table 4.1 lists the S200 Position Controller faults, the action that the drive will take upon sensing the fault condition, and the fault recovery methods allowed. Some of these faults can have multiple source reasons.

Display Error Code	Description of Fault	Drive Action	Reset Method
Fo1	Heat Sink Over Temperature	Drive disable with Fault	Cycle power after heat sink cools down
Fo2	Over Voltage	Drive disable with Fault	This fault is not latched but may cause other faults. Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
Fo4	SFD Error: Short, configuration corrupt, sensor failure, Uart error	Drive disable with Fault	Power Cycle
Fo5	Under Voltage: Bus voltage has sagged below the threshold value	Drive disable with Fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
Fo6	Motor Over Temperature: SFD sensed over temperature	Drive disable with Fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
F08	Over speed motor runs away, speed is too high	Drive disable with Fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
F09	EEPROM Checksum Error: Internal memory corrupt	Drive Disabled with Fault	Drive must be re-configured.
F12	Motor Phase short or open	Drive disable with Fault	Power cycle required.
F15	I <sup>2</sup> t maximum value exceeded (Note: The base unit can report an I <sup>2</sup> T fault as well.)	Drive disable with Fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
F16 – F19	Reserved		
F20	Option Card / Base Unit error	See 'b-faults'	See 'b-faults'
F21 – F23	Reserved		
F24	Warning is displayed as fault. (Advanced note: WMASK determines which warning will cause F24.)	Drive disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
F25	Reserved		
F26	Limit switch error on homing move	No Motion	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
F27 - F31	Reserved		
F32	System software not responding correctly This is internally called System-Panic. It's set	Drive disabled with Fault	Power Cycle Required. Drive should be reconfigured.

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Display Error Code	Description of Fault	Drive Action	Reset Method
	when a severe error occurs during system startup.		
01	Motor over temp (PTC) when using incremental encoder feedback option.	Drive disable with Fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
o02 – o30	Reserved		
F20o31	New Firmware detected. This is a reminder that the user area of the drive memory could be corrupt and should be reset by reloading variables to the drive.	Drive disable with Fault	Power Cycle: Code is a one-shot warning.
o32	User memory checksum error.	Drive disable with Fault	Drive must be 'Reset to Factory Default or have a previously saved setup down loaded to it, followed by Colstart.

## 8.4.7 Extended Fault Information

As stated in the above section the Position Controller fault may come from different sources. A Status word can be viewed using the GUI Utilities/Edit Variables On Line feature. The below table gives the meaning of each bit in the Status word.

Fault Code	Status Bit	Extended fault	Definition
<b>16</b> SFD UART Error	1	SFD UART parity error	The SFD UART received a parity error.
	2	SFD UART overrun error	The SFD UART received a second transfer without reading the first.
	3	SFD UART framing error	SFD UART stop bit was not the correct polarity.
<b>17</b> SFD Comm Error	4	SFD Frame timeout	Indicates that more then 89.6 uSecs has elapsed since last frame was received.
	5	SFD transfer incomplete	Indicates that a transfer started but did not complete in 18.4 microseconds.
	6	SFD CRC error(s)	In SFD Span mode, this indicates that there was more then one CRC error over 256 transfers. If not in SFD Span mode, any CRC error will fault.
	7	SFD Motor Data timeout	SFD configuration did not complete within 49.2 milliseconds.
<b>3</b> Drive Over/Under	8	Drive over temperature	The drive has an over temperature fault
	9	Drive under temperature	The drive has an under temperature fault
<b>9</b> Motor I-I or I-n Short	10	Drive short circuit	One or both the current sensor A/D has been in positive current saturation for longer then 10 microseconds.
	11	Drive output over current	Drive over current
<b>18</b> Option Card Watch Dog Time out	12	Option card read timeout	OC response time out
	13	Option card watchdog time out	OC Watchdog timer timed out
<b>19</b> PosErr Too Large	14	Step size overflow	Size of revs per step greater than 255 revs per step.
	15	PosErr overflow	Position loop position error greater then +/-128 revs.
<b>20</b> OC Fault	16	Option Card Feedback Fault	Fault with the option card encoder feedback

## 8.4.8 S200 Base Unit Faults (b-faults)

As previously stated the base unit Status LED will flash a code if the drive is in a faulted condition. The following table explains the fault code.

Flash Count	Status	Resulting Drive Action	Reset Method
1	No Fault drive disabled	Normal Operation	
2	Motor Over Temp sensor has tripped	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
3	Drive Over/Under Temp	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
4	Drive I*t Too High; Exceeded RMS ratings of the drive.	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
5	Motor I*I*t Too High; Exceeded RMS ratings of the motor.	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
6	Reserved		
7	Bus Over Voltage; Mains high-line or excessive regeneration.	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
8	Bus Under Voltage	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
9	Motor I-I or I-n Short	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
10	Output Over Current	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
11	Hall Fault	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
12	<b>SFD Configuration Error</b>	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
13	SFD Short	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
14	<b>SFD Motor Data Error</b>	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
15	SFD Sensor Failure	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
16	SFD UART Error	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
17	SFD Comm Error	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
18	Option Card Watch Dog Time out	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
19	PosErr Too Large	Drive Disabled with fault	Clear Fault input, Disable/Enable, Coldstart, GUI 'Drive Reset' Button, or Cycle Power
20			



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## 8.4.9 System Warnings

Warnings are like faults in that they can terminate motion. In most cases they will not cause the drive to disable. Warnings can be reset using Clear Fault input or GUI Drive Reset input.

Warning Code	Description
N01	Reserved
N02	Reserved
N03	Position Error Warning
N04	Watchdog Limit Reached
N05	Reserved
N06	Software Limit Switch 1 Active
N07	Software Limit Switch 2 Active
N08	Invalid Motion Task Has Been Initiated
N09	Home Reference Point Not Set
n10	Positive Hardware Limit Switch Activated
n11	Negative Hardware Limit Switch Activated
n12	Reserved
n13	Reserved
n14	Reserved
n15	Reserved
n16...n31	Reserved
n32	Current Drive Firmware Version is a Beta Release

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# 9.0 SERIAL COMMUNICATIONS AND MODBUS RTU

## 9.1 GENERAL INFORMATION

The serial communications port on the S200 Position Node product uses an RS232 physical layer and communicates using a protocol known as Modbus RTU. The Modbus protocol implementation of the S200 -CNS/ -DNS options is based on the documents:

- MODBUS over Serial Line V1.0
- MODBUS Application Protocol Specification V1.1

Details of the protocol itself are not covered in this document. Both aforementioned documents can be obtained at [www.modbus.org](http://www.modbus.org).

This document assumes that the user is knowledgeable about the information contained in those documents and has some level of knowledge about serial communications, in general. It is not the intent of this document to provide that basic information.

Section 7.6 will reiterate this, but the Modbus strategy is kept simple: always 2-16 bit word transfers (Defined by most interfaces as the 'swapped mode') using either integer or floating point data types. The tables at the end of this section identify the data types for each variable.

### 9.1.1 Abbreviations

Abbreviation	Description
UA	Unit Address The unit address of the option card configured through the rotary switches; S11 and S12.
FC	ModBus Function Code (Defined by standard)
CRC	16bit Cyclic Redundancy Check Value

## 9.2 RS232 SERIAL PORT CONFIGURATION

The S200 Position Node defaults the serial port settings as follows:

Baud rate: 38400  
Data bit: 8  
Stop bit: 1  
Parity: Odd (can be changed to Even using S13 Switch 3)

## 8.3 EXCEPTION MESSAGES

The Modbus protocol defines exceptions (error identification methods). The S200 implements exceptions according to the requirements and defines additional exception codes. The following table lists all proprietary codes.

---

<b>Exception Code</b>	<b>Description</b>
10	Invalid Quantity
11	Invalid register address
12	Invalid package number
13	Command is in execution
14	Unknown command ID
15	Command requires disabled drive
16	Invalid Motion Task number
17	Next Motion Task number is invalid
18	Enable Drive rejected
19	Writing data to FLASH failed
20	Parameter is not of type String
21	Scope: Internal error
22	Scope: Invalid Signal Name
23	Scope: Invalid Signal Size
24	Scope: Invalid record data
25	Step: Invalid Step length
26	Step: Velocity 1 for Step is out of range
27	Step: Velocity 2 for Step is out of range
28	Step: Velocity Mode is required
29	Memory Allocation Error
30	Internal error
31	Scope: No lookup table available
32	Scope: Wrong lookup number
33	String length is invalid

### **9.3 COMMUNICATION STRATEGY**

The S200 Position Node product has a lot of functionality. Decisions must be made as to how much of this should be implemented at the customer's end of the communication network. There may be some limitations. Most limitations can be overcome. Limitations include;

- 1.) The S200 Position Node communications is based on RS232 physical layer. This is to say that multidrop communications is not directly supported by the S200 Position Node hardware. This can be overcome with external RS485-to-RS232 converters.
- 2.) Changing the function of a discrete input on the S200 Position Node (Inx) requires a Coldstart function. A Coldstart function can be a little complex on the Modbus scheme as it requires a Manufacture-Specific Function Code and a status-check loop. It may be better to define the input functions in the GUI and associated drive setup configuration file and leave it static.

- 
- 3.) Certain functions require Manufacturer-Specific Function Codes to execute. This is normally not a problem unless you have a pre-manufactured terminal that has limited communications configuration capability that cannot easily support manufacture-specific function codes. For example; Modifications to Motion Task table requires a customized Function Code.
  - 4.) Setup of motor parameters over Modbus is not supported. Please use the GUI software and/or configuration backup files for setting these parameters.
  - 5.) Variables regarding the digital inputs can be misleading. In documentation and wiring diagrams we label the inputs DINP1 through DINP 10. In the Modbus protocol we call these Enable through IN9. Enable relates to DINP1, IN1 related to DINP2, IN2 relates to DINP3, etc.
  - 6.) When using third-party Modbus software such as Modbus Poll the data types may have to be set to Long Inverse or Float Inverse to make the data easily readable.

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## 9.4 MODBUS FUNCTIONS

To simplify the communications the S200 Position Node is set up with almost all data defined as 32bit values comprised of two 16-bit registers. The data type of any one of these register sets can be defined as Long, Text, or Float data types. With a few exceptions, all communications to the S200 Position Node card will be *Read Holding Registers* (FC=03) or *Write Multiple Registers* (FC = 16).

The register address of each parameter is aligned to an even register address values. Variable address in the GUI software is set up as 32-bit address space and is called the PDID (using variable browser utility). The Modbus registers, being 16 bit address space, are addressed at 2 \* PDID value. Please see address table at the end of this chapter.

The first register (even address) is the high word of the 32 bit value, the second register (odd address) the low word.

Important: Although data transfer should be done using FC 16 (Write Multiple Registers, quantity 2) the Position Node does support write of a single register:

1. To synchronize the write access when using single register access both registers of a parameter need to be written to starting with the high word (even address). If the low word is accessed first, an error exception occurs.
2. The firmware supports only a block read/write access of up to 2 registers. Both registers must belong to the same parameter.

Each parameter has a set of attributes like minimum value, maximum value, default value, read only, data type, etc., which can be uploaded from the option card. See tables at the end of this section for details.

### 9.4.1 Reading Variables

To read a variable use the Modbus Function 'Read Holding Registers'. As found in the Modbus documents the serial communication model for a variable read is presented as follows:

UA=xx	FC = 3	Address (16bit)	Number of registers (16bit)	CRC
-------	--------	-----------------	-----------------------------	-----

Where:

UA is the unit address of the drive as set by rotary switches S11 and S12.

FC is the Read Multiple Holding Register Function Code (03).

Address is the variable register address (even number).

Number of registers to read should be set to 2.

As defined by Modbus, the S200 Position Node product will respond with the value set in those registers:

UA=xx	FC=3	data length	data	CRC
-------	------	-------------	------	-----

Where:

UA is the unit address echoed back.

FC is the function code echoed back (03)

Data length will be 2 (Data count)

Data will be the 32 bit value of the variable read. Variable type may be Long or Float.

---

## 9.4.2 Writing Variables

To write variables use the Modbus Function 'Write Multiple Registers'. As found in the Modbus documents the serial communications model for a variable write is presented as follows:

UA	FC = 16	Address(16bit)	Register count (16bit)	Length	Data	CRC
----	---------	----------------	------------------------	--------	------	-----

Where:

UA is the unit address of the drive as set by rotary switches S11 and S12.

FC is the Write Multiple Registers function code (16 decimal = 0x10)

Register Count - Data length will be 2 (Data count)

Data will be the 32 bit value of the variable read. Variable type may be Long or Float

As defined by Modbus, the S200 Position Node product will respond with the value set in those registers:

UA	FC = 16	Address(16bit)	Number of Registers(16bit)	CRC
----	---------	----------------	----------------------------	-----

Where:

UA is the unit address echoed back.

FC is the function code echoed back (16d / 0x10).

Address is the address of the registers written echoed back.

Number of registers (written) echoed back - will be 2 (Data count)

## 9.4.3 Example: Read the ACC parameter

The following example on how to read the value of the ACC registers is presented. The guidelines in the example are as follows:

Unit address is 2 (S11 = 2, S12 = 0)

The actual value of ACC in the drive is 10,000 decimal / 0x2710

From the table, the address of ACC is 2 and the data type is long.

As defined in above text, all variables are 32 bit constructed with 2 contiguous 16 bit registers.

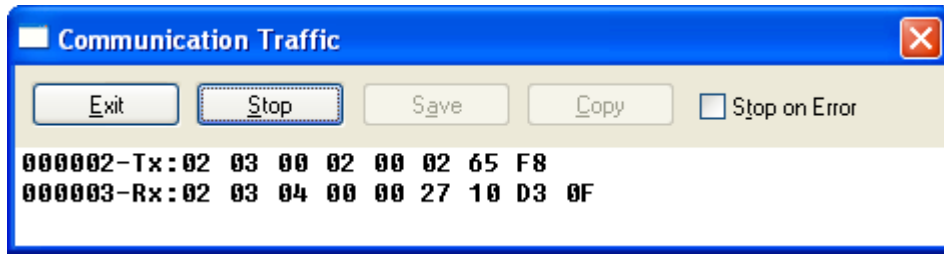
Transmit the request to read the value of ACC:

0x02	0x03	0x00	0x02	0x00	0x02	CRC low	CRC hi
------	------	------	------	------	------	---------	--------

Response from the S200 Position Node:

0x02	0x03	0x04	0x00	0x00	0x27	0x10	CRC low	CRC hi
------	------	------	------	------	------	------	---------	--------

An actual communications monitor report for this communication transaction looks like the following:



### 9.4.4 Example: Write the ACC parameter

Assume we wish to change the value of ACC to 20,000 in the above example:

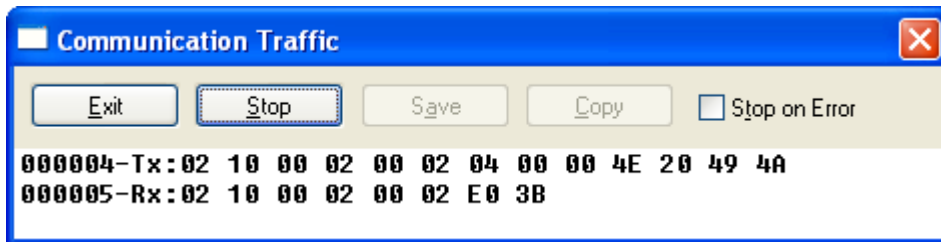
Transmit the request to write:

0x02	0x10	0x00	0x02	0x00	0x02	0x04	0x00	0x00	0x4E	0x20	CRC low	CRC high
------	------	------	------	------	------	------	------	------	------	------	---------	----------

Response from the S200 Position Node:

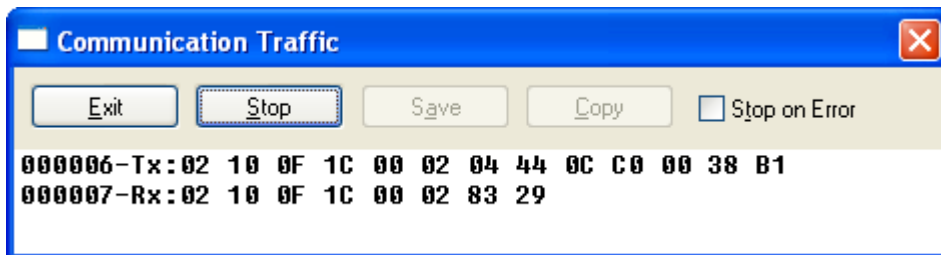
0x02	0x10	0x00	0x02	0x00	0x02	CRC low	CRC high
------	------	------	------	------	------	---------	----------

An actual communications monitor report for this communication transaction looks like the following:



### 9.4.5 Example: Change Speeds in Digital Velocity Mode

The S200 Position Node can be set up to operate in Digital Velocity Mode. Velocity is controlled by the 'J' parameter = PDID 1934 = Modbus Address 3868. The following communication traffic window changes the speed to 563 RPM:



Note that this data traffic representation is sending the speed, 563, as a floating point data type.

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## 9.5 MOTION TASK CONTROL

### 9.5.1 Command functions

Motion Task data can be considered a set of arrays: One array for each Motion Task. Modbus interface to the Motion Tasks is set up this way.

Name	Description	PDID	Register
MT.Number	Writing a number to this register populates MTTargetPositionHi to MTDelay (PDID 1215 to 1224) to the values of this Motion Task. If a ModBus error response is sent, check MotionTaskError for the error code.	1210	2420
MT.Error	Error code, if Motion Task operation failed	1211	2422
MT.Set	Writing a value of 1 stores the values of MTTargetPositionHi to MTDelay to MotionTaskNumber	1212	2424
MT.Clear	Clears MotionTaskNumber	1213	2426
MT.Clear.All	Clears all Motion Tasks	1214	2428
MT.Target.Hi	Reserved	1215	2430
MT.Target.Lo	Lo-Word (32bit) of TargetPosition	1216	2432
MT.Velocity	Motion Task Velocity in SI units (O_V)	1217	2432
MT.Acc	Acceleration (O_ACC)	1218	2436
MT.Dec	Deceleration (O_DEC)	1219	2438
MT.Control	Control Word (O_C)	1220	2440
MT.Tab.Number	Reserved, Not Supported	1221	2442
MT.Next.Task	Next Motion Task to execute (O_FN)	1222	2444
MT.Delay	Delay between Motion Tasks (O_FT)	1223	24446

The user can choose to enter each datum and execute MT.Set or recall all the present data with MT.Number, modify the desired data, and then re-write the data with MT.Set. See Modbus Register Table for additional information.

### 9.5.2 Creating and Editing Motion Tasks

To define a motion task, specify a value for each parameter. In the S200 OCTools, the task can be selected in the table or selected from the Motion Task number drop-down box. A motion task that consists of all parameter values set to zero is empty or available.

The S200 Position Node has 300 motion tasks. Motion tasks 1 – 200 are saved into non-volatile memory in the drive. The drive is required to be disabled while saving a task. Once a task is saved into memory in the drive, the task can be executed. Motion tasks 201 – 300 are stored in



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RAM and will be erased when the drive is powered down. Motion tasks 1 – 300 can be set in S200 OCTools or directly through Modbus communications.

The RAM-based tasks can be created, edited, saved, and executed without disabling the drive. A RAM-based task can be edited while that same task is running. The new values will take effect the next time the task is started.

On powering up the drive, tasks 1 – 100 are copied into tasks 201 – 300.

See section 9.5.4 for an example.

If it is necessary to edit a task without disabling the drive, use tasks 201 – 300. To eliminate recreating a task, create the task in one of the motion tasks from 1 – 100. On the next power-up (and all subsequent power-ups) that task will be copied to the corresponding task in 201 – 300. For example, task 1 copies to task 201, task 201 can then be edited and executed “on-the-fly”. Create task 1 with the closest values to what will be needed in task 201, so that minimal changes will be required for task 201.

### 9.5.3 Motion Task Error Table

Description	MT.Error	Comment
Invalid Task Number	1	Task number out of range
Invalid Next Task Number	2	Next Task number out of range
Drive is enabled	3	Motion Task not stored, because drive is enabled. Disable drive and try again
Command in progress	4	Command state machine is busy, i. e. with saving parameters non-volatile. Execution of storing a motion task is refused. Wait and try again.

### 9.5.4 Example: Editing Motion Tasks Though Modbus While Enabled

The procedure for writing to a motion task through Modbus consists of defining the task, writing the parameter values, and sending the values to the motion task registers.

The step-by-step sequence is as follows:

1. Set MT.Number to the number of the task to be modified.
2. Set the “MT.” parameters to define the acceleration, velocity, deceleration, distance, and other motion task settings.
3. For tasks 1 – 200, disable the drive. (For tasks 201 – 300, there is no need to disable the drive.)
4. Set MT.Set = 1. This will write all of the current “MT.” parameters to the registers associated with the motion task specified by the value of MT.Number.
5. Set MT.Set = 0, so it will be ready to be set to 1 next time.

For example, to change the distance and velocity of task 3 that has already been created:

1. Set MT.Number = 3.
2. Set MT.Target.Lo and MT.Velocity to the new values.
3. Disable the drive.
4. Set MT.Set = 1.
5. Set MT.Set = 0.

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To read the values of a motion task, set MT.Number to the task number. Then read the values of the "MT." parameters.

For example, to read the acceleration of task 205:

1. Set MT.Number = 205
2. Read MT.Acc.

## ***9.6 MODBUS ADDRESS AND FUNCTION TABLES***

The following tables contain the required data for implementing Modbus commands. The advanced user may determine that functions other than these will show up in the GUI Variable browser. The functions listed here are the only functions supported by the Modbus communication.

PDID Index	Modbus Address	Name	Data Type	Rights	Default Value	Min Value	Max Value	Units	Comments
1	2	ACC	Long	R/W	300000	1	12000000	RPM/S	Velocity Loop Acceleration Limits
2	4	ACCR	Long	R/W	300000	1	12000000	RPM/S	Jog and Homing Acceleration Limits
3	6	ACTFAULT	Long	R/W	1	0	1	See List	What to do upon fault
4	8	ACTIVE	Long	RO	-1	0	0	On/Off	Returns 1 if drive active, else 0
6	12	AENA	Long	R/W	1	0	1	On/Off	Software Auto Enable: 1 Normal, 0 Disable at power up
34	68	DEC	Long	R/W	300000	1	12000000	RPM/S	Velocity Loop Deceleration Limit
36	72	DECR	Long	R/W	300000	1	12000000	RPM/S	Jog and Homing Deceleration Limits
37	74	DECSTOP	Long	R/W	300000	1	12000000	RPM/S	Priority Stop Deceleration Rate (See Vel0)
41	82	DIPEAK	Float	RO	0	4294968	4294968	Amps	Returns Drive's Peak Current (RMS) Rating
44	88	DREF	Long	R/W	0	0	34	CW/CCW	Set Homing Direction
45	90	DRVSTAT	Long	RO	0	-1	-1	Bit Coded	Return Drive Status Bit Word
50	100	ENCIN	Long	R/W	1024	16	32767	LPR	Encoder Resolution for Encoder Feedback Systems
62	124	GEARI	Long	R/W	1024	-2.15E+09	2.147E+09	Counts	Gearing mode: Sets GEARI pulses within GEARO motor turns
63	126	GEARMODE	Long	R/W	0	0	9	See List	Sets Electronic Gearing Mode
64	128	GEARO	Long	R/W	1	0	2.147E+09	Counts	Gearing mode: Sets GEARI pulses within GEARO motor turns
88	176	I	Float	RO	0	4294968	4294968	Amps	Returns actual motor current
97	194	IN1	Long	RO	0	0	0	On/Off	Returns the state of DINP2
98	196	<b>IN1MODE</b>	Long	R/W				List	Sets the function of DINP2
100	200	IN2	Long	RO	0	0	0	On/Off	Returns the state of DINP3
101	202	<b>IN2MODE</b>	Long	R/W	17	0	90	List	Sets function of DINP3
103	206	IN3	Long	RO	0	0	0	On/Off	Returns the state of DINP4
104	208	<b>IN3MODE</b>	Long	R/W	9	0	90	List	Sets function of DINP4
106	212	IN4	Long	RO	0	0	0	On/Off	Returns the state of DINP5
107	214	<b>IN4MODE</b>	Long	R/W	0	0	90	List	Sets function of DINP5
109	218	INPOS	Long	RO	0	0	0	On/Off	Returns the state of the IN Position bit of the Status Register
110	220	IPEAK	Float	R/W	2.25	0	4.5	Amps	Allows the user to lower the peak application current
122	244	LATCH2P32	Long	RO	0	-1	-1	Counts	Returns Positive edge latch position

PDID Index	Modbus Address	Name	Data Type	Rights	Default Value	Min Value	Max Value	Units	Comments
123	246	LATCH2N32	Long	RO	0	-1	-1	Counts	Returns Negative Edge Latch Position
140	280	VLIM	Long	R/W	10000	0	10000	RPM	Defines the maximum application velocity
141	282	MH	Long	WO	0	-128	127	Start	Move to home
145	290	MJOG	Long	WO	0	-128	127	Start	Jog at VJOG speed and ACCR / DECR Ramps
163	326	MSPEED	Long	R/W	10000	0	16000	RPM	Motor's rated speed
174	348	O1	Long	RO	0	0	1	On/Off	Returns the state of DOUT1
177	354	O2	Long	RO	0	0	1	On/Off	Returns the state of DOUT2
180	360	OPMODE	Long	R/W	8	0	8	List	Sets the drive's mode of operation
197	394	PE	Long	RO	0	-1	-1	Counts	Returns the position error
198	396	PEINPOS	Long	R/W	4000	0	2.147E+09	Counts	Sets the allowable window condition for the In Window for Pos flag, status bit, In Pos Output
199	398	PEMAX	Long	R/W	262144	-2.15E+09	2.147E+09	Counts	Sets the maximum allowable position error
200	400	PFB	Long	RO	-1	-1	-1	Counts	Returns the Position Feedback value
201	402	PFBO	Long	RO	-1	-1	-1	Counts	Returns the position counter of the external encoder
202	404	PGEARI	Long	R/W	65536	1	2.147E+09	NA	Numerator (with PGEARO) used in setting user position and velocity units
203	406	PGEARO	Long	R/W	1	1	32768	NA	Denominator (with PGEARI) used in setting user position and velocity units
210	420	PRD	Long	RO	0	-1	-1	Counts	Returns the inter-revolution feedback position
215	430	PV	Long	RO	0	-1	-1	RPM	Returns the actual velocity as seen by the position control loop
216	432	PVMAX	Long	R/W	10000	0	10000	RPM	Sets the maximum velocity allowed in a motion task
221	442	READY	Long	RO	0	0	0	On/Off	Returns the state of the software enable bit
228	456	REMOTE	Long	RO	0	0	0	On/Off	Returns the state of the hardware enable input, DINP1
234	468	S	Long	WO	0	-128	127	Start	Stop: Decel at DECSTOP and disable drive
240	480	SETREF	Long	WO	0	-128	127	Start	Set present position as home
251	502	STAT	Long	RO	0	0	4.295E+09	Bits	Returns a compressed 16-Bit status word
253	506	STATUS	Long	RO	0	0	4.295E+09	Bits	Returns full status word
254	508	STOP	Long	WO	0	-128	127	Start	Force velocity to 0

PDID Index	Modbus Address	Name	Data Type	Rights	Default Value	Min Value	Max Value	Units	Comments
263	526	ARHPD	Long	R/W	0	0	10 NA		High-pass damping of the velocity loop filter (BQMODE)
264	528	ARHPF	Long	R/W	1000	80	4000 Hz		High-pass frequency of the velocity loop filter (BQMODE)
266	532	ARLPD	Long	R/W	0	0	10 NA		Low-pass damping of the velocity loop filter (BQMODE)
267	534	ARLPF	Long	R/W	160	0	1000 Hz		Low-pass frequency of the velocity loop filter (BQMODE)
279	558	UVLTMODE	Long	R/W	0	0	1 On/Off		1' Turns on under-voltage monitoring
280	560	V	Float	RO	0	4294968	4294968 RPM		Returns the actual motor velocity
282	564	VBUS	Long	RO	0	-1	-1 Volts		Returns the DC Bus voltage value
289	578	VJOG	Long	R/W	60	-10000	10000 RPM		Jog command while in Motion Tasking or Gearing Modes
295	590	VOSPD	Long	R/W	3600	0	12000 RPM		Sets the Over Speed Fault detection threshold
296	592	VREF	Long	R/W	60	0	10000 RPM		Defines velocity for home to reference
304	608	INPT0	Long	R/W	10	0	32000 Milliseconds		Defines the minimum removal time of the 'In Pos' output
322	644	MOVE	Long	R/W	0	0	300 Task Number		Execute the motion task number of the argument.
340	680	PTARGET	Long	RO	0	-1	-1 Counts		Returns the last target position resulted from Motion Task
358	716	BQMODE	Long	R/W	1	0	4 List		BiQuad Filter Mode
466	932	NREFMT	Long	R/W	0	0	511 Task Number		Defines which motion task to automatically execute immediately following a homing
470	940	GEARFILT	Long	R/W	4	0	8 List		Sets low pass filter frequency on gearing input
471	942	AUTOHOME	Long	R/W	0	0	2 On/Off		Enables Auto Homing
501	1002	IN5	Long	RO	0	0	1 On/Off		Returns the state of DINP6
502	1004	IN5MODE	Long	R/W	9	0	90 List		Sets function of DINP6
504	1008	IN6	Long	RO	0	0	1 On/Off		Returns the state of DINP7
505	1010	IN6MODE	Long	R/W	9	0	90 List		Sets function of DINP7
507	1014	IN7	Long	RO	0	0	1 On/Off		Returns the state of DINP8
508	1016	IN7MODE	Long	R/W	9	0	90 List		Sets function of DINP8
510	1020	IN8	Long	RO	0	0	1 On/Off		Returns the state of DINP9

PDID Index	Modbus Address	Name	Data Type	Rights	Default Value	Min Value	Max Value	Units	Comments
511	1022	IN8MODE	Long	R/W	9	0		90 List	Sets function of DINP9
513	1026	IN9	Long	RO	0	0		1 On/Off	Returns the state of DINP10
514	1028	IN9MODE	Long	R/W	9	0		90 List	Sets function of DINP10
549	1098	O3	Long	R/W	0	0		1 On/Off	Returns the state of DOUT3 or if O3MODE=0 can turn on or off DOUT3
550	1100	O3MODE	Long	R/W	0	0		100 List	Sets the function of DOUT3
551	1102	O3TRIG	Long	R/W	0	-2.15E+09	2.147E+09		Sets trigger level associated with O3MODE
1008	2016	Motor.Name	String	R/W				ASCII	Motor Name String
1009	2018	KVP	Float	R/W	0.014	0.001	110.769	A/(rad/s)	Velocity Loop Proportional gain
1010	2020	KVI	Long	R/W	100	0	3000	Hz	Velocity Loop Integrator Rate
1011	2022	ILmtPlus	Long	R/W	50	0	100	%	Positive Current Limit
1012	2024	ILmtMinus	Long	R/W	50	0	100	%	Negative Current Limit
1013	2026	BU.Error.code	Long	RO	0	0	4.295E+09	List	Base Unit Error Code
1014	2028	OC.Error.code	Long	RO	0	0	4.295E+09	List	Position Node fault code
1015	2030	Warning.Code	Long	RO	0	0	4.295E+09	List	Position Node Warning Code
1017	2034	DPoles	Long	R/W	10	2	254	Pole-pairs	Motor's pole pair
1025	2050	KPP	Float	R/W	16	0	300	(rad/s)/rad	Position Loop Proportional gain
1026	2052	KVFF	Long	R/W	100	0	1000	%	Position Loop Velocity Feed forward tuning parameter
1027	2054	KTFF	Long	R/W	1	0	1000	%	Position Loop Acceleration Feed Forward tuning parameter
1028	2056	AVGTIME	Long	R/W	0	0	4.295E+09	Reads	Sets the number of reads used to average data over for presentation to the user.
1200	2400	Save	Long	WO	0	0	1	Command	Writing a 1 to this location causes the S200 Position Node to save parameters to non-volatile memory.
1201	2402	Fault Reset	Long	WO	0	0	1	Command	Writing a 1 to this location causes the S200 Position Node to attempt a fault reset.
1202	2404	SW Enable	Long	R/W	AENA	0	1	Command	Writing a 0 disables the drive, writing a 1 enables the drive. Default depends on AENA.
1203	2406	En Stat	Long	RO	AENA	0	16	Bit Code	Enable Status: Bit 0 = Fault, Bit 1 = Reserved, Bit 2 = Coldstart Required, Bit 3: Reserved.
1204	2408	Coldstart	Long	WO	0	0	1	Command	Writing a one to this register starts the Coldstart Process.
1210	2420	MT.Number	Long	R/W	0	0	180	Number	Writing 0-180 to this register causes the S200 Position Node to populate the values of PDID1215 through 1224 with the data for the motion task whose number was written to this

register.

PDID Index	Modbus Address	Name	Data Type	Rights	Default Value	Min Value	Max Value	Units	Comments
1211	2422	MT.Error	Long	RO	0	0	255	Stat Code	This register holds the error code of an unsuccessful attempt to write a motion task.
1212	2424	MT.Set	Long	WO	0	0	1	Command	Writing a 1 to this register causes the S200 Position Node to accept and process the Motion Task Data in PDID 1215-1224.
1213	2426	MT.Clear	Long	WO	0	0	1	Command	Writing a '1' to this register causes the Motion Task pointed to by MT.Number to be cleared.
1214	2428	MT.ClearAll	Long	WO	0	0	1	Command	Writing a '1' to this register clears all Motion Tasks.
1215	2430	MT.Target Hi	Long	R/W	-	-1	+1	Reserved	Do Not Use this register
1216	2432	MT.Target Lo	Long	R/W		-2.15E+09	2.147E+09	Bits	Motion Task Target Distance
1217	2434	MT.Velocity	Long	R/W	-0	0	2.147E+09	RPM	Motion Task Target Velocity
1218	2436	MT.Acc	Long	R/W	300000	1	12000000	RPM/S	Motion Task Acceleration Rate
1219	2438	MT.Decel	Long	R/W	300000	1	12000000	RPM/S	Motion Task Deceleration Rate
1220	2440	MT.Control	Long	R/W	-	0	65536	Bit Code	See S300 Documentation for O_C
1221	2442	MT.Tab.Number	Long	R/W					Reserved – Do not use
1222	2444	MT.Next.Task	Long	R/W	-	0	180	Number	Next task to auto execute. 0 means none.
1223	2446	MT.Delay	Long	R/W	0	0	65536	Milliseconds	Delay before executing Next Motion Task.
1404	2808	Digital.Inputs	Long	RO	0	0	4.295E+09	Bit Coded	Returns DINP2-DINP10 in one word weighted 2^INx
1453	2906	Motor.Lqll	Float	R/W	0	0	255	Henry	Motor Q-Axis inductance
1454	2908	Motor.Ldll	Float	R/W	0	0	255	Henry	Motor D-Axis Inductance
1455	2910	Motor.KVPAuto	Float	R/W	0	0	255	Arms/rad/sec	
1456	2912	Motor.Mlpeak	Float	R/W	0	0	255	Arms	Motor's Peak Rated Current
1457	2914	Motor.Mlcont	Float	R/W	0	0	255	Arms	Motor's continuous rated current
1458	2916	Motor.MTF0	Float	R/W	0	0	255	Hz	
1502	3004	Error.code			0	-2.15E+09	2.147E+09		
1620	3240	EncOut(BU)	Long	R/W	3	0	15	List	Sets Encoder Output Resolution
1642	3284	HSTemp(BU)	Float	RO	0	0	0	Degrees C	Returns the temperature of the drive heat sink
1935	3870	J	Float	R/W	0	-3.40E+38	3.40E+38	RPM	Sets (or returns set value) for Digital Velocity Mode Velocity

## 9.7 STAT AND STATUS WORD INFORMATION

### 9.7.1 Status Word

The Status word is bit-coded as follows:

Status Word PDID 243, Modbus Register 506		
Bit	Name	Description
0	No Hardware Enable	Hardware Enable is not asserted
1	No Software Enable	Software Enable is not present
2	Reserved	Should be masked
3	Fault Disabled	A fault has caused the drive to become disabled
4	Enabled	Drive Power Stage is enabled
5	Reserved	Should be masked
6	Reserved	Should be masked
7	Reserved	Should be masked
8	Task Active	Motion Task is executing
9	Reference Set	Drive has been Homed
10	Home Position	Motor is at 0 location
11	In Position	Motor is within tolerance of target position
12	Latch Positive Dinp3	Registration Latch on Input #3 has been detected
13	Homing	Drive is in the process of homing
14	TIP	
15	Latch Negative Dinp3	Registration Latch on Input #3 has been detected
16	Stop Active	A Stop command is being executed (HW or SW)
17	Latch Positive Dinp2	Registration Latch on Input #2 has been detected
18	Latch Negative Dinp2	Registration Latch on Input #2 has been detected
19	FF Off	Feed Forward gain is 0
20	Homing Complete	Homing Process has completed
21-32	Reserved	Should be masked

### 9.7.2 Stat Word

The Stat Word is bit coded as follows:

Stat Word PDID 251, Modbus Register 502		
Bit	Name	Description
0	Drive Disabled	The Drive Power Stage does not have power
1	Drive is not in operation	No motion is being commanded
2	Unused	Reserved, should be masked
3	StepMode	
4	Unused	Reserved, should be masked
5	Hardware Reset	A hardware reset has occurred
6	Reserved	Internal Use - Should be masked
7	Reserved	Internal Use - Should be masked
8	Not Saved	New Data has not been saved to NV memory
9	Unused	Reserved, should be masked
10	Reserved	Internal Use - Should be masked
Nov-31	Unused	Reserved, should be masked



## 10.0 UPGRADING FIRMWARE PROCEDURE

Firmware can be downloaded to the drive using the S200 OC TOOLS User Interface Software. The firmware to download must be accessible by the computer via local media (hard drive, floppy, CDRom, memory stick, etc.).

### 10.1 OVERALL FIRMWARE LOAD PROCEDURE

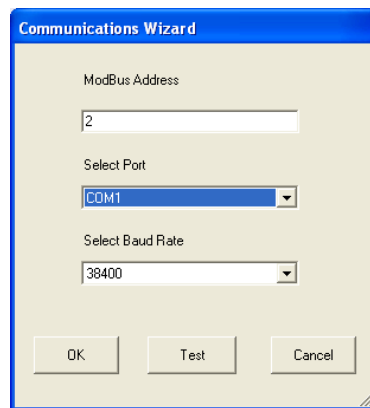
The proper procedure for upgrading firmware is as follows:

- 1.) Archive drive settings as described in Saving Drive Settings, above.
- 2.) Execute the following firmware upgrade procedure. (See 10.2)
- 3.) Clear memory by 'Utilities / Reset Variables to Factory Default'
- 4.) Restore the drive settings using the procedure describes above for 'Configuring Drive from Existing File'

### 10.2 DETAILED FIRMWARE LOAD PROCEDURE

The drive must be selected on the 'folder-side' of the S200 OC TOOLS window.

- 1.) Record the present settings for the Modbus address switches S12, S11.
- 2.) Set the Modbus Address switches on the front of the panel to 02 (S12=0, S11 = 2)
- 3.) Use GUI 'Edit Variables on line' to query the setting of RS232.Baudrate and record its present value.
- 4.) If RS232.Baudrate is not 38400 then change it to 38400, perform a non-volatile memory save and cycle power on the drive.
- 5.) Use the GUI 'Communication Wizard' to ensure that it is set to address 02 and 38400 baud rate. Hit OK.



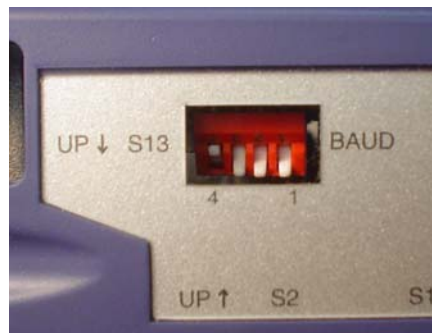
- 6.) Ensure that the drive is Disabled.
- 7.) Use the Utilities\Download New Firmware to Drive following the interactive instructions.
  - a. Select the desired firmware file and hit OK.



#### NOTE

A file name that includes the letters 'CAN' (ie: S200\_CAN\_V1\_10\_00.BIN) supports CANOpen field bus communication for –CNS product. A filename that contains the letters 'DeviceNet' (ie: S200\_DeviceNet\_V1\_10\_00.BIN) supports DeviceNet filed bus communications for –DNS product.

- b. The GUI will ask you to set S13-4 down.
- c. The GUI will complete the download and ask you to turn S13-4 Up and cycle power.



**NOTE**

Some Versions of S200 OC TOOLS mistakenly refer to switch S13 as S3.

d. A progress window will come up to indicate the firmware load is taking place. Upon completion S200 OC TOOLS will put up a status box asking you to turn S13 back to it's original (UP) position and cycle power on the drive BEFORE clicking the 'OK' box. S200 OC TOOLS will then begin to operate normally with a data refresh.

- 8.) Use S200 OC Tools to return RS232.Baudrate, if required, to its setting as recorded in step 4.
- 9.) Return the Modbus Address switches to the setting recorded in step 1, if required.
- 10.) Cycle Drive Power
- 11.) Use the Communication Wizard to adjust Modbus Address and Baud rate accordingly.



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