

Instruction Manual

D12600-000

(CLT2000-000)

D12600-001

(CLT2000-024)

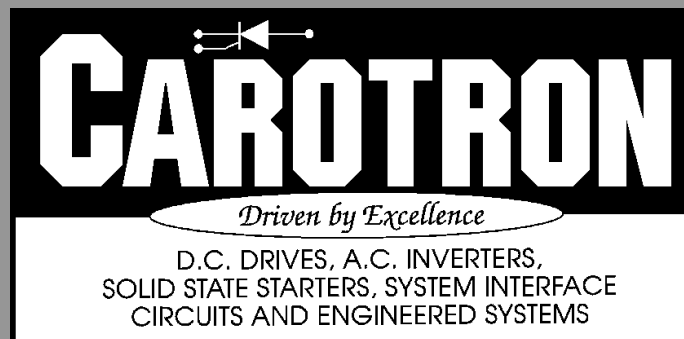


Table of Contents

| | |
|--|----|
| 1. General Description | 4 |
| 2. Specifications | 5 |
| 2.1 Electrical | 5 |
| 2.2 Physical..... | 6 |
| 3. Installation | 6 |
| 3.1 Wiring Guidelines..... | 6 |
| 4. Terminal Connections & Functions..... | 7 |
| 4.1 Signal Connections | 7 |
| 5. Programming & Adjustments | 7 |
| 5.1 Accel/Decel Blocks | 8 |
| 5.2 Application Calculators | 9 |
| 5.2.1 Roll Speed Calculator..... | 9 |
| 5.2.2 Diameter Calculator..... | 10 |
| 5.2.3 Taper Tension Calculator..... | 12 |
| 5.2.4 CTCW (Constant Tension Center Winder) Calculator | 13 |
| 5.3 Length Calculator Block..... | 16 |
| 5.4 Reference Select Blocks..... | 16 |
| 5.5 Sum Blocks..... | 17 |
| 5.6 Digital Inputs | 18 |
| 5.7 Analog Inputs..... | 19 |
| 5.8 Frequency Inputs | 20 |
| 5.9 Relay Outputs | 23 |
| 5.10 Analog Outputs | 24 |
| 5.11 Frequency/Digital Outputs | 26 |
| 5.12 LED Outputs | 28 |
| 5.13 Internal Links | 29 |
| 5.14 Communications | 30 |
| 5.15 System Parameters | 31 |
| 5.16 Threshold Blocks | 33 |
| 5.17 Timer Blocks | 35 |
| 5.18 Auxiliary Parameters..... | 37 |
| 5.19 PID Loops | 37 |
| 5.20 Logic Switches | 40 |
| 5.21 Logic Gates..... | 40 |
| 5.22 Turret Logic Block..... | 42 |
| 5.23 Brake Letoff Logic Block | 45 |
| 5.24 General Parameters..... | 48 |
| 5.25 Processing Order | 48 |
| 5.26 Parameter Tables | 50 |
| 6. LT Builder & Calibrators | 70 |
| 6.1 LT Builder | 70 |
| 6.2 LT Calibrators | 70 |
| 7. Prints | 71 |
| D12626 Example Connections | 71 |
| D12647 Modbus® Network Connections..... | 72 |
| D12702 Application Examples 1 of 6..... | 73 |

| | |
|---|-----|
| D12702 Application Examples 2 of 6..... | 74 |
| D12702 Application Examples 3 of 6..... | 75 |
| D12702 Application Examples 4 of 6..... | 76 |
| D12702 Application Examples 5 of 6..... | 77 |
| D12702 Application Examples 6 of 6..... | 78 |
| D12656 Sonic Option Connections | 79 |
| D12627 Software Block Diagram: Blocks, 1 of 7 | 80 |
| D12627 Software Block Diagram: Brake Letoff, 2 of 7 | 82 |
| D12627 Software Block Diagram: CTCW, 3 of 7 | 84 |
| D12627 Software Block Diagram: Velocity Mode Turret Winder, 4 of 7..... | 86 |
| D12627 Software Block Diagram: Velocity Mode PID Trim, 5 of 7..... | 88 |
| D12627 Software Block Diagram: Velocity Mode Dia Comp PID Trim, 6 of 7..... | 90 |
| D12627 Software Block Diagram: Velocity Mode Slipping Core, 7 of 7 | 92 |
| 8. Appendix | 94 |
| 8.1 Modbus® Protocol..... | 94 |
| 8.2 Modbus® Functions | 95 |
| 8.2 CRC-16 Calculations | 104 |
| 9. Standard Terms & Conditions of Sale..... | 107 |

List of Tables

| | |
|--|----|
| Table 1: Typical Inertia Sensitivity Values..... | 15 |
| Table 2: Reference Selection..... | 17 |
| Table 3: Analog Input Status Readings..... | 20 |
| Table 4: Count Reset Action | 22 |
| Table 5: Analog Output Readings | 25 |
| Table 6: Command Entry Codes..... | 32 |
| Table 7: Command Status Codes..... | 32 |
| Table 8: Set Reset Truth Table | 42 |
| Table 9: Processing Order Codes..... | 49 |
| Table 10: Parameters by Tag..... | 50 |
| Table 11: Parameters by Name | 60 |
| Table 12: Supported Modbus® Functions..... | 94 |

List of Figures

| | |
|--|----|
| Figure 1: Physical Dimensions | 6 |
| Figure 2: Signal Connections | 7 |
| Figure 3: Software Block Diagram Key | 8 |
| Figure 4: Accel/Decel Blocks..... | 8 |
| Figure 5: Winder Speed vs. Diameter Curve..... | 9 |
| Figure 7: Diameter Calculator Block..... | 10 |
| Figure 8: Taper Tension Calculator Block..... | 12 |
| Figure 9: Tension vs. Diameter | 12 |
| Figure 10: CTCW Calculator Block | 13 |
| Figure 11: Length Calculator Block | 16 |
| Figure 12: Reference Selects Blocks | 16 |
| Figure 13: Summing Blocks | 17 |
| Figure 14: Digital Inputs Blocks..... | 18 |
| Figure 15: Setting a Destination..... | 18 |
| Figure 16: Analog Input Blocks | 19 |
| Figure 17: Setting an Analog Input..... | 20 |

| | |
|--|----|
| Figure 18: Frequency Input Blocks | 21 |
| Figure 19: Relay Output Blocks | 23 |
| Figure 20: Setting a Relay Output | 24 |
| Figure 21: Analog Output Blocks | 24 |
| Figure 22: Setting an Analog Output | 25 |
| Figure 23: Frequency Digital Output Blocks | 26 |
| Figure 24: Setting Frequency Digital Output for Frequency..... | 27 |
| Figure 25: Setting Frequency Digital Output for Digital..... | 28 |
| Figure 26: LED Output Blocks | 28 |
| Figure 27: Internal Links Block | 29 |
| Figure 28: Using an Internal Link..... | 29 |
| Figure 29: Communication Block..... | 30 |
| Figure 30: System Block..... | 31 |
| Figure 31: Threshold Blocks..... | 33 |
| Figure 32: Threshold Example..... | 34 |
| Figure 33: Timer Blocks..... | 35 |
| Figure 34: Timer Functions..... | 36 |
| Figure 35: Auxiliary Block | 37 |
| Figure 36: Auxiliary Block Example | 37 |
| Figure 37: PID Loop Blocks | 38 |
| Figure 38: Logic Switch Blocks | 40 |
| Figure 39: Logic Gate Blocks..... | 40 |
| Figure 40: Turret Logic Block..... | 42 |
| Figure 41: Turret Logic Operating Sequence | 44 |
| Figure 42: Brake Letoff Logic Block..... | 45 |
| Figure 43: Brake Letoff Operational Profile | 45 |
| Figure 44: General Parameters Block | 48 |
| Figure 45: Processing Order Block..... | 48 |

1 General Description

The Cortex LT is a DSP (digital signal processor) based system controller. The LT includes configurable blocks including Brake Letoff, CTCW, Diameter Calculator, two PID loops, four Timers and a Turret Winder. The advanced mathematical models designed into the Cortex LT give it many advantages over other system controls in the market place. This advanced design makes the Cortex LT an excellent choice for a wide range of dancer, loadcell, and sensorless applications for control of Center Driven Unwinds, Center Driven Rewinds, Surface Driven Unwinds, Surface Driven Rewinds, Brake Unwinds, and speed compensation between driven nip rolls.

The Cortex LT is available in two models. Model D12600-000 is powered from 115VAC, while model D12600-001 is powered from a 24VDC supply. Models are typically sold in kits that contain a communications cable and software on a CD. Kit CLT2000-000 contains model D12600-000, and kit CLT2000-024 contains D12600-001.

2

Specifications

2.1 Electrical

A.C. Input Voltage Range - Single Phase (D12600-000)

- 115 VAC \pm 10%, 50/60 Hz \pm 2 Hz

D.C. Input Voltage Range (D12600-001)

- 24 VDC \pm 10%

Power Supplies

- +24V unregulated supply: 100mA
- +15V regulated supply: 100mA
- +10V regulated supply: 20mA
- +5V regulated supply (com C): 100mA

Digital Inputs (5 Total)

- Sink Mode
 - Vil=+20.0 VDC max
 - Vih=0.0 VDC min to +17.0 VDC max
- Source Mode
 - Vil=+5.0 VDC max
 - Vih=+8.0 VDC min to +30.0 VDC max

Analog Inputs (4 Total)

- 10 bit resolution (oversampled to achieve 12 bit)
- Voltage Range: 0 to +10 VDC
- Input Impedance: 1M Ω

Frequency Inputs (2 Total)

- Frequency: 42kHz max, square wave
- Voltage: +15 VDC max
 - Vil=0.0 VDC min to +1.1 VDC max
 - Vih=+3.0 VDC min to +15.0 VDC max

Relay Outputs (2 Total)

- Form-C contacts
- 2 A @ 115 VAC
- 2 A @ 60 VDC

Analog Outputs (2 Total)

- 12 bit resolution
- 0 to +10 VDC max, 20mADC max

Frequency/Digital Outputs (2 Total)

- Frequency: 5kHz max, square wave
- Output voltage: 5-24VDC max
- Output current
 - Sink: 50mA max
 - Source: Supply voltage dependent
 - 5V: 2.8mA max
 - 12V: 6.6mA max
 - 15V: 8.33mA max
 - 24V: 13.3mA max

Communication Ports

- Com A, RS485 Primary Multidrop, Term.
- Com B, RS485 Auxiliary Multidrop, RJ12
- Com C, RS485/RS232 Singledrop, RJ11

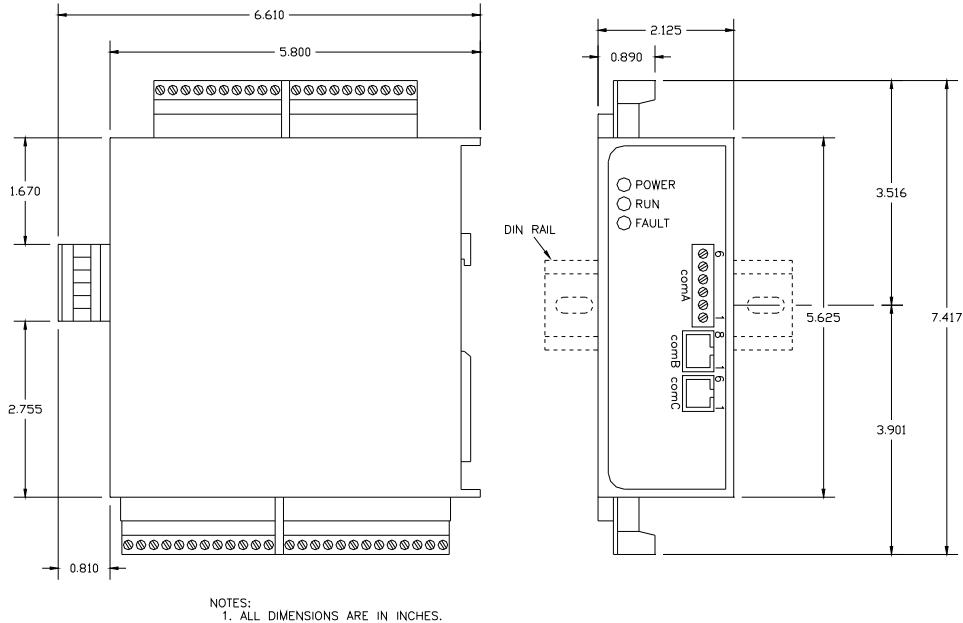
Temperature Range

- Chassis: 0-55°C
- Enclosed: 0-40°C

Power Dissipation

- Less than 5 W

2.2 Physical



NOTES:
1. ALL DIMENSIONS ARE IN INCHES.

Figure 1: Physical Dimensions

3

Installation

3.1 Wiring Guidelines

To prevent electrical interference and to minimize start-up problems, adhere to the following guidelines.

Make no connections to ground other than the designated terminal strip location.

Use fully insulated and shielded cable for all signal wiring. The shield should be connected at one end only to circuit common. The other end of the shield should be clipped and insulated to prevent the possibility of accidental grounding.

Signal level wiring such as listed above should be routed separately from high level wiring such as armature, field, operator control and relay control wiring. When these two types of wire must cross, they should cross at right angles to each other.

Any relays, contactors, starters, solenoids or electro-mechanical devices located in close proximity to or on the same line supply as the Cortex[®] LT should have a transient suppression device such as an MOV or R-C snubber connected in parallel with its coil. The suppressor should have short leads and should be connected as close to the coil as possible.

4

Terminal Connections & Functions

4.1 Signal Connections

Figure 2 shows signal connections to a Cortex® LT unit. The dashed lines represent isolation zones. **NOTE: THE COM C PORT IS NOT ISOLATED ON THE 24VDC VERSIONS!**

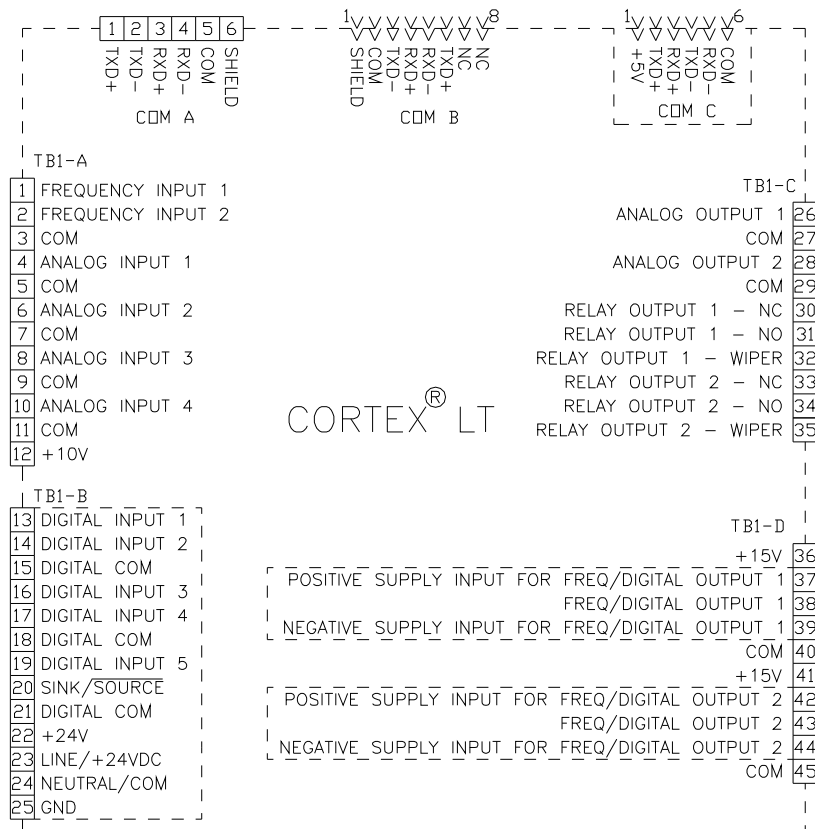


Figure 2: Signal Connections

5

Programming & Adjustments

Programming and adjustment of the Cortex® LT is accomplished by changing parameter settings via the one of the serial port COM connections. Each parameter has a descriptive name and a tag (or number) identifier. Parameters are grouped together in blocks according to their function. The following sections contain each software block diagram and descriptions of each parameter function. Refer to Figure 3 for key conventions that are used in the block diagrams. Each parameter is one of three types: Read-Only (RO), Inhibit Change while Running (ICR), or Read-Write (RW). ICR parameters can be changed only when the unit is not in the Run mode.

Note: When parameters are altered, the changes must be saved. Otherwise, changes will be lost after a reset or power loss.

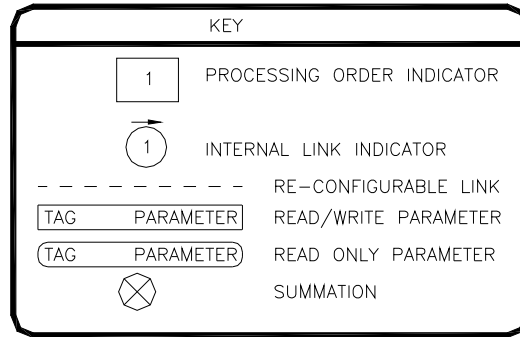


Figure 3: Software Block Diagram Key

5.1 Accel/Decel Blocks

The Accel/Decel blocks control the rate at which a reference changes.

Ramp Reset (251-252)

Ramp Reset resets the **Ramp Output** to 0 when True.

Ramp Hold (253-254)

The **Ramp Output** is held at its current value while **Ramp Hold** is True. When the hold is released, the **Ramp Output** will continue to ramp up or down from its current value. The **Ramp Reset** parameter overrides this setting.

Ramp Bypass (255-256)

Ramp Bypass disables the Accel/Decel rates and simply passes the **Ramp Input** through to the **Ramp Output**. The **Ramp Reset** parameter overrides this setting.

Accel Time (257-258)

The accel adjustments control the amount of time that it takes for the **Ramp Output** to make an increasing 100% change.

Decel Time (259-260)

The decel adjustments control the amount of time that it takes for the **Ramp Output** to make a decreasing 100% change.

Ramp Input (247-248)

Input signal to the Accel/Decel block.

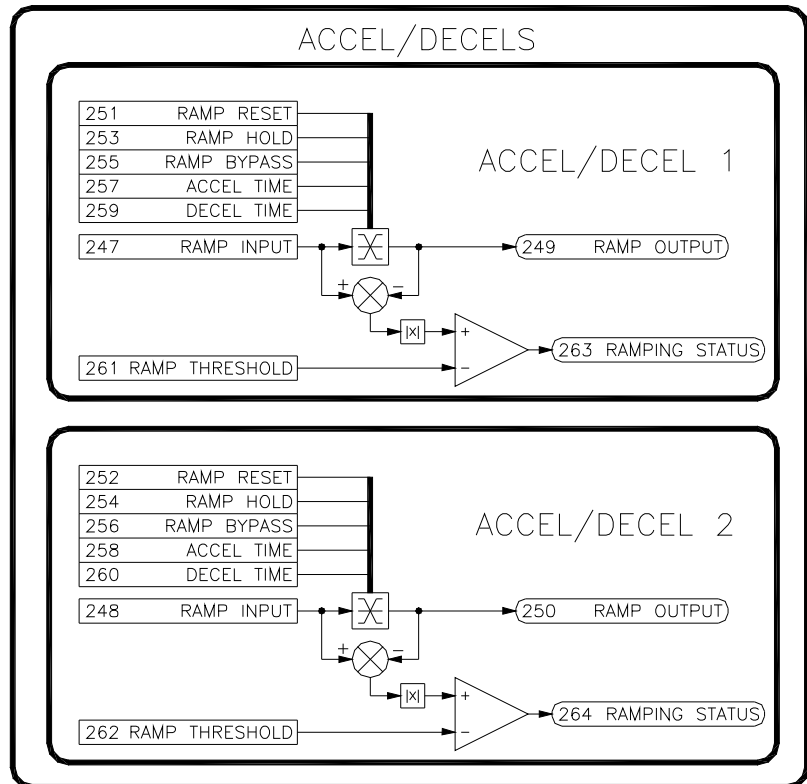


Figure 4: Accel/Decel Blocks

Ramp Output (249-250, Read-Only)
Ramped output signal.

Ramping Status (263-264, Read-Only)
The **Ramping Status** parameter signals when **Ramp Output** is changing.

Ramp Threshold (261-262)
Ramp Threshold adjusts the level at which the **Ramping Status** parameter is active.

5.2 Application Calculators

The Application Calculators block contains four calculators that are commonly used in winding and unwinding applications. The Roll Speed calculator is typically used in velocity (speed) control configurations while the CTCW calculator is typically used in torque control configurations.

5.2.1 Roll Speed Calculator

A problem encountered in center driven takeup and letoff applications is the nonlinear relationship between the diameter of a roll and the motor speed required to maintain constant surface speed of the roll during diameter increase or decrease. A plot of this relationship shows a hyperbolic curve.

When the line speed and roll diameter values are known, the required roll speed can be calculated. The rate of material take-up or pay-out from a center driven winder or unwinder would be held constant during roll diameter changes. The line speed signal typically comes from a tachometer or encoder on the line drive. The diameter information can be obtained through a number of different methods described below in the Diameter Select parameter selection.

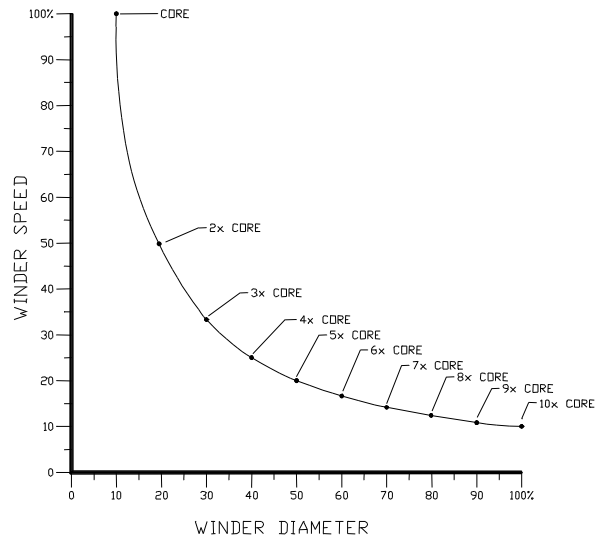


Figure 5: Winder Speed vs. Diameter Curve

The scaled line speed is divided by the scaled diameter signal to generate the center drive speed reference. Depending on required system response, a dancer or other device may be required for limited transient compensation between the center winder/unwinder and other driven parts of a line.

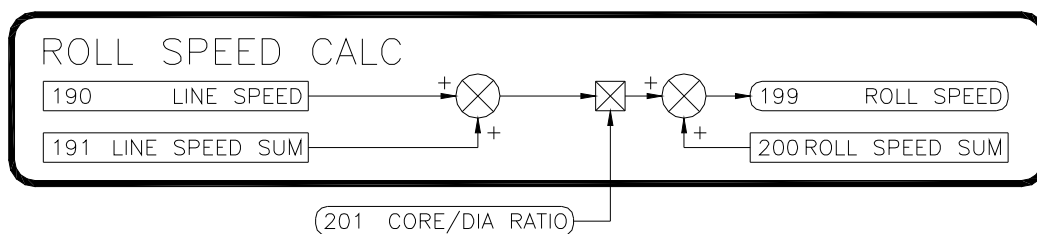


Figure 6: Roll Speed Calculator Block

Line Speed (190)

This signal is used along with the Core/Diameter Ratio to calculate the takeup or letoff **Roll Speed**.

Line Speed Sum (191)

This parameter provides a place to sum a signal with the Line Speed before it is multiplied by the **Core/Diameter Ratio**. A typical use would be to sum in the output of the PID block.

Roll Speed (199, Read-Only)

The calculated takeup or letoff roll speed.

Roll Speed Sum (200)

This parameter provides a place to sum a signal after the Line Speed has been multiplied by the **Core/Diameter Ratio**. A typical use would be to sum in the output of the PID block.

5.2.2 Diameter Calculator

Diameter compensation is essential for stable and accurate tension control of winders and unwinders. The diameter calculator provides a number of methods of calculating the diameter.

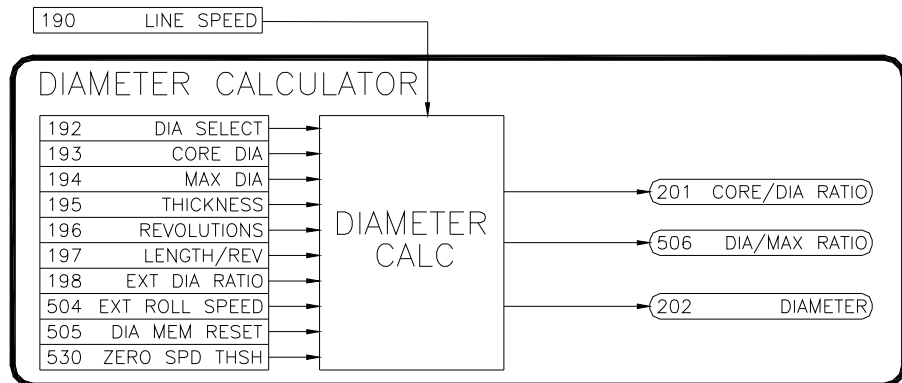


Figure 7: Diameter Calculator Block

Diameter Select (192)

Determines which method is used to calculate the diameter.

None

The diameter calculator is disabled, and the **Diameter** is equal to the **Core Diameter**.

External Diameter

An external diameter signal is provided to the Cortex® LT. This signal could come from an ultrasonic measuring unit like the SONICTRAC® or from a mechanical measuring device such as a rider arm and pot.

Roll Revolutions

The diameter is calculated by the material thickness and the number of revolutions of the takeup or letoff roll. The revolution count can be easily obtained by from an pulse type encoder mounted on the takeup or letoff drive

or roll.

Line Revolutions

The diameter is calculated by the number of line speed revolutions, length per revolution, and material thickness. The revolution count can be easily obtained by from an pulse type encoder mounted on the line drive.

Line Speed & Roll Speed

The diameter is calculated by dividing the Line Speed signal by the Winder Speed signal.

Core Diameter (193)

The diameter of an empty core in inches. If multiple size cores are used, enter the smallest size.

Maximum Diameter (194)

The maximum roll diameter in inches.

Material Thickness (195)

Used to calculate the diameter when the Roll or Line revolution methods are selected by **Diameter Select**.

Revolutions (196)

The number of revolutions of the takeup/letoff roll or the line speed roll. Used to calculate the diameter when the Roll or Line revolution methods are selected by **Diameter Select**. Typically, the Revolution counter of Frequency Input 2 is linked to this parameter when used.

Length Per Revolution (197)

The length in inches of material per one revolution of the Line Speed pulse count. Used to calculate the diameter when the Line revolution method is selected by **Diameter Select**.

External Diameter Ratio (198)

Ratio that is proportional to the diameter of the takeup or letoff roll. Used to calculate the diameter when the External Diameter Ratio method is selected by **Diameter Select**. Typically, a external analog or frequency input is linked to this parameter to provide the diameter information. The signal should be scaled via the Gain and Bias of the input so that this value reads 0.00% at **Core Diameter** and 100.00% at **Maximum Diameter**.

Core/Diameter Ratio (201, Read-Only)

The ratio obtained by dividing the **Core Diameter** by the calculated **Diameter**. This value is used along with the **Line Speed** to calculate the **Roll Speed**.

Diameter (202, Read-Only)

The calculated diameter in inches.

External Roll Speed (504)

Signal used to calculate **Diameter** along with the **Line Speed**. This parameter is only used when **Diameter Select** is set to Line & Roll Speed.

Diameter Memory Reset (505)

A diameter memory function is provided to maintain speed based diameter levels during stop (when the **Line Speed** and **Ext Roll Speed** signals are at 0.00%). The memory function only allows the **Diameter** signal to increase in value. When **Diameter Memory Reset** is True (default), the memory circuit is reset to the **Core Diameter** value and **Diameter** is based upon the current **Line Speed** and **Roll Speed** calculations. The diameter memory function can only be used when **Diameter Select** is set to the Line & Roll Speed method of diameter calculation.

Diameter/Max Ratio (506, Read-Only)

The ratio obtained by dividing the **Diameter** by the **Max Diameter**. This value is used along with **Tension Demand** to calculate **Diameter Torque** in the CTCW calculator.

Zero Speed Threshold (530)

This adjust the point where the Cortex LT considers the line speed to be zero. Also affects the Brake Letoff function. (see Brake Letoff Logic)

5.2.3 Taper Tension Calculator

In some cases, decreasing tension (taper tension) is desirable to prevent telescoping and/or wrinkling of inner layers of material. The tension calculator can be configured to provide tapering tension starting at any point in the roll. **Tension Demand** will decrease by a percentage of the **Tension Setpoint** from the **Taper Diameter** setting to the **Max Diameter**.

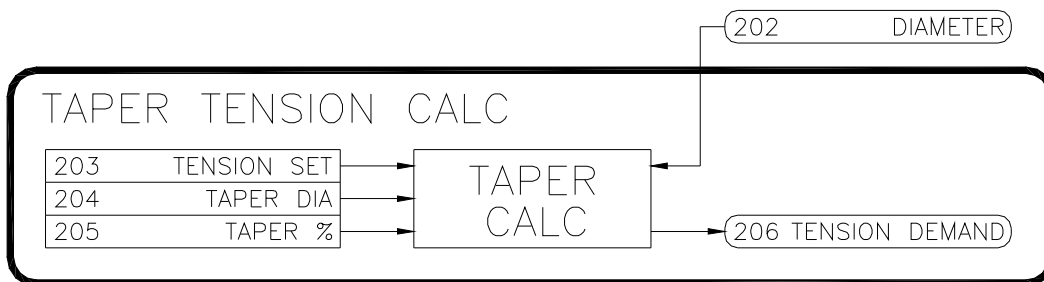


Figure 8: Taper Tension Calculator Block

Tension Setpoint (203)

The desired tension setpoint.

Taper Diameter (204)

The diameter level (in inches) at which tapering begins.

Taper Percentage (205)

The desired percentage of the Tension Setpoint that the Tension Demand signal will be tapered when

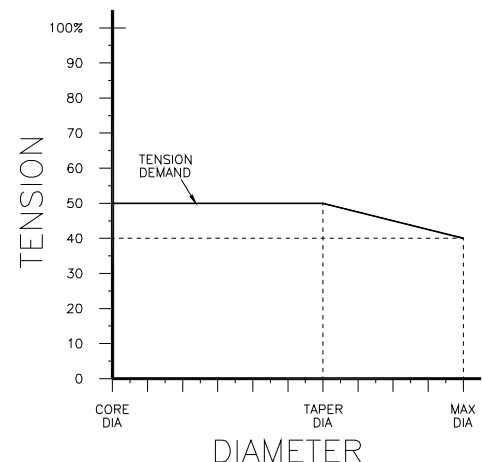


Figure 9: Tension vs. Diameter

Diameter is at the Max Diameter. Refer to Figure 9. In this example, the Tension Setpoint=50.00% and the Taper Percentage=20.00%. Thus, at Max Diameter, the Tension Demand signal has decreased by 10.00% (20.00% of the Tension Setpoint).

Tension Demand (206, Read-Only)

The tapered tension demand output. In a dancer position system, this value would be output to control the tension on an air-loaded dancer. In a loadcell system, this value would be used as the setpoint for the PID. When the calculated **Diameter** is less than the **Taper Diameter**, the **Tension Demand** will be equal to the **Tension Setpoint**. In a CTCW system, this value is used to determine the amount of **Diameter Torque**.

5.2.4 CTCW (Constant Tension Center Winder) Calculator

The CTCW block allows the Cortex LT to provide constant or taper tension control without external tension sensors. The CTCW block provides a torque reference output that is composed of diameter torque, inertia torque, friction torque, static friction torque, and pulse torque. Diameter torque is supplied to compensate for the increase in roll diameter. Inertia torque is supplied when the line is accelerating. Friction torque must also be supplied to overcome the mechanics in the drive train. A momentary pulse of torque (pulse torque) can be supplied to help 'break away' the mechanics of the system.

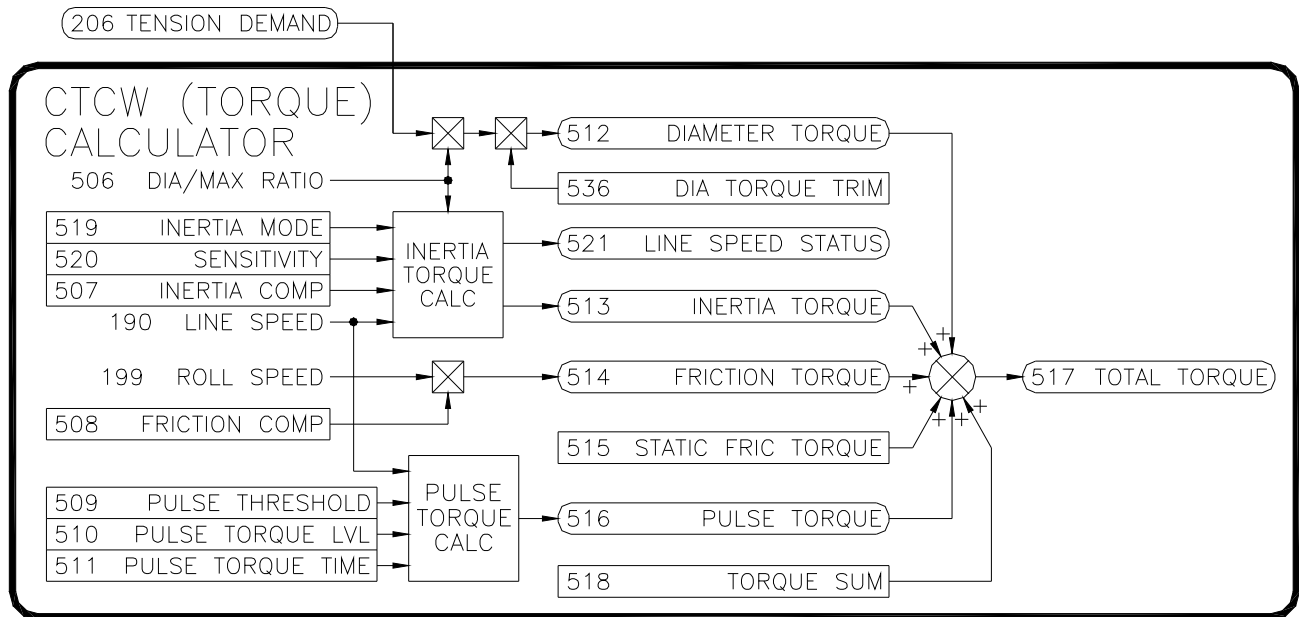


Figure 10: CTCW Calculator Block

Inertia Compensation (507)

Additional torque is required by the winder drive when the line speed is accelerating. This parameter is used in conjunction with **Line Speed** to control the amount of additional **Inertia Torque**.

Friction Compensation (508)

Torque is required to overcome the dynamic friction in the mechanics of the drive train. Friction loading typically increases with speed. The amount of **Friction Torque** is controlled by **Friction Compensation**.

Pulse Threshold (509)

The level that the **Line Speed** signal must exceed before the **Pulse Torque Level** is applied to **Pulse Torque**. After the pulse torque has been applied, the **Line Speed** signal must return to 0.00% and again exceed the threshold for pulse torque to be re-applied.

Pulse Torque Level (510)

When the mechanics of a system are oversized for the desired level of tension, the friction of the system while stopped may need to be overcome with additional starting torque. This additional torque is only needed momentarily to 'break away' the mechanics of the system. This parameter sets the level of torque to be momentarily applied.

Pulse Torque Time (511)

The amount of time that the pulse torque signal is applied.

Diameter Torque (512, Read-Only)

In order to provide constant tension, the winder torque must increase proportionally to the increase in diameter.

Inertia Torque (513, Read-Only)

The amount of additional torque reference supplied when the line is accelerating.

Friction Torque (514, Read-Only)

The amount of torque reference supplied to compensate for frictional loading.

Static Friction Torque (515)

Torque is required to overcome the static friction in the mechanics of the drive train. This parameter sums with all the other torque signals to produce the **Total Torque** signal.

Pulse Torque (516)

When the **Line Speed** exceeds the **Pulse Torque Threshold**, the **Pulse Torque** signal will be equal to the **Pulse Torque Level** signal for the amount of time specified by **Pulse Torque Time**. After the time has expired, **Pulse Torque** will reset to zero.

Total Torque (517, Read-Only)

The sum of the **Inertia Torque**, **Friction Torque**, **Static Friction Torque**, **Pulse Torque**, **Diameter Torque**, and **Torque Sum** parameters. The **Friction Torque**, **Static Friction Torque**, **Diameter Torque**, and **Torque Sum** levels are first summed and limited to 100%. The **Inertia Torque** & **Pulse Torque** are then summed and the total is limited to 150%. This parameter is typically output through

an analog output to a motor drive configured as a torque regulator.

Torque Sum (518)

This parameter provides an auxiliary summing point before the **Total Torque** is calculated. A typical use would be to sum in a correction signal from the output of a PID block when loadcells are used with the CTCW Calculator.

Inertia Mode (519)

Controls the type of inertia compensating torque supplied. Typically, winders (takeups) need accelerating compensation and unwinders (letoffs) need decelerating compensation.

Inertia Sensitivity (520)

The Inertia Torque calculator monitors the Line Speed parameter to provide an Inertia Torque output level. This level depends upon how fast the line speed is changing. This derivative calculation is made by examining the Line Speed at a set interval and determining the amount of change. This parameter adjusts the amount of time between samples. With fast line acceleration/deceleration rates of a few seconds, the sampling time can be set at 1 or 2. With slower rates, the time between samples typically would need to be increased. Refer to the following table for recommended initial values depending upon the line accel/decel rates. Note that these values may need to be adjusted to obtain steady levels of **Inertia Torque** depending upon the amount of electrical noise present on the signal.

| Line Accel/Decel Times (secs) | Typical Inertia Sensitivity Values |
|-------------------------------|------------------------------------|
| 1-3 | 1 |
| 4-7 | 2 |
| 8-11 | 3 |
| 12-13 | 4 |
| 14-20 | 5 |
| 21-26 | 6 |
| 27 or higher | 7 |

Table 1: Typical Inertia Sensitivity Values

Line Speed Status (521)

Indicates whether Line Speed is accelerating, decelerating, or steady.

Diameter Torque Trim (536)

This parameter provides a trim adjustment for the **Diameter Torque**. Typically, the maximum amount of torque that the motor (and gearing) can provide is greater than the actual amount of torque required to provide the desired tension level at the maximum diameter. This trim adjustment provides a means to scale down the **Diameter Torque** level so that a **Tension Demand** level of 100% provides only the required torque level to achieve 100% tension.

5.3 Length Calculator Block

This block can be used to provide batching functions to a system. The calculator determines the length of material by counting the revolutions of a line speed encoder signal. This pulse count along with the length per revolution allows the calculator to provide precise length calculations.

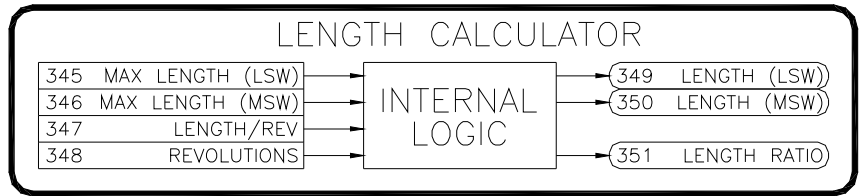


Figure 11: Length Calculator Block

Max Length (345-346)

The maximum length in inches. This value is a 32 bit integer and is broken into a least significant word and most significant word.

Length Per Revolution (347)

The length in inches of material per one revolution of the Line Speed pulse count.

Revolutions (348)

The number of revolutions of the Line Speed roll. Typically, the Revolution counter of Frequency Input 2 is linked to this parameter when used.

Length (349-350)

The calculated length in inches. This value is a 32 bit integer and is broken into a least significant word and most significant word.

Length Ratio (351)

The ratio obtained by dividing the **Length** by the **Max Length**. Typically this value is used to activate one of more relay outputs.

5.4 Reference Select Blocks

The Reference Select blocks select between multiple references.

Reference n (209-212,216-219)

References 0 through 3 are four independently adjustable references that can be selected by the **Reference Select** parameter.

Reference Select (207-208,214-215)

The **Reference Select** parameters select between the four internal references and passes the value to the **Reference Select Output**. The parameter is divided into two parts, a Most Significant Bit and a Least Significant Bit to allow all four

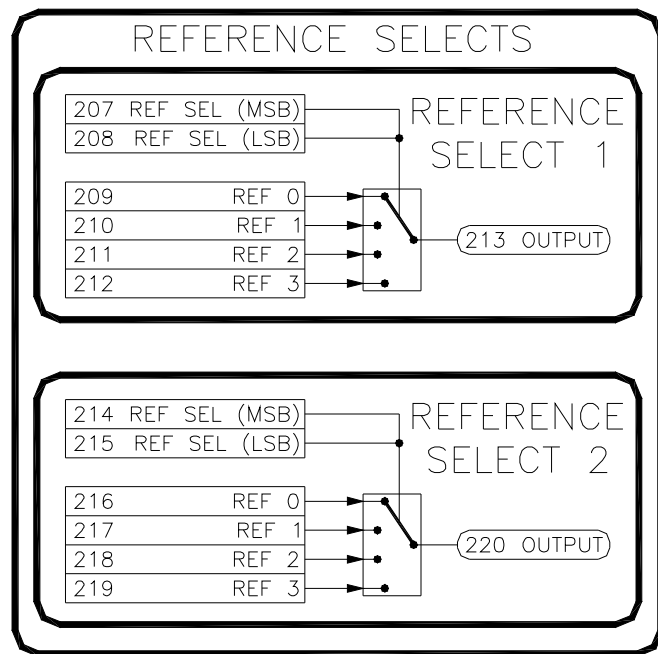


Figure 12: Reference Selects Blocks

references to be selected easily by two digital inputs if desired.

| MSB | LSB | Reference |
|-----|-----|-----------|
| 0 | 0 | Ref 0 |
| 0 | 1 | Ref 1 |
| 1 | 0 | Ref 2 |
| 1 | 1 | Ref 3 |

Table 2: Reference Selection

Reference Select Output (213, 220, Read-Only)

The **Reference Select Output** parameter will have the same value as one of the four references, depending upon which reference is selected by the **Reference Select** parameter.

5.5 Sum Blocks

The Sum Blocks sums four individual inputs to obtain the **Sum**. Each input polarity can be individually scaled and/or inverted.

Ratio A-D

(221,224,227,230,234,237,240,243)

Provides a scaling factor that is applied to the input before being summed.

Inputs A-D

(222,225,228,231,235,238,241,244)

Each Sum block has four individual summing inputs. Each of these inputs can be scaled and/or inverted before they are summed together to produce the **Sum**.

Invert A-D

(223,226,229,232,236,239,242,245)

When True, the input value's polarity is inverted before being summed.

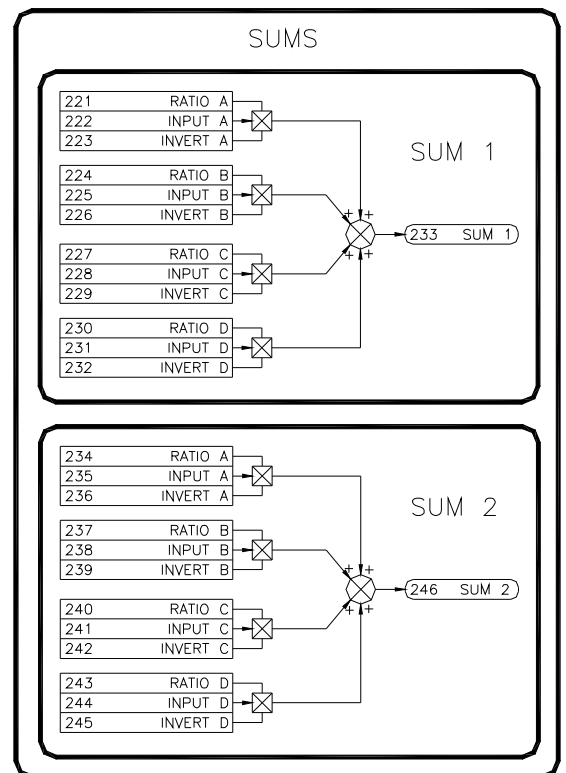


Figure 13: Summing Blocks

5.6 Digital Inputs

The Cortex® LT has 5 configurable digital inputs. Each digital input can write a value to any Read/Write parameter.

Destination (19-23, ICR)

The tag number of the destination parameter where the Open or Closed Value data is to be sent.

Open Value (24-28)*

The value in this parameter is sent to the destination parameter when the digital input is open (off).

Closed Value (29-33)*

The value in this parameter is sent to the destination parameter when the digital input is closed (on).

Status (34-38, Read-Only)

Each digital input state can be viewed for diagnostic purposes.

Example - Digital Input

Using Digital Input 4 to select between two PID Gain settings of 1.00 and 2.00:

1. Set Digital Input 4 **Destination** to **PID Prop Gain** (353).
2. Set Digital Input 4 **Open Value** to 1.00.
3. Set Digital Input 4 **Closed Value** to 2.00.

Digital Input 4 will now write the value of 1.00 to **PID Prop Gain** when the pushbutton is open. When closed, it will write the value of 2.00.

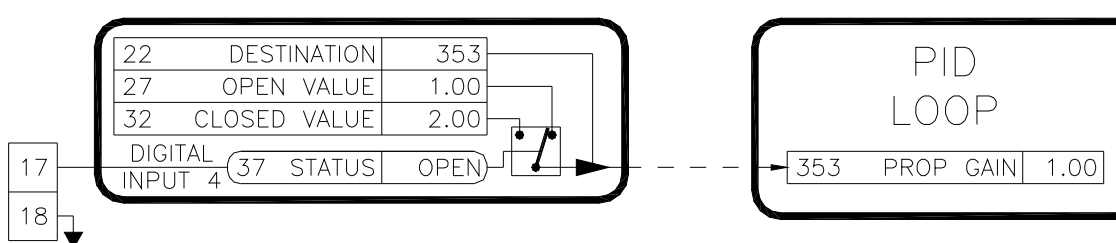


Figure 15: Setting a Destination

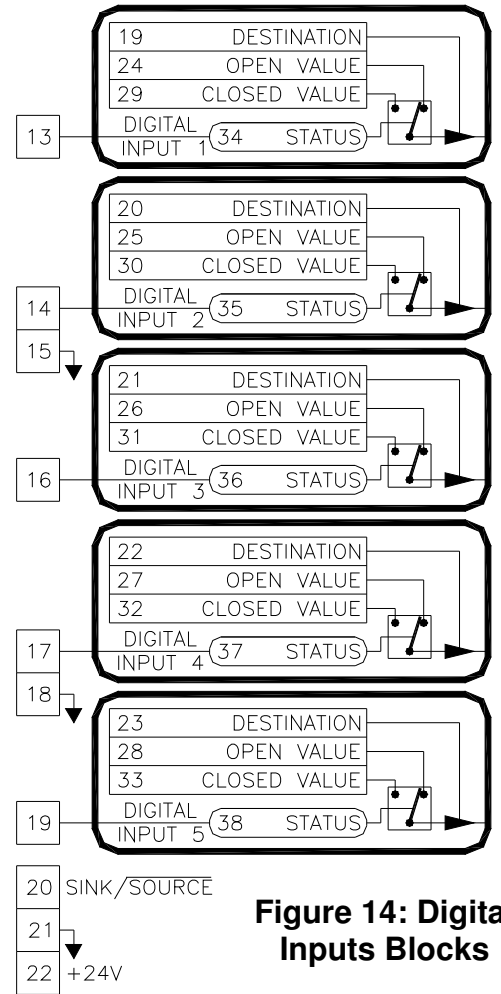


Figure 14: Digital Inputs Blocks

* Note that the units and number of decimal places of this parameter will change to match that of the Destination parameter.

5.7 Analog Inputs

The Cortex® LT has 4 configurable analog (voltage) inputs. Each input can be configured to write to any Read/Write parameter.

Destination (39-42, ICR)

The tag number of the destination parameter where the analog input information is to be sent.

Filtering (59-62)

An averaging filter can be applied to the incoming signal to reduce the effects of noise. Increasing the value increases the filtering.

0% Calibration (43-46)

This calibration value corresponds to the 12 bit value from the A2D when the input signal is at its minimum level. This defines 0% input signal. For proper operation, the **0% Calibration** value must be less than the **100% Calibration** value. Use the following formula to set the value manually.

$$0\% \text{ Cal} = \frac{\text{Minimum Input Voltage}}{10V} \times 4092$$

100% Calibration (47-50)

This calibration value corresponds to the 12 bit value from the A2D when the input signal is at its maximum level. This defines 100% input signal. For proper operation, the **100% Calibration** value must be greater than the **0% Calibration** value.

$$100\% \text{ Cal} = \frac{\text{Maximum Input Voltage}}{10V} \times 4092$$

Bias (51-54) Refer to footnote * on p.18

The **Bias** parameter defines the minimum value sent to the destination parameter when the input signal is at 0%.

Gain (55-58) Refer to footnote * on p.18

The **Gain** parameter defines the maximum value sent to the destination parameter when the input signal is at 100%.

Status (63-66, Read-Only)

Each analog input A2D reading can be viewed for diagnostic purposes. Refer to the chart below for typical readings:

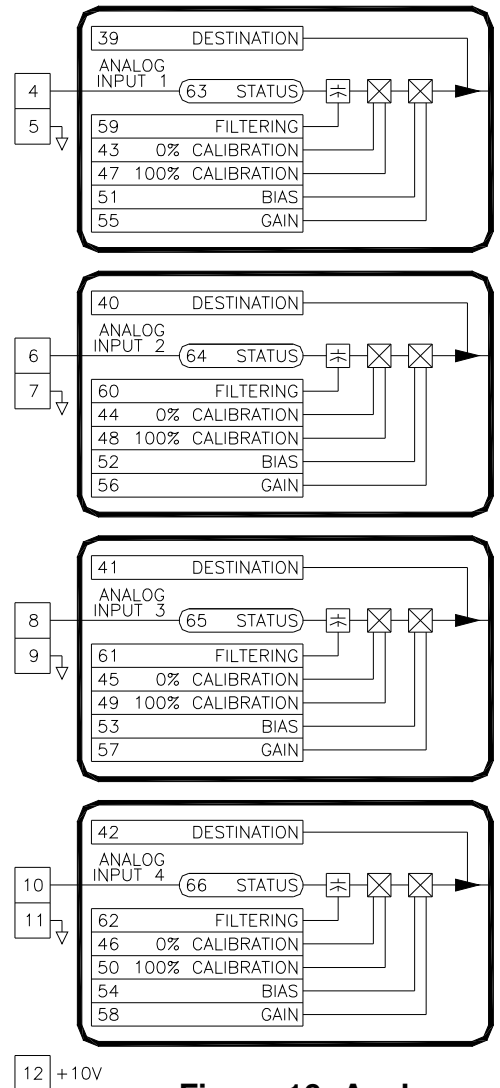


Figure 16: Analog Input Blocks

| Input Voltage | Status |
|---------------|--------|
| 10.0 | 4092 |
| 7.5 | 3069 |
| 5.0 | 2046 |
| 2.5 | 1023 |
| 0.0 | 0 |

Table 3: Analog Input Status Readings

Example - Analog Input

Setup **Analog Input 3** to control the **PID Feedback** parameter. Define the 1-9V input to produce 0.00%-100.00% setpoint.

1. Set **Analog Input 3 Destination** to **PID Feedback** (360).
2. Set **Analog Input 3 0% Calibration** to 409.

$$0\% \text{ Cal} = \frac{\text{Minimum Input Voltage}}{10\text{V}} \times 4092 = \frac{1\text{V}}{10\text{V}} \times 4092 = 409$$

3. Set **Analog Input 3 100% Calibration** to 3683.

$$100\% \text{ Cal} = \frac{\text{Maximum Input Voltage}}{10\text{V}} \times 4092 = \frac{9\text{V}}{10\text{V}} \times 4092 = 3683$$

4. Set **Analog Input 3 Bias** to 0.00%.
5. Set **Analog Input 3 Gain** to 100.00%.

When any voltage signal below 1V is applied, **PID Feedback** equates to 0.00%. As the voltage increases to 9V, **PID Feedback** increases linearly to 100.00%. The value will remain at 100.00% for all voltages over 9V.

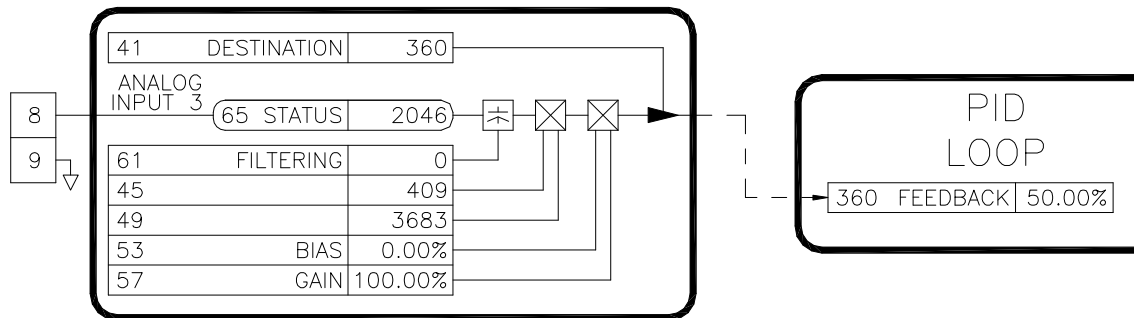


Figure 17: Setting an Analog Input

5.8 Frequency Inputs

The Cortex® LT has 2 configurable frequency inputs that can be configured to write to any Read/Write parameter. Note that the Frequency inputs have two modes of operation: frequency or sonic (distance). Additionally, Frequency input 2 can simultaneously function as a pulse counter.

Destination (67-68, ICR)

The tag number of the destination parameter where the frequency input information is to be sent.

Filtering (77-78)

A averaging filter can be applied to the incoming signal to reduce the effects of noise. Increasing the value increases the filtering.

0% Calibration (69-70)

This calibration value corresponds to the minimum frequency or distance that the input signal will provide. This defines 0% input signal. For proper operation, the **0% Calibration** value must be less than the **100% Calibration** value.

100% Calibration (71-72)

This calibration value corresponds to the maximum frequency or distance that the input signal will provide. This defines 100% input signal. For proper operation, the **100% Calibration** value must be greater than the **0% Calibration** value.

Bias (73-74) Refer to footnote * on p.18

The **Bias** parameter defines the minimum value sent to the destination parameter when the input signal is at 0%.

Gain (75-76) Refer to footnote * on p.18

The **Gain** parameter defines the maximum value sent to the destination parameter when the input signal is at 100%.

Status (79-80, Read-Only)

The actual frequency level in Hertz or distance in inches can be viewed for diagnostic purposes.

Frequency Input Mode (81,489)

The Frequency Inputs have two modes of operation: frequency mode or sonic mode. In frequency mode, the input measures the incoming frequency and generates an output according to the frequency level. In sonic mode, the input measures the incoming pulse width to determine the distance in inches. This mode requires an external Carotron sonic transducer assembly.

Out of Range (82,490, Read-Only)

When a Frequency Input is in the sonic mode, **Out of Range** will become True anytime the measured distance falls outside of the 0% and 100% calibration levels. For example, if the 0% and 100% calibrations are defined respectively as 12.00 inches and 20.00 inches, **Out of Range** will be True for any distance less than 12 or greater than 20 inches. The output value written to the destination parameter will be held at its last valid value when **Out of Range** is True.

Revolution Destination (83)

The tag number of the destination parameter where the Frequency input 2 revolution count information is to be sent.

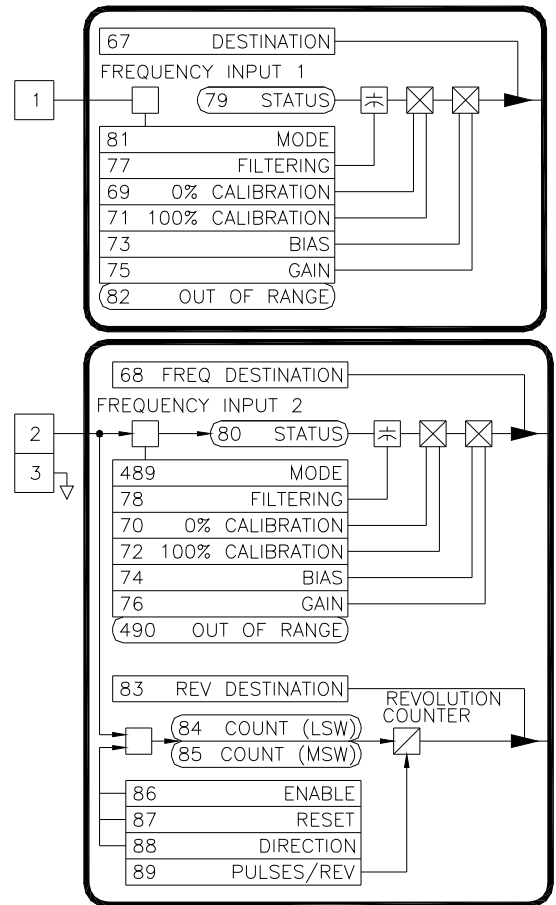


Figure 18: Frequency Input Blocks

Count (84-85, Read-Only)

The counter value is a 32 bit integer and is broken into a least significant word and most significant word. When **Count Enable** is True, every rising edge on the input signal causes the **Count** value to increase or decrease depending upon **Count Direction**. **Count** has a lower limit of 0 and an upper limit of 4,294,967,295. When **Count** reaches the upper or lower limit, the value does not rollover, but will saturate at its upper or lower limit.

Count Enable (86)

When True, each rising edge will cause **Count** to increase or decrease. Edges are ignored when False.

Count Reset (87)

Resets the **Count** parameter. As shown below, when **Count Reset** is set to 2, the **Count** parameter is reset to a level that corresponds to the **Maximum Diameter** in the Diameter Calculator block. This is useful when letoff applications where the diameter is calculated in the Winder or Line Revolutions mode.

| Count Reset | Action |
|-------------|---|
| 0 | None |
| 1 | Resets Count to zero |
| 2 | Resets Count to the value corresponding to Max Diameter |

Table 4: Count Reset Action

Count Direction (88)

Controls the direction of the counter: Up or Down.

Pulses per Revolution (89)

This parameter is divided into the **Count** value to produce a revolution count. For example, if the pulse count feedback device is rated for 1024 pulses or lines per one revolution, entering 1024 into the **Pulses per Revolution** parameter will cause the destination parameter to increment or decrement only once for each revolution.

Example 1 - Frequency Input

Setup Frequency Input 2 as the Line Speed input to the Diameter Calculator Block. The max speed of the line drive is 1750 RPM with a 1024 line encoder. This gives a maximum frequency of 29866 Hz as shown below:

$$1750 \frac{\text{revolutions}}{\text{minute}} \times \frac{1 \text{ minute}}{60 \text{ seconds}} \times \frac{1024 \text{ pulses}}{1 \text{ revolution}} = 29866 \frac{\text{pulses}}{\text{second}} = 29866 \text{ Hz}$$

1. Set the **Frequency Input 2 Destination** to **Line Speed** (190).
2. Set the **Frequency Input 2 0% Calibration** to 0 Hz.
3. Set the **Frequency Input 2 100% Calibration** to 29866 Hz.
4. Set the **Frequency Input Bias** to 0.00%.
5. Set the **Frequency Input Gain** to 100.00%.

Example 2 - Sonic Input

Setup Frequency Input 1 in Sonic Mode to provide a diameter signal to the Diameter Calculator Block. This example also uses Frequency/Digital Output 1 to generate the

required 7 Hz clock signal.

1. Connect the Sonic transducer per drawing D12656 on page 79.
2. Set the **Frequency/Digital Output 1 Mode** to Frequency.
3. Set the **Frequency/Digital Output 1 Source** to **Aux 1** (179).
4. Set **Aux 1** value to 0.14% (7 Hz = 5000 Hz x .0014).
5. Set the **Frequency Output 1 Bias** to 0.00%.
6. Set the **Frequency Output 1 Gain** to 100.00%.
7. Set the **Frequency Input 1 Mode** to Sonic.
8. Set the **Frequency Input 1 Destination** to **Ext Dia Ratio** (198).
9. Load the smallest empty core that will be used, and observe the distance reading displayed in the **Status** parameter (164).
10. Set the **Frequency Input 1 100% Calibration** to this value.
11. Load the largest diameter roll that will be used, and observe the distance reading displayed in the **Status** parameter (164).
12. Set the **Frequency Input 1 0% Calibration** to this value.
13. Set the **Frequency Input Bias** to 100.00%.
14. Set the **Frequency Input Gain** to 0.00%.

5.9 Relay Outputs

The Cortex® LT has 2 configurable form C relay outputs. Each relay can be configured to turn on (or energize) at a programmable level and turn off (or de-energize) at a different level. Thus the relay outputs have built in hysteresis that can be completely controlled by the customer. Figure 19 shows the relay outputs in the off (de-energized) state.

Source (90-91, ICR)

The tag number of the source parameter from which data is to be read.

Absolute Value (92-93)

When **Absolute Value** is True, the absolute value of the source data is used to provide a positive only level. This allows bipolar signals to operate the relays properly regardless of the signal polarity.

On Threshold (94-95)*

The threshold level that the source signal must equal or exceed in order for the relay to turn on (or energize).

Off Threshold (96-97)*

The threshold level that the source signal must equal or fall below in order for the relay to turn off (or de-energize).

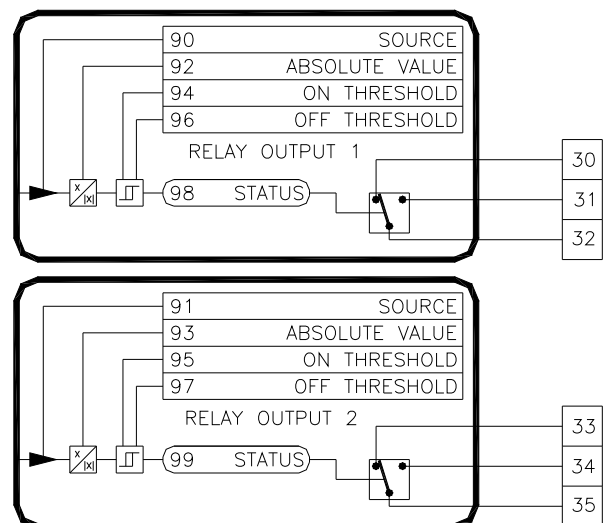


Figure 19: Relay Output Blocks

* Note that the units and number of decimal places of this parameter will change to match that of the Source parameter.

Status (165-167, Read-Only)

The state of each relay can be viewed for diagnostic purposes: Open (de-energized) or Closed (energized).

Example - Relay Output

Setup Relay Output 2 to signal when the Line Speed is above 5% with a hysteresis of 3%.

1. Set **Relay Output 2** Source to **Line Speed (190)**.
2. Set **Relay Output 2 On Threshold** to 5.00%.
3. Set **Relay Output 2 Off Threshold** to 2.00 %.

Relay Output 2 will energize when the line speed equals or exceeds 5.00% and will de-energize when the speed equals or falls below 2.00%. A hysteresis level was used to prevent the relay from 'chattering' (continually energizing and de-energizing) when the drive runs at 5.00% speed.

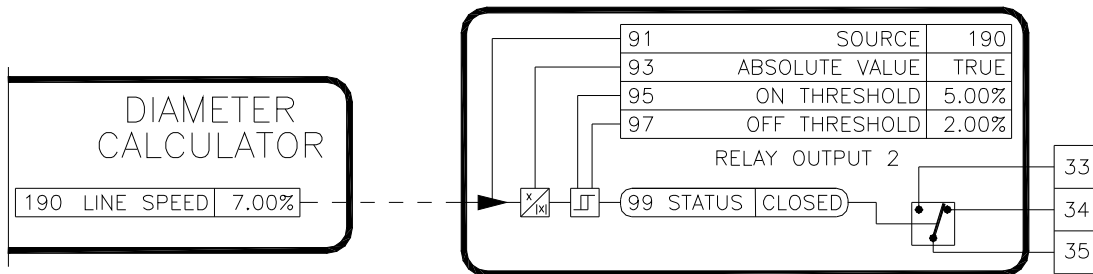


Figure 20: Setting a Relay Output

5.10 Analog Outputs

The Cortex® LT has 2 configurable unipolar analog voltage outputs. Each output can supply up to 20 mA, and can therefore be configured to serve as an open loop current output if the load impedance is known.

Mode (100, ICR)

When **Mode** is Unipolar, the two analog outputs function independently. However, when **Mode** is Bipolar, the separate unipolar analog outputs can be used together to produce a pseudo bipolar output signal. In this mode, all of the parameters associated with Analog Output 2 are ignored.

Refer to Example Connections on page 71 for bipolar mode connection information.

Source (101-102, ICR)

The tag number of the parameter from which data is to be read.

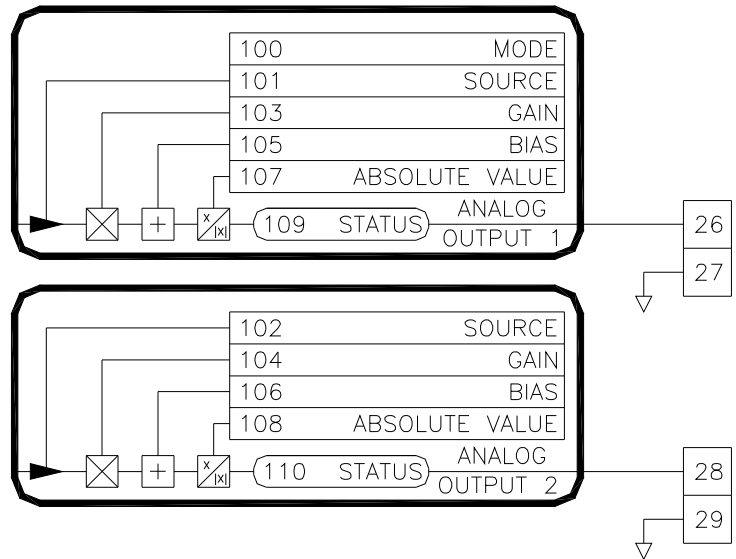


Figure 21: Analog Output Blocks

Gain (103-104)

The analog output level is controlled by the **Gain** setting. Nominally, a source value of 100% will produce 10V output with the **Gain** set at 100%.

$$\text{Gain} = \frac{\text{Desired Full Scale Voltage}}{10\text{V}} \times 100\% - \text{Bias}$$

Bias (105-106)

The **Bias** adjustment can be used to set a minimum output.

$$\text{Bias} = \frac{\text{Desired Minimum Voltage}}{10\text{V}} \times 100\%$$

Absolute Value (107-108)

If set to True, the absolute value of the source data will be taken, allowing parameters with negative polarities to produce positive outputs.

Status (168, 169, Read-Only)

Each DAC output (12 bit) can be viewed for diagnostic purposes. See Table 5 for common readings.

| Voltage | Status |
|---------|--------|
| 10.0 | 4095 |
| 7.5 | 3071 |
| 5.0 | 2047 |
| 2.5 | 1024 |
| 0.0 | 0 |

Example - Analog Output

Table 5: Analog Output Readings

Setup Analog Output 1 to output the **PID Output** signal. Scale the analog output so that a 100.00% value from the **PID Output** gives 5V.

1. Set **Analog Output 1 Source** to **PID Output** (369).
2. Set **Analog Output 1 Bias** to 0.00%.
3. Set **Analog Output 1 Gain** to 50.00%.

$$\text{Gain} = \frac{\text{Desired Full Scale Voltage}}{10\text{V}} \times 100\% - \text{Bias} = \frac{5\text{V}}{10\text{V}} \times 100\% - 0\% = 50\%$$

4. Set **Analog Output 1 Absolute Value** to False.

Analog Output 1 will give a 5V full-scale version of **PID Output**. If a 10V full-scale signal were required, the **Analog Output 1 Gain** should be set to 100% in Step 3.

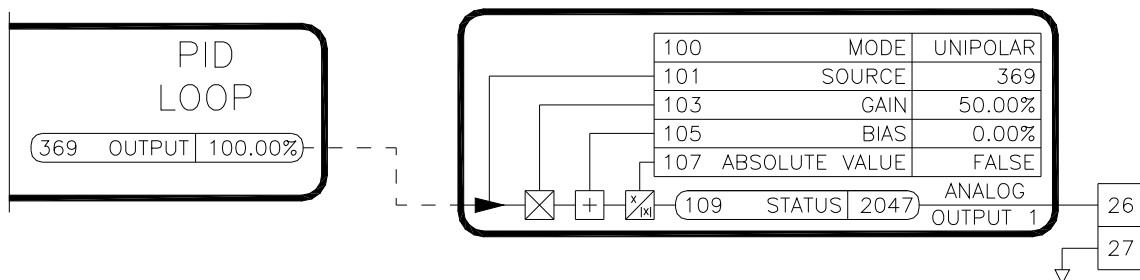


Figure 22: Setting an Analog Output

5.11 Frequency/Digital Outputs

The Cortex® LT has two configurable multi-function Frequency/Digital outputs. Both outputs can function as digital outputs that can be setup to output logic values (on/off). Output 1 can also function as a frequency output and output values in the form of a frequency level. Output 2 can also serve as a frequency output. However, its frequency output level is always the same as output 1 with the logic inverted. This specific function is mainly utilized when Frequency Output 1 is used to drive a sonic transducer. Frequency Output 2 could then be used as an inverted clock signal to an additional sonic transducer. The inverted logic of the frequency outputs prevents the sonic transducers from interfering with each other.

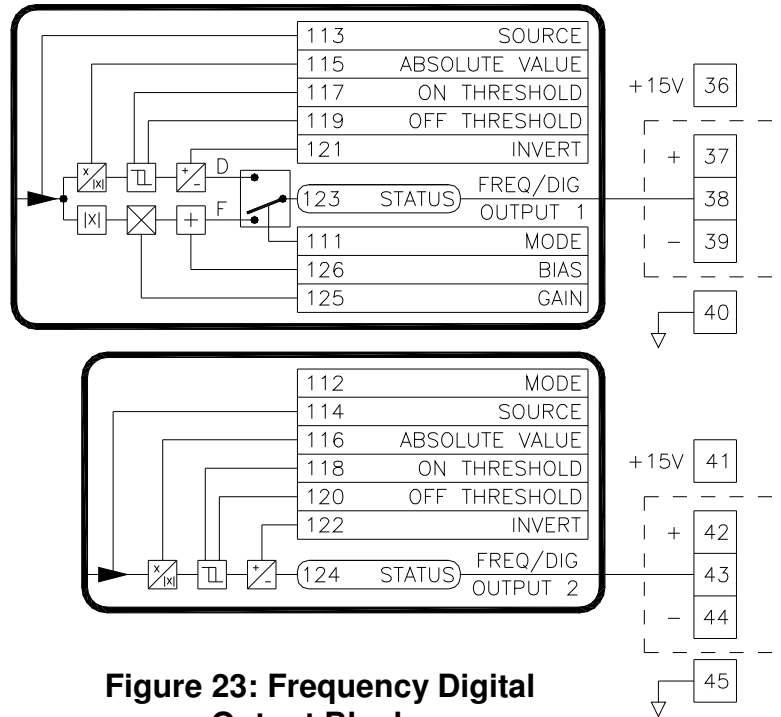


Figure 23: Frequency Digital Output Blocks

Note: The Frequency/Digital Output is an isolated open collector opto-coupler output. A voltage must be supplied at terminals 37 & 39 for output 1 and terminals 42 & 44 for output 2. If isolation is not required, a +15V supply and common are supplied at adjacent terminals for simplified connections.

Frequency/Digital Output Mode (111-112)

This parameter selects the type of output desired: frequency or digital.

Source (113-114, ICR)

The tag number of the source parameter from which data is to be read.

Absolute Value (Applicable for digital output mode only) (115-116)

When **Absolute Value** is True, the absolute value of the source data is used to provide a positive only level. This allows bipolar signals to operate the output properly regardless of the signal polarity.

On Threshold (Applicable for digital output mode only) (117-118) Refer to footnote * on p.23

The threshold level that the source signal must equal or exceed in order for the digital output to be on.

Off Threshold (Applicable for digital output mode only) (119-120) Refer to footnote * on p.23

The threshold level that the source signal must equal or fall below in order for the digital output to be off.

Invert (Applicable for digital output mode only) (121-122)

When Invert is True, the output logic is inverted.

Gain (Applicable for frequency output mode only) (125)

The **Gain** adjustment is used to scale the maximum output. 100.00% gain equates to 5000 Hz output. This value can be calculated as follows:

$$\text{Gain} = \frac{\text{Maximum Output in Hertz}}{5000 \text{ Hz}} \times 100\% - \text{Bias}$$

Bias (Applicable for frequency output mode only) (126)

The **Bias** adjustment can be used to set a minimum output.

$$\text{Bias} = \frac{\text{Minimum Output in Hertz}}{5000 \text{ Hz}} \times 100\%$$

Status (123-124, Read-Only)

The level of the frequency/digital output can be viewed for diagnostic purposes. In the frequency mode, the sensor indicates the actual frequency level output in Hertz. In the digital output mode, False indicates the output is off (low), while True indicates the output is on (high).

Example - Frequency Output

Setup Frequency Output 1 to output the Sum 1 parameter. A full-scale level of 1800 Hz should be output when Sum 1 is at 100%.

1. Set the **Frequency/Digital Output 1 Mode** to Frequency.
2. Set the **Frequency/Digital Output 1 Source** to **Sum 1** (233).
3. Set the **Frequency Output 1 Bias** to 0.00%.
4. Set the **Frequency Output 1 Gain** to 36.00%.

$$\text{Gain} = \frac{\text{Maximum Output in Hertz}}{5000 \text{ Hz}} \times 100\% - \text{Bias} = \frac{1800 \text{ Hz}}{5000 \text{ Hz}} \times 100\% - 0\% = 36.00\%$$

Frequency Output 1 will give a 1800 Hz full-scale signal when **Sum 1** equals 100%. If a 5000 Hz full-scale signal were required, the **Gain** should be set to 100% in Step 4.

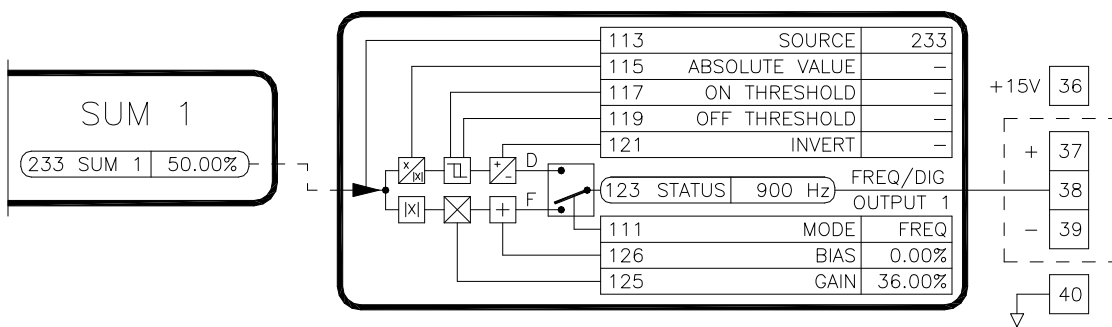


Figure 24: Setting Frequency Digital Output for Frequency

Example - Digital Output

Setup Digital Output 1 to indicate when the diameter is above 40 inches.

1. Set the **Frequency/Digital Output 1 Mode** to Digital.
2. Set the **Frequency/Digital Output 1 Source** to **Diameter** (202).
3. Set the **Digital Output On Threshold** to 40.00 inches.
4. Set the **Digital Output Off Threshold** to 39.00 inches.
5. Set the **Digital Output Invert** to False.

The Digital Output will be on when the diameter is at or above 40 inches. The output will be off when the diameter is at or below 39 inches.

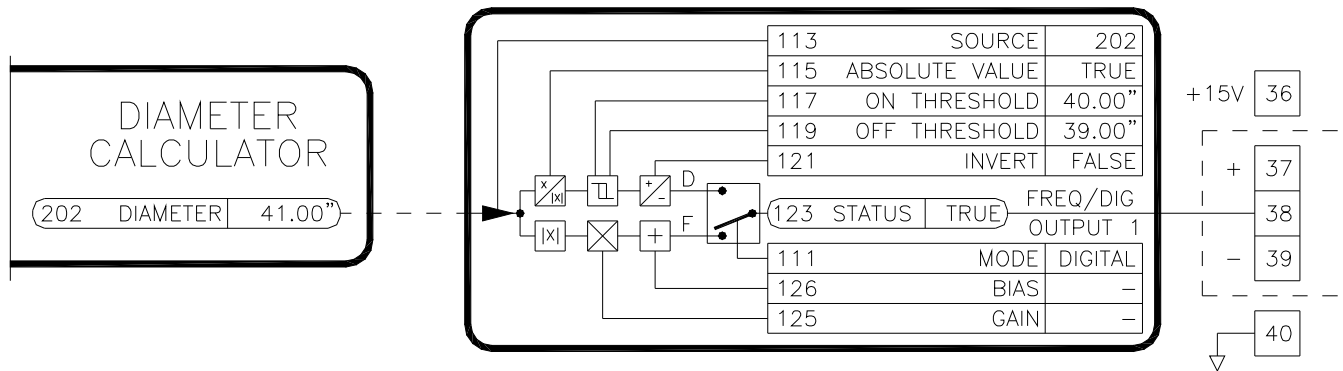


Figure 25: Setting Frequency Digital Output for Digital

5.12 LED Outputs

The Cortex® LT has two LED indicator outputs labeled Run and Fault. Each LED can be configured to monitor up to five parameters and indicate when any of them are true.

Source A-E (127-131, 133-137)

The tag of the source parameters. When any of the source parameters are True (non-zero) the LED will be on.

Status (132,138, Read-Only)

Parameter indicating the current state of the LED. True indicates the LED is on and False indicates the LED is off.

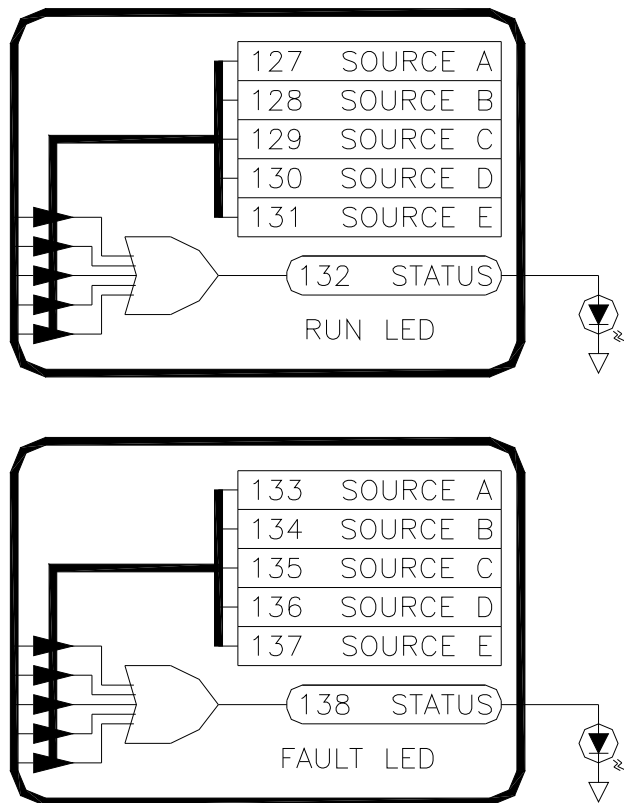


Figure 26: LED Output Blocks

5.13 Internal Links

The internal links can be used to connect or link parameters together. The Cortex® LT provides 20 links for custom configuration. Each link has a source and a destination.

Note: When two parameters with different numbers of decimal places are linked together the following occurs: The source parameter value is reformatted into an integer without any decimal places. The number of decimal places of the destination parameter is then applied to the resulting integer. For example, if a source parameter has a value of 12.34% (2 decimals) and it is linked to an accel/decel time parameter (1 decimal), 12.34% is converted to an integer value of 1234, and then reformatted with 1 decimal place, 123.4. Therefore, the destination will contain the value 123.4 seconds.

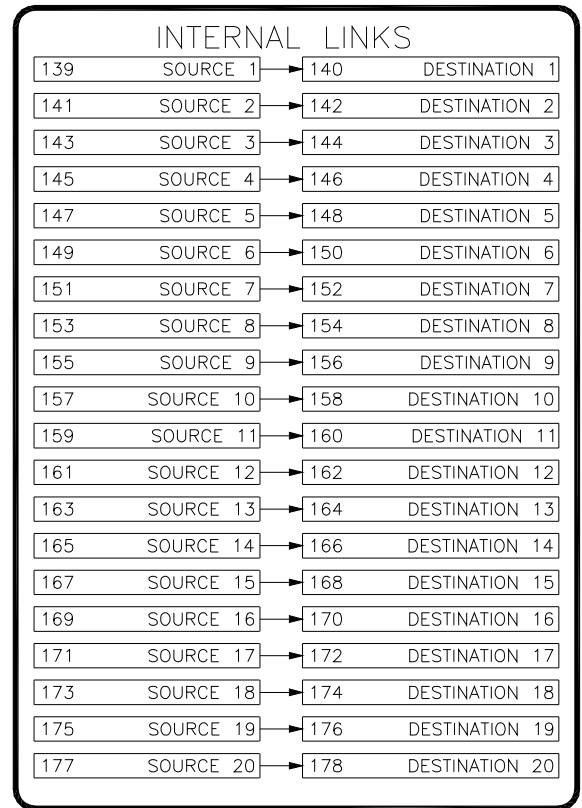


Figure 27: Internal Links Block

Source

The tag of the source parameter.

Destination (ICR)

The tag of the destination parameter.

Example - Internal Link

Setup an internal link from **Accel Time 1** to **Decel Time 1**. Whenever the **Accel Time 1** parameter is changed, the **Decel Time 1** parameter is also changed to the same value.

1. Set **Internal Link 5 Source** to **Accel Time 1 (257)**.
2. Set **Internal Link 5 Destination** to **Decel Time 1 (259)**.

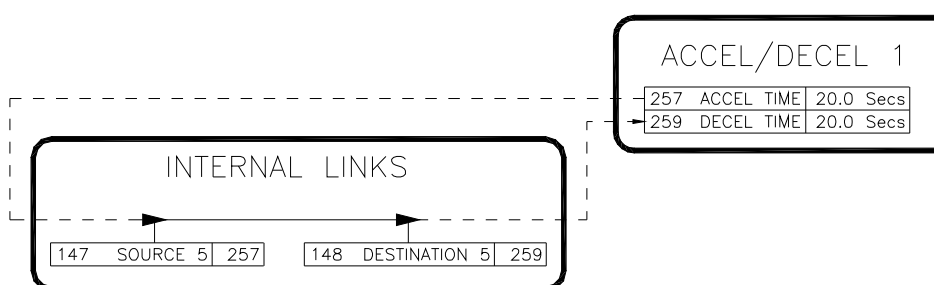


Figure 28: Using an Internal Link

5.14 Communications

The Communication parameters control the Modbus® serial port interfaces at Com A, Com B, and Com C. Refer to the Appendix on page 94 for detailed info on the Modbus® protocol.

Com A is a multidrop RS485 port. This port is primarily used to interface to monitoring and control equipment such as HMI's (Human Machine Interface). While the baud rate is adjustable, the Parity and Stop Bits are fixed at None, and One respectively.

Com B is an auxiliary RS485 port. This port is currently not used and provided for future expansion.

Com C is a single drop RS485/RS232 port that is generally intended to interface to a PC for initial setup and/or monitoring of the Cortex® LT.

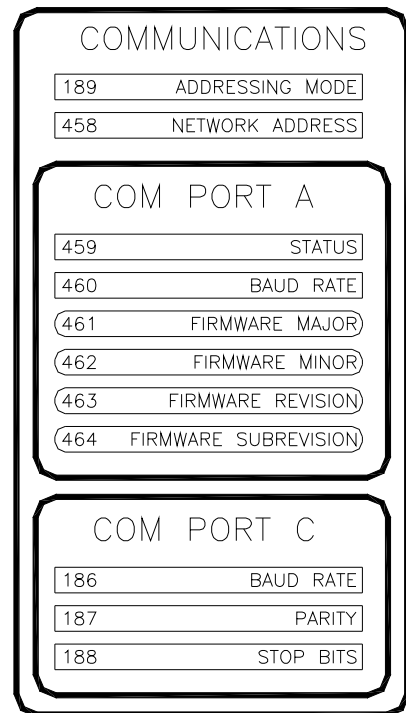


Figure 29: Communication Block

Network Address (458)

The address of the Cortex® LT on the Modbus® network. Each device on the network must have a unique network address.

Addressing Mode (189)

In the Modbus® specification, registers are addressed using an offset. For example, to read register 1, an address of 0 must be used. Much of the available Modbus® master communications equipment (PLC's and touchscreens) take this offset into account. Therefore, to read register 1, an address of 1 is used when programming. The master device will decrement the address before requesting it from the slave.

However, not all master devices take this offset into account. The **Addressing Mode** parameter in the Cortex® LT can be used to implement either scheme and "match up" the addresses so that the actual address is used to address that register.

In order to determine which mode to use with a particular master, have the master read the **Address Mode Test 2** parameter. If the returned value is 0xAAAA in hex, everything is correct. If the returned value is 0x5555 (the value of **Address Mode Test 1**), then the **Addressing Mode** parameter needs to be changed.

Com A Status (459)

On power up, the Cortex LT performs an internal test on the Com A serial port module. True indicates the module is responding correctly. False indicates a device and/or hardware malfunction in the serial port.

Com A Baud Rate (460)

This parameter sets the transmit and receive rate of data over the serial communications port A. Available selections are 2400,4800,9600,19200, & 38400.

Com A Firmware Version (461-464)

These parameters contain the firmware version of the serial communications port A module.

Com C Baud Rate (186)

This parameter sets the transmit and receive rate of data over the serial communications port C. Available selections are 2400,4800,9600,19200, & 38400.

Com C Parity (187)

The **Parity** parameter sets the type of byte level error checking that is used on com port C. Available selections are None, Odd, & Even.

Com C Stop Bits (188)

Sets the number of stop bits used per byte on com C. In the Modbus® specification, the number of stop bits is determined by the parity selection. One stop bit should be used with Even or Odd parity, and two stop bits should be used with No parity.

Note: When using 38400 baud rate, Carotron recommends that No Parity and two stop bits be used.

5.15 System Parameters

The majority of these parameters are used by the LT Link PC software.

Firmware Version (6-8, Read-Only)

Version of firmware in the Cortex® LT.

Command Entry (9)

The Command Entry parameter provides a means for predefined commands to be activated via the serial communications port. An unlock code of 1492 (decimal) must first be entered. Once unlocked, a command code is entered. Refer to Table 6 for codes and descriptions.

| SYSTEM | |
|--------|-------------------------|
| 0 | TRASH |
| 1 | ADDR MODE TEST1 |
| 2 | ADDR MODE TEST2 |
| 3 | CONFIGURATION CODE |
| 4 | CUSTOMIZATION CODE(LSW) |
| 5 | CUSTOMIZATION CODE(MSW) |
| 6 | FIRMWARE MAJOR |
| 7 | FIRMWARE MINOR |
| 8 | FIRMWARE REVISION |
| 9 | COMMAND ENTRY |
| 10 | COMMAND STATUS |
| 11 | SYSTEM STATUS |
| 12 | BOOT FIRMWARE MAJOR |
| 13 | BOOT FIRMWARE MINOR |
| 14 | BOOT FIRMWARE REVISION |
| 15 | TOTAL PARAMETERS |
| 16 | RESERVED |
| 17 | RESERVED |
| 18 | RESERVED |
| 491 | PARAMETERS CHANGED |

Figure 30: System Block

| Code | Description |
|------|---|
| 101 | Save - Makes current settings permanent |
| 102 | Load - Loads last saved settings |
| 103 | Load Factory - Loads factory preset settings |
| 104 | Reset - Performs power on reset |
| 105 | Re-initialize - Clears all settings and loads factory |
| 106 | Reserved |
| 107 | Analog In 1 0% Cal - Copies Analog Input #1 Status to 0% Cal |
| 108 | Analog In 2 0% Cal - Copies Analog Input #2 Status to 0% Cal |
| 109 | Analog In 3 0% Cal - Copies Analog Input #3 Status to 0% Cal |
| 110 | Analog In 4 0% Cal - Copies Analog Input #4 Status to 0% Cal |
| 111 | Analog In 1 100% Cal - Copies Analog Input #1 Status to 100% Cal |
| 112 | Analog In 2 100% Cal - Copies Analog Input #2 Status to 100% Cal |
| 113 | Analog In 3 100% Cal - Copies Analog Input #3 Status to 100% Cal |
| 114 | Analog In 4 100% Cal - Copies Analog Input #4 Status to 100% Cal |
| 115 | Frequency In 1 0% Cal - Copies Freq Input #1 Status to 0% Cal |
| 116 | Frequency In 2 0% Cal - Copies Freq Input #2 Status to 0% Cal |
| 117 | Frequency In 1 100% Cal - Copies Freq Input #1 Status to 100% Cal |
| 118 | Frequency In 2 100% Cal - Copies Freq Input #2 Status to 100% Cal |
| 119 | Reset Com Ports A & B |

Table 6: Command Entry Codes

Command Status (10)

Status code of **Command Entry** sequence.

| Code | Description |
|------|------------------------------------|
| 0 | OK: Command completed Successfully |
| 1 | Ready: Valid unlock code received |
| 2 | Data: Waiting for data |
| 3 | Active: Command active |
| 4 | Error: Error in command sequence |

Table 7: Command Status Codes

Boot Firmware Version (12-14, Read-Only)

Version of bootloader firmware in the Cortex® LT.

Total Parameters (15)

Contains the number of parameters in this version of the Cortex LT firmware.

Parameters Changed (491)

When True, signals that a parameter or parameters have been changed but not saved.

5.16 Threshold Blocks

The threshold blocks compare an input value to two threshold levels. Depending upon the comparison, one of two values are sent to the output.

Input (301-304)

The value of the internal parameter that serves as the control for the switch. An input or internal link must be used to connect the desired parameter to this input.

Absolute Value (297-300)

When True, the absolute value of the input is taken before comparing to the **On Threshold** and the **Off Threshold**.

On Threshold (289-292)

The threshold level that the **Input** signal must equal or exceed in order for the **On Value** to be sent to the **Output**.

Off Threshold (293-296)

The threshold level that the **Input** signal must equal or fall below in order for the **Off Value** to be sent to the **Output**.

On Value (281-284)

The value sent to the **Output** when the **Input** is greater than or equal to the **On Threshold**.

Off Value (285-288)

The value sent to the **Output** when the **Input** is less than or equal to the **Off Threshold**.

Output (305-308, Read-Only)

Contains either the **On Value** or **Off Value** depending on the comparison between the **Input** and the **On Threshold** and **Off Threshold**.

Example - Thresholds

Setup the Threshold 1 block to monitor the Diameter and change the PID Proportional Gain parameter. The Proportional Gain should be 1.00 below 5.00 inches and 2.00 above.

1. Set **Internal Link 9 Source** to **Diameter (202)**.
2. Set **Internal Link 9 Destination** to **Threshold 1 Input (301)**.
3. Set **Threshold 1 On Value** to 5.00%.
4. Set **Threshold 1 Off Value** to 4.00%.

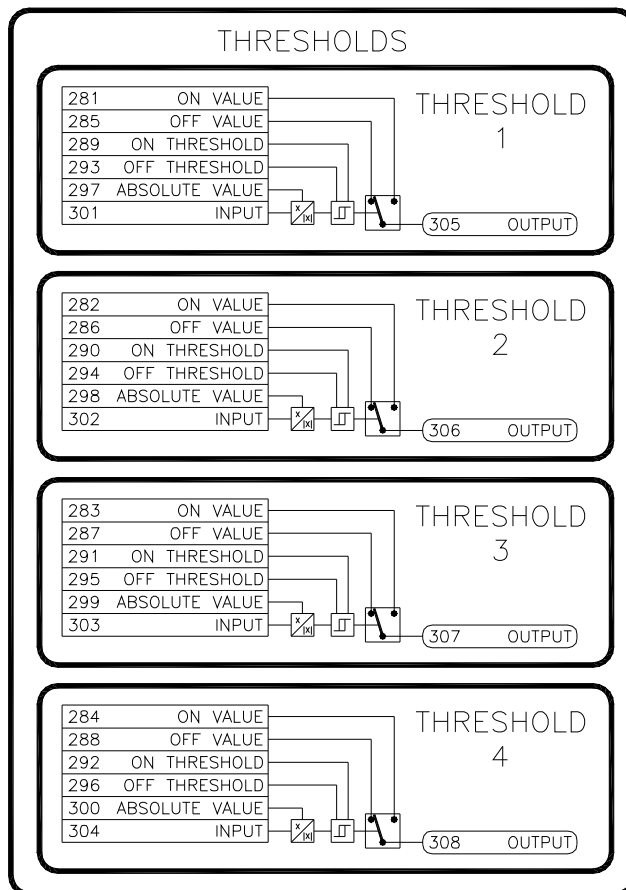


Figure 31: Threshold Blocks

5. Set **On Value** to 1.00%.
6. Set **Off Value** to 2.00%.
7. Set **Internal Link 10 Source** to **Threshold 1 Output (305)**.
8. Set **Internal Link 10 Destination** to **PID Prop Gain (353)**.

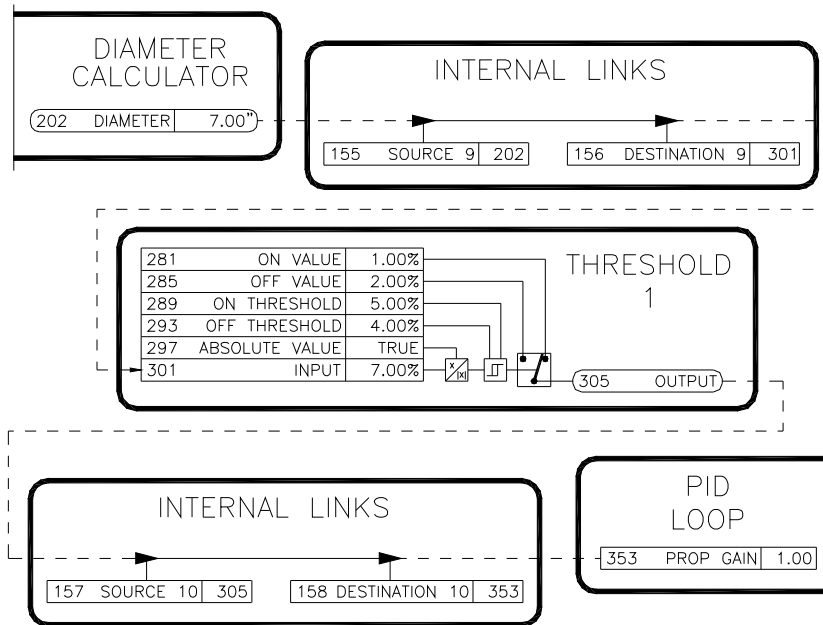


Figure 32: Threshold Example

5.17 Timer Blocks

Each of the four timers can operate in one of seven modes. Depending upon the mode and the input, one of two values are sent to the output.

Mode (317-320)

Sets the timer function:

On Delay

When Input becomes True, the Output switches from Value B to Value A after a pause of Delay Time 1. Output switches back to Value B when Input becomes False.

Off Delay

When Input becomes True, the Output immediately switches from Value B to Value A. When Input becomes False, the Output switches from Value A to Value B after a pause of Delay Time 1.

One Shot

When Input becomes True, the Output immediately switches from Value B to Value A. After a pause of Delay Time 1, the Output switches back to Value B. The timer ignores any successive state changes on the Input (i.e. cannot be retriggered).

Retriggerable One Shot

Performs the same as the One Shot described above, except that successive state changes on the Input reset the delay.

Single Cycle

When Input becomes True, the Output switches from Value B to Value A after a pause of Delay Time 1. The Output switches back to Value B after a pause of Delay Time 1.

Repeat Cycle

When Input becomes True, the Output immediately switches from Value B to Value A. After a pause of Delay Time 1, the Output switches back to Value B. After a pause of Delay Time 2, the Output switches back to Value A. The cycle repeats until Input becomes False.

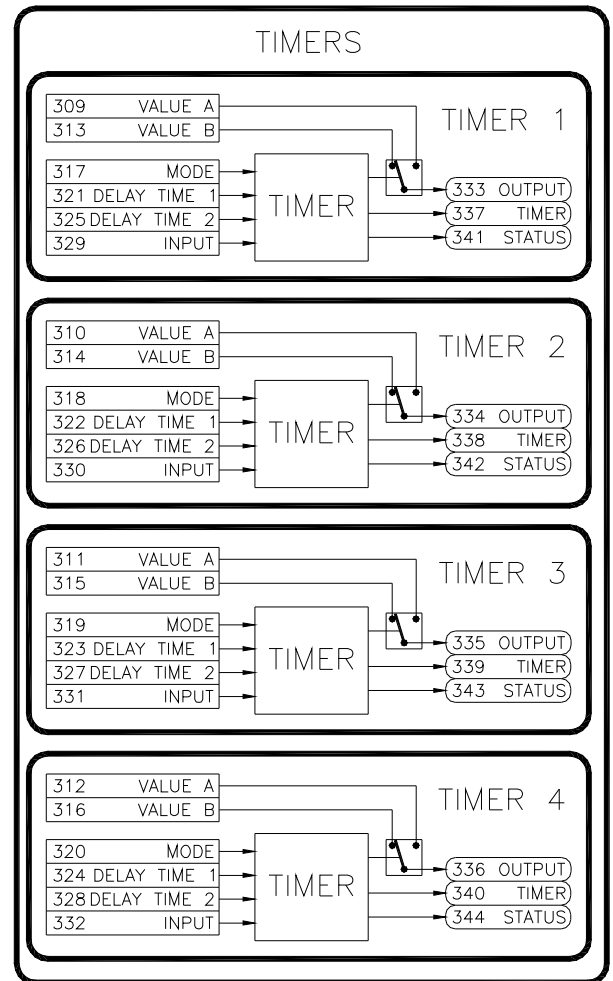


Figure 33: Timer Blocks

Delayed Start Repeat Cycle

Performs the same as above, except when the Input initially becomes True a pause of Delay Time 2 is executed before the Output switches from value B to Value A.

Input (329-332)

This parameter serves as the trigger or control signal to the timer.

Timer (337-340)

The value of the Timer in seconds.

Value A (309-312)

One of two possible values the Output can be when the timer is active.

Value B (313-316)

Initial value that the Output has before the timer is triggered.

Delay Time 1 (321-324)

Adjustable time delay from 0 to 300.0 seconds.

Delay Time 2 (325-328)

Adjustable time delay from 0 to 300.0 seconds.

Status (341-344)

True indicates the Timer is running. False indicates the Timer is stopped.

Timer Output (315, Read-Only)

Contains either the **Value A** or **Value B** values depending on the **Timer** value and **Mode**.

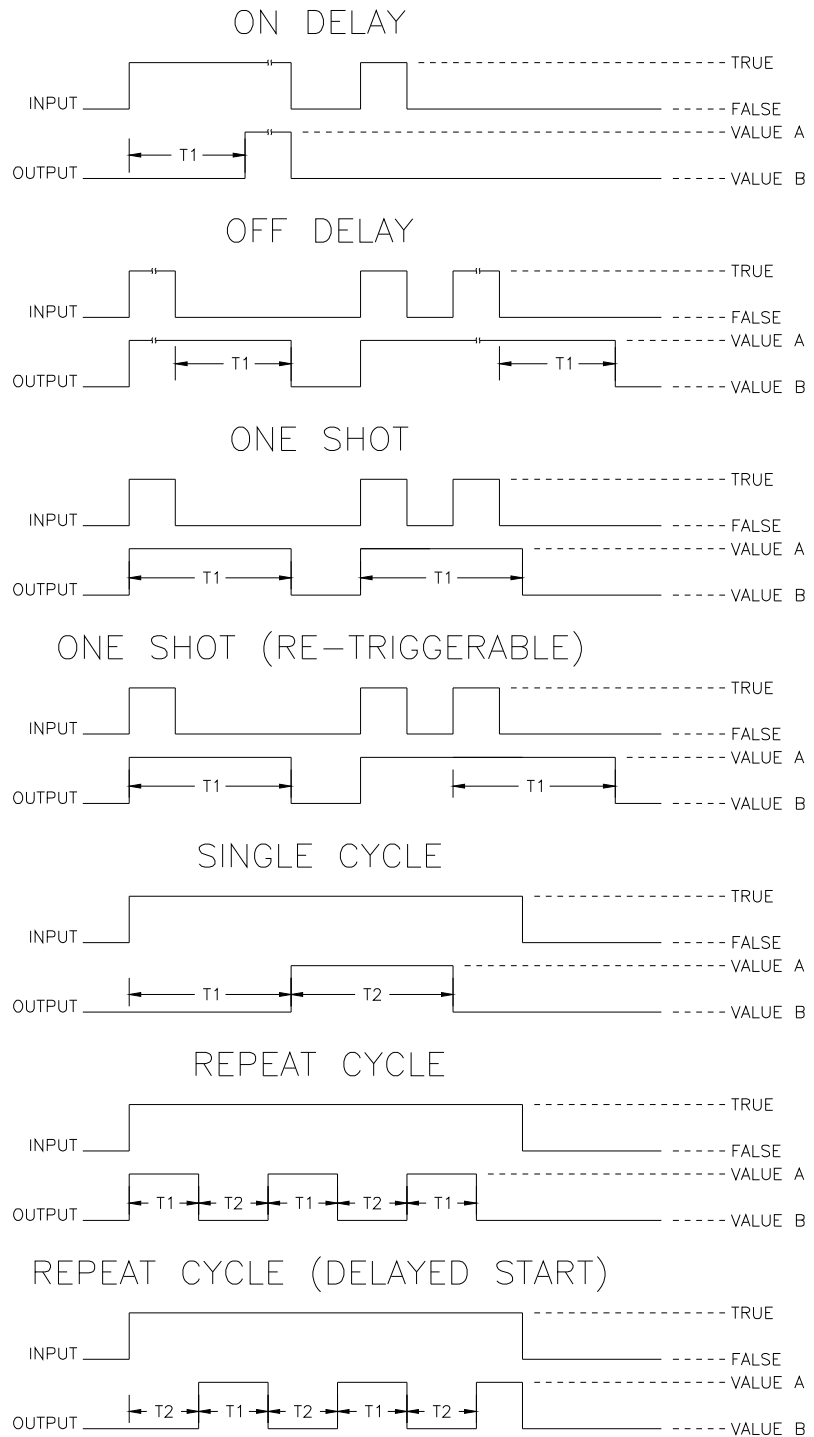


Figure 34: Timer Functions

5.18 Auxiliary Parameters

The Cortex® LT provides 7 auxiliary parameters for general use. One specific function the auxiliary parameters are used for is to tie an input directly to an output.

Example - Auxiliary Parameters

A frequency to voltage conversion is needed. The Cortex® LT can perform the conversion using its frequency input and an analog output. Setup the Cortex® LT to convert a 0 to 4000 Hz signal to a voltage signal of 0 to 7.5VDC.

1. Set the **Frequency Input 1 Destination** to **Auxiliary 1** (179),
 2. Set the **Frequency Input 1 Min Calibration** to 0 Hz.
 3. Set the **Frequency Input 1 Max Calibration** to 4000 Hz.
 4. The **Frequency Input 1 Bias** and **Gain** parameters should be set the factory presets of 0.00% and 100.00%.
 5. Set **Analog Output 1 Source** to **Auxiliary 1** (179).
 6. Set **Analog output 1 Bias** to 0.00%.
 7. Set **Analog Output 1 Gain** to 75.00% ($7.5\text{VDC}/10.0\text{VDC}=75\%$).
- Analog Output 1 should now give the desired voltage levels.

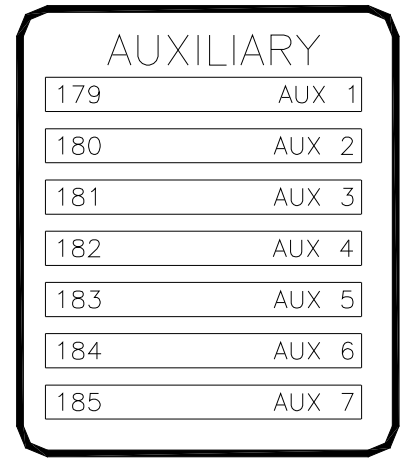


Figure 35: Auxiliary Block

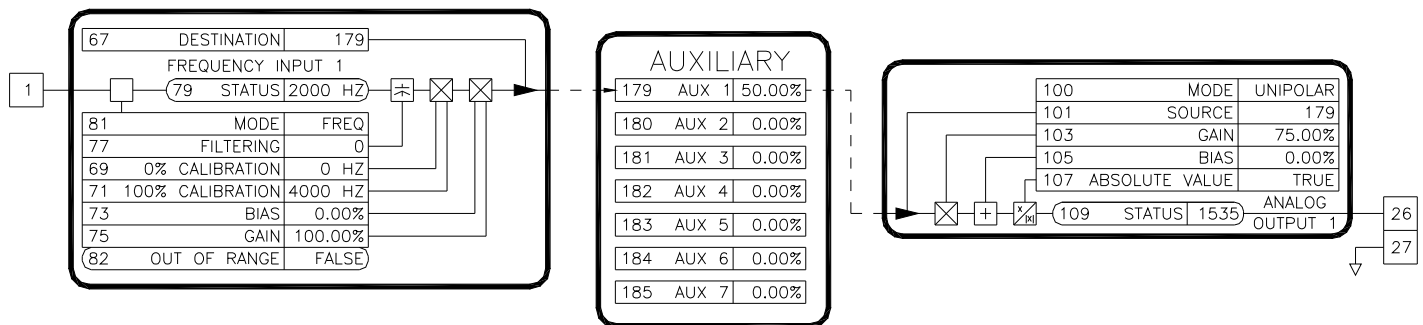


Figure 36: Auxiliary Block Example

5.19 PID Loops

The Cortex LT provides 2 PID Loops for system integration with dancer potentiometers, loadcells, etc...

Enable (352,470)

This parameter must be set to True for the PID block to function. When False, all of the PID parameters are held at their previous value.

Proportional Gain (353,471)

The **Proportional Gain** scales the output based upon the **Error**. Increasing the gain improves the loop response but can also increase overshoot.

Integral Time (354,472)

The **Integral Time** adjustment eliminates steady-state error. Decreasing the integral time improves loop response. However, setting it too low can cause oscillation. The adjustment is in seconds and corresponds to the amount of time that the **PID Output** signal would take to integrate from 0.00% to 100%.

Derivative Gain

(355,473)

With derivative action, the controller output is proportional to the rate of change of the error. The **Derivative Gain** output is based upon the predicted **Error** by analyzing the previous error levels. Increasing the **Derivative Gain** can help reduce overshoot.

Integral Clamp (356,474)

When **Integral Clamp** is True, the integral signal is clamped to zero in the PID loop, yielding proportional and derivative control only.

Integral Polarity (357,475)

The **Integral Polarity** parameter controls whether the integral portion of the controller is unipolar (positive only) or bipolar (positive and negative).

Deadband (358,476)

The **Deadband** adjustment is used to provide a window of tolerance in the error signal that the integral circuit will ignore. This is commonly used to ignore small dancer movements.

Setpoint (359,477)

The desired position on dancer systems or the desired tension in loadcell control systems.

Feedback (360,478)

The dancer feedback signal or loadcell feedback signal. This signal will typically come from one of the Analog Inputs.

Error (361,479, Read-Only)

The difference between the desired **Setpoint** and the actual **Feedback**.

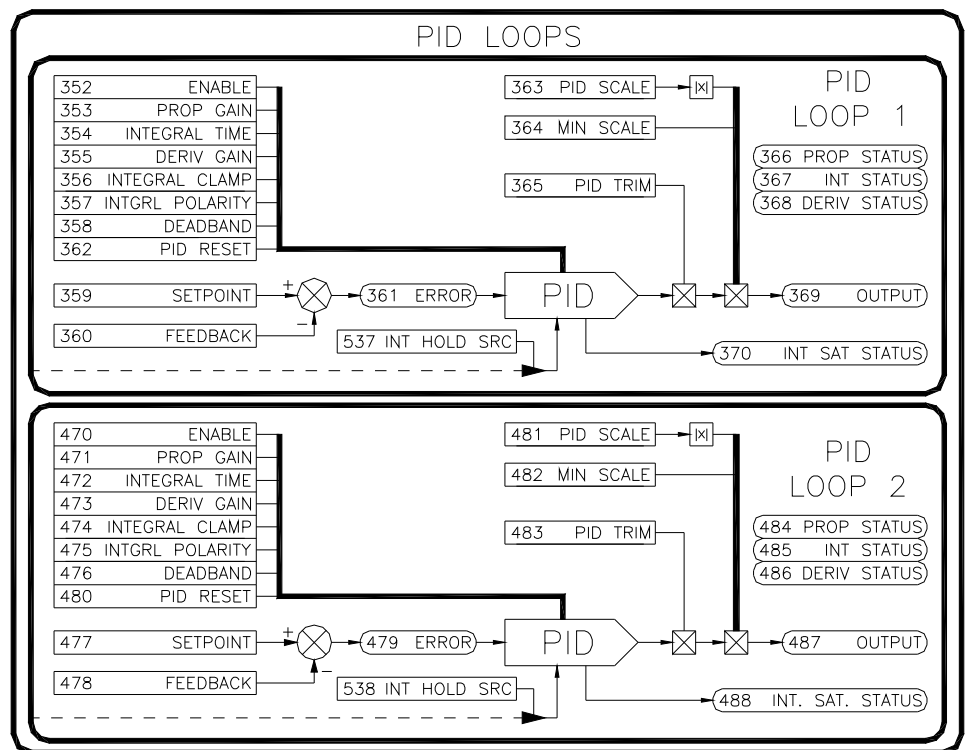


Figure 37: PID Loop Blocks

PID Reset (362,480)

When True, resets the **PID Output** to zero.

PID Scale (363,481)

The **PID Scale** adjustment provides for a method to scale the **PID Output** via an external signal. This signal is typically a line speed signal from an Analog Input.

PID Min Scale (364,482)

The **Min Scale** adjustment provides for a minimum level of scaling even when the PID Scale parameter is at zero.

PID Trim (365,483)

The **PID Trim** adjustment controls the amount of correction that the **PID Output** can provide.

Proportional Status (366,484, Read-Only)

The individual proportional component of the **PID Output**. This parameter is provided for aid in setup and tuning.

Integral Status (367,485, Read-Only)

The individual integral component of the **PID Output**. This parameter is provided for aid in setup and tuning.

Derivative Status (368,486, Read-Only)

The individual integral component of the **PID Output**. This parameter is provided for aid in setup and tuning.

PID Output (369,487, Read-Only)

The output of the PID loop after being modified by the **PID Trim** and **PID Scale** parameters.

Integral Saturation Status (370,488, Read-Only)

When the Integral signal saturates at $\pm 100.00\%$, the **Integral Saturation Status** parameter becomes True. This may indicate that the **PID Trim** parameter may need to be increased. This parameter is provided for aid in setup and tuning.

PID Integrator Hold Source (537, 538)

This parameter is designed to keep the integration from going negative. It will monitor another parameter and if the monitored parameter is less than or equal to zero and moving more negative, the integrator goes into a hold mode. When the monitored parameter is greater than zero or less than zero but moving toward positive, the integrator behaves normally. This is an optional parameter. This parameter is disabled when set to 0 (Trash).

Integral Mode (545, 546)

The Integral portion has two modes of operation. In the Linear mode, the rate of change of the integral value is not dependent on the amount of error. This mode is useful and typically more stable in dancer/loadcell systems. In the Standard mode, the rate of change of the integral is dependent on the amount of error (the greater the error, the faster the integration).

5.20 Logic Switches

The Cortex[®] LT provides four logic switches that can emulate internal relays or switches.

Coil (265-268)

When True, the **Output** is equal to the **On Value**. When False, the **Output** is equal to the **Off Value**.

On Value (269-272)

The value that the **Output** has when the **Coil** is True.

Off Value (273-276)

The value that the **Output** has when the **Coil** is False.

Output (277-280)

Is equal to the **On Value** or **Off Value** depending upon the state of **Coil**.

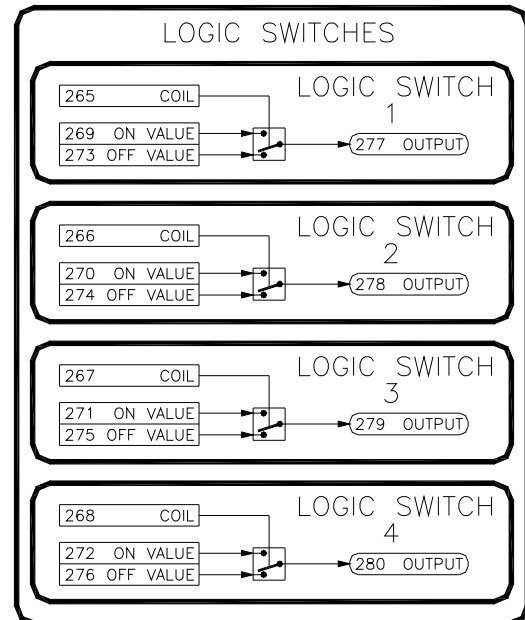


Figure 38: Logic Switch Blocks

5.21 Logic Gates

The Logic Gate blocks provide logic and comparison functions.

Mode (378-381)

Determines the function of the gate.

And

Output is True if both **Input A** and **Input B** are non-zero. Otherwise, **Output** is False.

Nand

Inverted output of And.

Or

Output is True if either **Input A** or **Input B** is non-zero. Otherwise, **Output** is False.

Nor

Inverted output of Or.

Exclusive Or (Xor)

Output is True if either **Input A** or **Input B** is non-zero, but not both.

Exclusive Nor (Xnor)

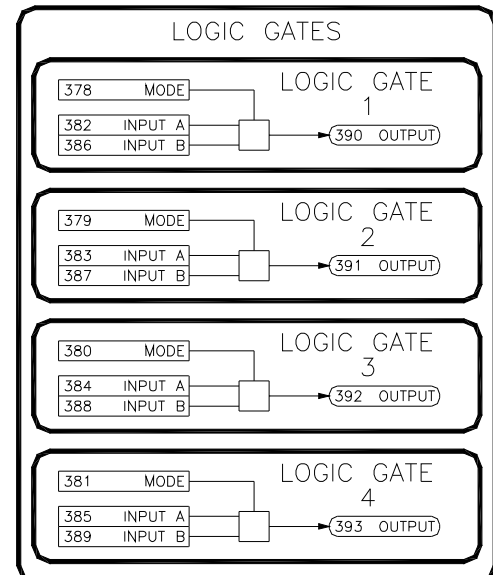


Figure 39: Logic Gate Blocks

Inverted output of Exclusive Or.

Not

Output is True if **Input A** is zero. **Output** is False otherwise.

Greater Than

Output is True if **Input A** > **Input B**.

Greater Than or Equal

Output is True if **Input A** >= **Input B**.

Less Than

Output is True if **Input A** < **Input B**.

Less Than or Equal

Output is True if **Input A** <= **Input B**.

Equal

Output is True if **Input A** equals **Input B**.

Not Equal

Output is True if **Input A** and **Input B** are not equal.

Absolute Value

Output is equal to the absolute value of **Input A**.

Negative Absolute Value

Output is equal to the negative absolute value of **Input A**.

Invert

Output is equal to **Input A** with opposite polarity.

Sum

Output is equal to **Input A** + **Input B**.

Difference

Output is equal to **Input A** - **Input B**.

Ratio

Output is equal to **Input A** ratioed by **Input B**.

Filter

Output is equal to **Input A**. **Input B** controls the filter gain. The higher the gain, the more filtering that is applied.

Set-Reset

Input A functions as the Set and **Input B** functions as the Reset. Refer to Table 8 for Output states.

| Set (Input A) | Reset (Input B) | Output |
|---------------|-----------------|-----------|
| False | False | No Change |
| False | True | False |
| True | False | True |
| True | True | False |

Table 8: Set Reset Truth Table

Positive Edge Latch

The value in **Input A** is latched into **Output** when **Input B** transitions from False to True.

Negative Edge Latch

The value in **Input A** is latched into **Output** when **Input B** transitions from True to False.

Input A (382-385)

First input to the logic gate.

Input B (386-389)

Second input to the logic gate.

Output (390-393)

Output of the logic gate. Value is determined by **Mode**, **Input A**, and **Input B**.

5.22 Turret Logic Block

The Turret Logic Block is provided to allow a single Cortex® LT to control both rolls of a dual turret winder.

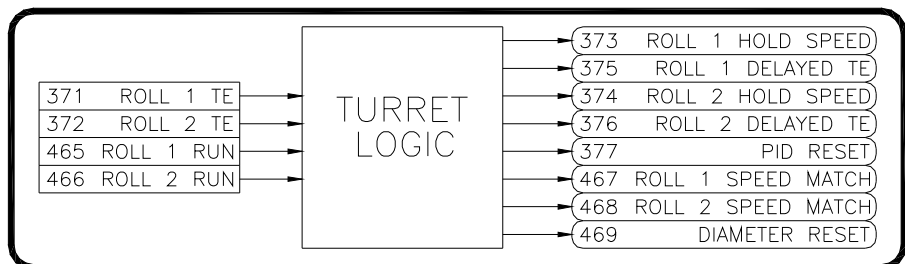


Figure 40: Turret Logic Block

Roll 1 Tension Enable

(371)

Input that typically is linked from one of the digital inputs. This input is used to enable the diameter based tension output on roll 1.

Roll 2 Tension Enable (372)

Input that typically is linked from one of the digital inputs. This input is used to enable the diameter based tension output on roll 2.

Roll 1 Run (465)

Input that typically is linked from one of the digital inputs. This input is used to enable the output on roll 1.

Roll 2 Run (466)

Input that typically is linked from one of the digital inputs. This input is used to enable the output on roll 2.

Roll 1 Hold Speed (373)

Output that typically is linked to the **Ramp Hold** parameter in the Accel/Decel 1 block. This output is used to temporarily hold the roll 1 speed constant during the splice and switch over to roll 2.

Roll 2 Hold Speed (374)

Output that typically is linked to the **Ramp Hold** parameter in the Accel/Decel 2 block. This output is used to temporarily hold the roll 2 speed constant during the splice and switch over to roll 1.

Roll 1 Delayed Tension Enable (375)

Output that is typically linked to the **Reference Select 1 (MSB)** parameter. This output is used to enable the diameter based tension output in roll 1. This signal is delayed to allow the PID to be reset momentarily before becoming active with the new roll.

Roll 2 Delayed Tension Enable (376)

Output that is typically linked to the **Reference Select 2 (MSB)** parameter. This output is used to enable the diameter based tension output in roll 2. This signal is delayed to allow the PID to be reset momentarily before becoming active with the new roll.

PID Reset (377)

Output that is typically linked to the **PID Reset** parameter of the PID block. This output becomes True momentarily to provide automatic reset of the PID loop when switching over from a full roll to an empty core.

Roll 1 Speed Match (467)

Output that is typically linked to the **Reference Select 1 (LSB)** parameter. This output is used to enable the speed match reference output for roll 1.

Roll 2 Speed Match (468)

Output that is typically linked to the **Reference Select 2 (LSB)** parameter. This output is used to enable the speed match reference output for roll 1.

Diameter Reset (469)

Output that is typically linked to the **Count Reset** parameter of Frequency input 2. This output is used only if the diameter is calculated by counting Line Speed revolutions or Roll Speed revolutions. This output becomes True momentarily to provide automatic reset of the diameter when switching over from a full roll to an empty core.

Turret Winder Operating Sequence

Initially, all of the Run and Tension Enable contacts are open and empty cores are loaded onto both winders. Material is loaded into the machine for Roll 1. Close the Roll 1 Run and Roll 1 Tension Enable contacts. The line drive can be activated and ramped up to speed.

As Roll 1 nears maximum diameter, the Roll 2 Run causing Roll 2 to speed match with the line. When change over is made, the Roll 2 Tension contact must be closed.

Roll 1 will hold its present speed until both the Roll 1 Run and Roll 1 Tension Enable contacts are opened. Once opened, Roll 1 will ramp down to zero speed and the roll can be replaced with an empty core.

As Roll 2 nears maximum diameter, the Roll 1 Run contact is closed, causing Roll 1 to speed match with the line. When the splice and change over is made, the Roll 1 Tension Enable contact must be closed.

Roll 2 will hold its present speed until both the Roll 2 Run and Roll 2 Tension Enable contacts are opened. Once opened, Roll 2 will ramp down to zero speed and the roll can be replaced with an empty core.

The above cycle may repeat until the machine needs to be stopped.

Stopping and re-starting a partially built roll (Roll 1 described)

To temporarily stop the winder when Roll 1 is active (winding), stop the line drive. After it ramps to zero speed, open the Roll 1 Run contact but keep the Roll 1 Tension Enable contact closed. This will prevent the diameter from being reset. When ready to restart, simply close the Roll 1 Run contact and then restart the line drive.

Stopping a completely built roll (Roll 1 described)

To stop the cycle when Roll 1 is active (winding), stop the line drive. After it ramps to zero speed, open all of the Run and Tension Enable contacts for both rolls.

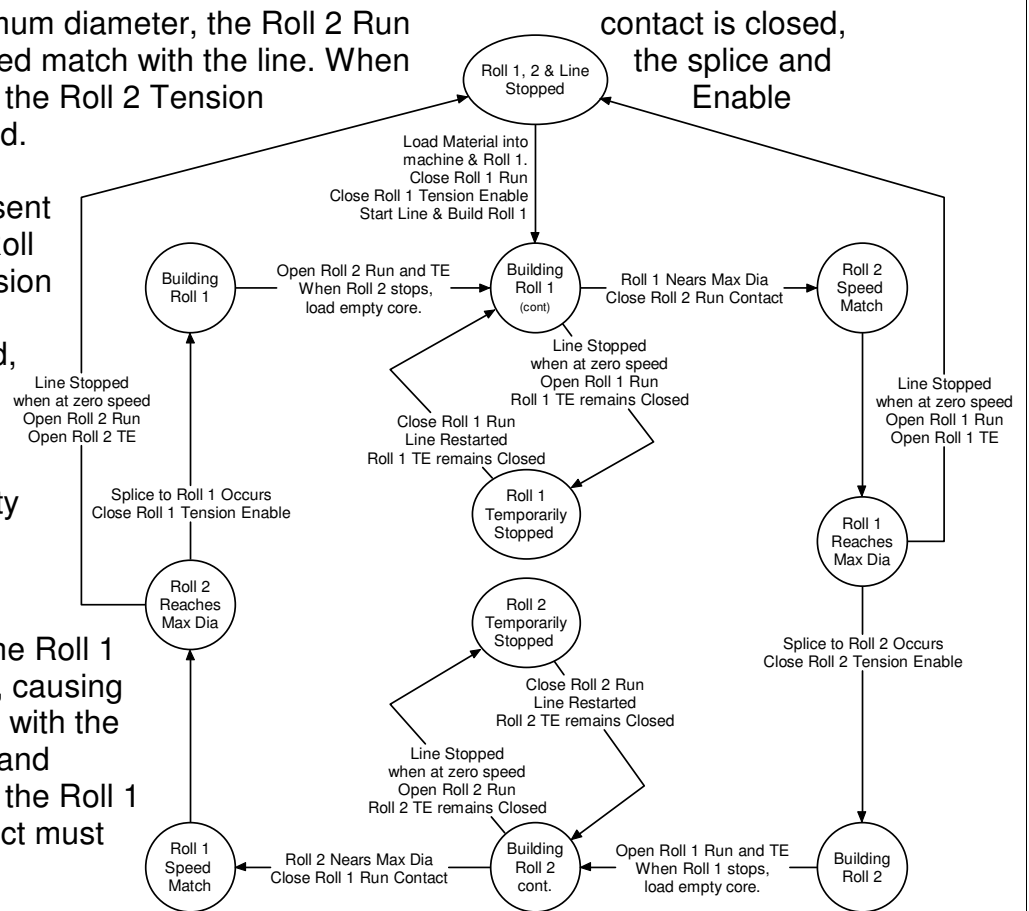


Figure 41: Turret Logic Operating Sequence

5.23 Brake Letoff Logic Block

The Cortex[®] LT provides a logic block to implement control of a undriven brake letoff. This logic block serves as a control block for many of the other function

blocks. All of the following assumes that the Cortex LT is configured as a Brake Letoff controller (refer to the LT Builder in the Cortex LT Link software).

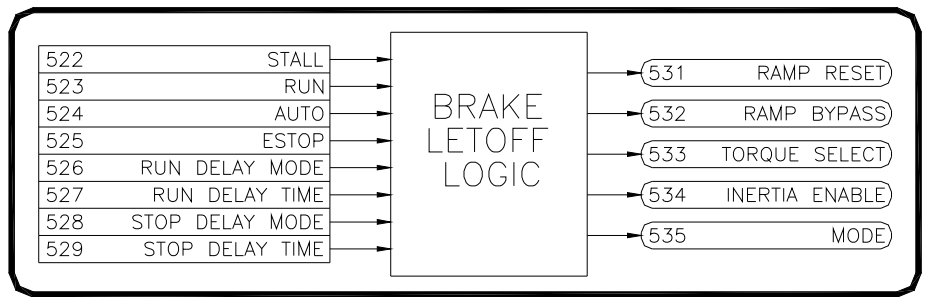


Figure 42: Brake Letoff Logic Block

Tension is controlled by the LT by providing a braking torque signal through varying levels of roll diameter and line speeds. Two basic modes of operation are provided: manual and auto. In manual mode, the level of output torque from the Cortex LT is simply controlled by the Manual Torque setting. In Auto mode, the output torque is compensated by the change in diameter in order to provide constant tension. Additionally, loadcells may also be used in this mode to provide for closed loop tension control. The operating sequence is detailed below. Refer to Figure 43.

When the Stall input is closed, the output torque ramps to the Stall Torque level. This mode is used to prevent the letoff from unrolling while the line is stopped. When the Run input is closed and the line begins accelerating up to speed, the braking torque ramps to the Initial Run Torque level. This is typically a very low torque level, allowing the line to accelerate the letoff up to speed. The output torque is held at the Initial Run Torque level until the Run Delay Mode conditions are met (timer expires and/or line at speed). If the Auto Input is open (manual mode), the output torque ramps to the Manual Torque level. If the Auto Input is closed (auto mode), the output torque ramps to a torque level based upon the diameter and the Tension Setpoint. This torque level will be adjusted to maintain the desired tension as the diameter of the letoff decreases. When the Run Input is opened and the line begins decelerating, the braking torque will continue to be output as in the Run mode. Once the Stop Delay Mode conditions are met (timer expires and/or line at zero speed), the output torque ramps to the Stall Torque level. When the Stall Input is opened, the torque signal is immediately clamped to zero. An Emergency Stop Input is also provided. When this input is opened, the output torque immediately transitions to an adjustable E-Stop Torque level allowing the letoff to be quickly stopped.

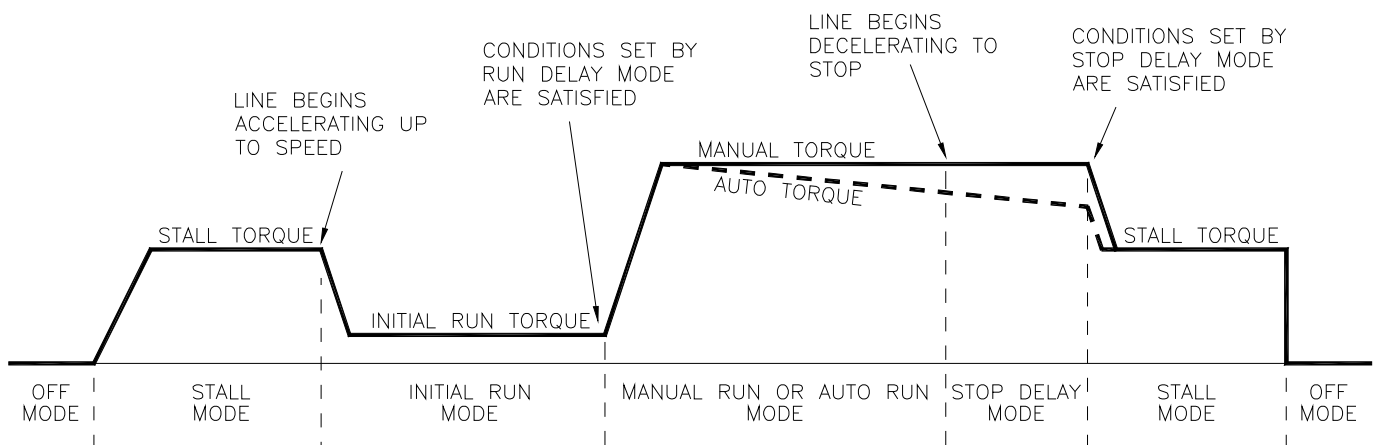


Figure 43: Brake Letoff Operational Profile

Stall (522)

Input that typically is linked from digital input 1. A value of True selects the Stall mode, while False selects the Off mode.

Run (523)

Input that typically is linked from digital input 2. When Run becomes True, the unit exits the Stall mode and enters the Initial Run mode. When Run becomes False, the unit exits the Manual or Auto Run mode and enters the Stop Delay mode.

Auto (524)

Input that may be linked from digital input 3. A value of True selects the auto mode of operation, and the torque output will be compensated for changes in diameter and line speed. A value of False selects the manual mode of operation, and a constant level of torque is output.

Emergency Stop (525)

Input that is typically linked from digital input 4. A value of True overrides all other modes and causes the Emergency Stop torque level to be selected. When the Emergency Stop mode is entered, the Stall and Run inputs must be de-activated to return to the Off mode.

Run Delay Mode (526)

Determines the conditions that must be met before the unit exits the Initial Run mode and enters the Manual Run or Auto Run mode.

Timer

The Run mode is entered when the time specified by **Run Delay Time** has elapsed.

Speed

The Run mode is entered when the **Line Speed Status** transitions from accelerating to steady (i.e. when Line Speed finishes accelerating).

Either

The Run mode is entered when either of the above conditions are met.

Both

The Run mode is entered when both of the above conditions are met.

Run Delay Time (527)

The length of time the unit remains in the Initial Run mode before entering the Manual or Auto Run mode. This parameter is used when **Run Delay Mode** is set to Timer, Either, or Both.

Stop Delay Mode (528)

Determines the conditions that must be met before the unit exits the Stop Delay mode and enters the Stall mode.

Timer

The unit exits the Stop Delay mode when the time specified by **Stop Delay Time** has elapsed.

Speed

The unit exits the Stop Delay mode when Line Speed falls below the **Zero Speed Threshold**.

Either

The unit exits the Stop Delay mode when either of the above conditions are met.

Both

The unit exits the Stop Delay mode when both of the above conditions are met.

Stop Delay Time (529)

The length of time the unit remains in the Initial Run mode before entering the Manual or Auto Run mode. This parameter is used when **Run Delay Mode** is set to Timer, Either, or Both.

Ramp Reset (531, Read-Only)

Output that is typically linked to the **Ramp Reset** parameter of the Accel/Decel 2 block. This output is True only in the Off mode in order to clamp the output to zero.

Ramp Bypass (532, Read-Only)

Output that is typically linked to the **Ramp Bypass** parameter of the Accel/Decel 2 block. This output is True only in the Auto Run mode.

Torque Select (533, Read-Only)

Output that is typically linked to the **Reference Select (LSB)** parameter of Reference Select 1 block. The Torque Select value is used to select between the Stall, Initial Run, Manual, & Diameter Torque levels.

Inertia Compensation Enable (534, Read-Only)

Output that is typically linked to the **Coil** parameter of the Logic Switch 1. This output is True only in the Auto Run mode.

Mode (535, Read-Only)

Displays the mode of the Brake Letoff Logic block.

EStop

Off

Stall

Initial Run

Initial Auto Run

Manual Run

Auto Run

Stop Delay

Zero Speed Threshold (530, moved to the Application Calculator block)

The threshold that **Line Speed** must fall below before the unit exits the Stop Delay mode. This parameter is used when **Stop Delay Mode** is set to Speed, Either, or Both.

5.24 General Parameters

The Cortex® LT provides 12 general use parameters. Typically, these parameters are used as a control block interface to HMI (Human Machine Interface) displays.

| GENERAL | |
|---------|------------|
| 492 | GENERAL 1 |
| 493 | GENERAL 2 |
| 494 | GENERAL 3 |
| 495 | GENERAL 4 |
| 496 | GENERAL 5 |
| 497 | GENERAL 6 |
| 498 | GENERAL 7 |
| 499 | GENERAL 8 |
| 500 | GENERAL 9 |
| 501 | GENERAL 10 |
| 502 | GENERAL 11 |
| 503 | GENERAL 12 |

Figure 44: General Parameters Block

5.25 Processing Order

The Cortex® LT provides great flexibility in allowing the block interconnects (links) to be reconfigured. It is therefore essential that the processor executes the blocks in a specific order to minimize the time that it takes for signals to propagate through the device. Normally, the settings in the Processing Order block are set by the LT Link configuration software. Changes to these settings may only be required if the Cortex® LT is configured manually.

The Processing Order block provides the means to control not only the order, but also which blocks do and do not execute. Each individual block in the Cortex® LT has a unique integer code assigned to it. This code must be entered into one of the Processing Order Block parameters in order for that block to be executed. The block whose integer code is in **Block 1** is executed first. Followed by **Block 2**, etc...

If an internal block's code is not entered into one of the Execution Order's block parameters, it will not be executed by the processor.

| PROCESSING ORDER | | | |
|------------------|----------|-----|----------|
| 394 | BLOCK 1 | 417 | BLOCK 24 |
| 395 | BLOCK 2 | 418 | BLOCK 25 |
| 396 | BLOCK 3 | 419 | BLOCK 26 |
| 397 | BLOCK 4 | 420 | BLOCK 27 |
| 398 | BLOCK 5 | 421 | BLOCK 28 |
| 399 | BLOCK 6 | 422 | BLOCK 29 |
| 400 | BLOCK 7 | 423 | BLOCK 30 |
| 401 | BLOCK 8 | 424 | BLOCK 31 |
| 402 | BLOCK 9 | 425 | BLOCK 32 |
| 403 | BLOCK 10 | 426 | BLOCK 33 |
| 404 | BLOCK 11 | 427 | BLOCK 34 |
| 405 | BLOCK 12 | 428 | BLOCK 35 |
| 406 | BLOCK 13 | 429 | BLOCK 36 |
| 407 | BLOCK 14 | 430 | BLOCK 37 |
| 408 | BLOCK 15 | 431 | BLOCK 38 |
| 409 | BLOCK 16 | 432 | BLOCK 39 |
| 410 | BLOCK 17 | 433 | BLOCK 40 |
| 411 | BLOCK 18 | 434 | BLOCK 41 |
| 412 | BLOCK 19 | 435 | BLOCK 42 |
| 413 | BLOCK 20 | 436 | BLOCK 43 |
| 414 | BLOCK 21 | 437 | BLOCK 44 |
| 415 | BLOCK 22 | 438 | BLOCK 45 |
| 416 | BLOCK 23 | 439 | BLOCK 46 |

Figure 45: Processing Order Block

| Block | Code | Block | Code |
|-------------------------|------|--------------------|------|
| Application Calculators | 1 | Internal Link 5 | 24 |
| PID 1 Block | 2 | Internal Link 6 | 25 |
| Length Calculator | 3 | Internal Link 7 | 26 |
| Reference Select 1 | 4 | Internal Link 8 | 27 |
| Reference Select 2 | 5 | Internal Link 9 | 28 |
| Summing 1 | 6 | Internal Link 10 | 29 |
| Summing 2 | 7 | Internal Link 11 | 30 |
| Threshold 1 | 8 | Internal Link 12 | 31 |
| Threshold 2 | 9 | Internal Link 13 | 32 |
| Threshold 3 | 10 | Internal Link 14 | 33 |
| Threshold 4 | 11 | Internal Link 15 | 34 |
| Logic Switch 1 | 12 | Internal Link 16 | 35 |
| Logic Switch 2 | 13 | Internal Link 17 | 36 |
| Logic Switch 3 | 14 | Internal Link 18 | 37 |
| Logic Switch 4 | 15 | Internal Link 19 | 38 |
| Timer 1 | 16 | Internal Link 20 | 39 |
| Timer 2 | 17 | Turret Logic | 40 |
| Timer 3 | 18 | Logic Gate 1 | 41 |
| Timer 4 | 19 | Logic Gate 2 | 42 |
| Internal Link 1 | 20 | Logic Gate 3 | 43 |
| Internal Link 2 | 21 | Logic Gate 4 | 44 |
| Internal Link 3 | 22 | PID 2 Block | 45 |
| Internal Link 4 | 23 | Brake Letoff Logic | 46 |

Table 9: Processing Order Codes

5.26 Parameter Tables

The following two tables lists all the Cortex® LT parameters and their properties. Table 10 is sorted by Tag Number and Table 11 is sorted by Parameter Name. ICR stands for *Inhibit Change while Running* and identifies the parameters that cannot be modified while the unit is in the Run mode. Furthermore, RO indicates *Read-Only* parameters.

Table 10: Parameters by Tag

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|---|----------|----------|-----|----|--------|------|
| 0 | Trash | -32768 | 32767 | | | 0 | |
| 1 | Addressing Mode Test 1 | 0 | 65535 | | RO | 21845 | |
| 2 | Addressing Mode Test 2 | 0 | 65535 | | RO | 43690 | |
| 3 | Configuration Code | 0 | 65535 | | RO | - | |
| 4 | Customization Code (LSW) | 0 | 65535 | | RO | - | |
| 5 | Customization Code (MSW) | 0 | 65535 | | RO | - | |
| 6 | Firmware Version Major | 0 | 255 | | RO | - | |
| 7 | Firmware Version Minor | 0 | 255 | | RO | - | |
| 8 | Firmware Version Revision | 0 | 255 | | RO | - | |
| 9 | Command Entry | 0 | 65535 | | | 0 | |
| 10 | Command Status | 0 | 3 | | RO | 0 | |
| 11 | Reserved | 0 | 65535 | | | 0 | |
| 12 | Reserved | 0 | 65535 | | | 0 | |
| 13 | Reserved | 0 | 65535 | | | 0 | |
| 14 | Reserved | 0 | 65535 | | | 0 | |
| 15 | Reserved | 0 | 65535 | | | 0 | |
| 16 | Reserved | 0 | 65535 | | | 0 | |
| 17 | Reserved | 0 | 65535 | | | 0 | |
| 18 | Reserved | 0 | 65535 | | | 0 | |
| 19 | Digital Input 1 Term 13 Destination | 0 | 546 | ICR | | 0 | |
| 20 | Digital Input 2 Term 14 Destination | 0 | 546 | ICR | | 0 | |
| 21 | Digital Input 3 Term 16 Destination | 0 | 546 | ICR | | 0 | |
| 22 | Digital Input 4 Term 17 Destination | 0 | 546 | ICR | | 0 | |
| 23 | Digital Input 5 Term 19 Destination | 0 | 546 | ICR | | 0 | |
| 24 | Digital Input 1 Term 13 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 25 | Digital Input 2 Term 14 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 26 | Digital Input 3 Term 16 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 27 | Digital Input 4 Term 17 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 28 | Digital Input 5 Term 19 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 29 | Digital Input 1 Term 13 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 30 | Digital Input 2 Term 14 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 31 | Digital Input 3 Term 16 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 32 | Digital Input 4 Term 17 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 33 | Digital Input 5 Term 19 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 34 | Digital Input 1 Term 13 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 35 | Digital Input 2 Term 14 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 36 | Digital Input 3 Term 16 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 37 | Digital Input 4 Term 17 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 38 | Digital Input 5 Term 19 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 39 | Analog Input 1 Term 4 Destination | 0 | 546 | ICR | | 0 | |
| 40 | Analog Input 2 Term 6 Destination | 0 | 546 | ICR | | 0 | |
| 41 | Analog Input 3 Term 8 Destination | 0 | 546 | ICR | | 0 | |
| 42 | Analog Input 4 Term 10 Destination | 0 | 546 | ICR | | 0 | |
| 43 | Analog Input 1 Term 4 0% Calibration | 0 | 4092 | | | 0 | |
| 44 | Analog Input 2 Term 6 0% Calibration | 0 | 4092 | | | 0 | |
| 45 | Analog Input 3 Term 8 0% Calibration | 0 | 4092 | | | 0 | |
| 46 | Analog Input 4 Term 10 0% Calibration | 0 | 4092 | | | 0 | |
| 47 | Analog Input 1 Term 4 100% Calibration | 0 | 4092 | | | 4092 | |
| 48 | Analog Input 2 Term 6 100% Calibration | 0 | 4092 | | | 4092 | |
| 49 | Analog Input 3 Term 8 100% Calibration | 0 | 4092 | | | 4092 | |
| 50 | Analog Input 4 Term 10 100% Calibration | 0 | 4092 | | | 4092 | |
| 51 | Analog Input 1 Term 4 Bias | 0.00% | 200.00% | | | 0.00% | |
| 52 | Analog Input 2 Term 6 Bias | 0.00% | 200.00% | | | 0.00% | |
| 53 | Analog Input 3 Term 8 Bias | 0.00% | 200.00% | | | 0.00% | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|---|------------|-----------|-----|----|------------|------|
| 54 | Analog Input 4 Term 10 Bias | 0.00% | 200.00% | | | 0.00% | |
| 55 | Analog Input 1 Term 4 Gain | 0.00% | 200.00% | | | 100.00% | |
| 56 | Analog Input 2 Term 6 Gain | 0.00% | 200.00% | | | 100.00% | |
| 57 | Analog Input 3 Term 8 Gain | 0.00% | 200.00% | | | 100.00% | |
| 58 | Analog Input 4 Term 10 Gain | 0.00% | 200.00% | | | 100.00% | |
| 59 | Analog Input 1 Term 4 Filtering | 0 | 15 | | | 0 | |
| 60 | Analog Input 2 Term 6 Filtering | 0 | 15 | | | 0 | |
| 61 | Analog Input 3 Term 8 Filtering | 0 | 15 | | | 0 | |
| 62 | Analog Input 4 Term 10 Filtering | 0 | 15 | | | 0 | |
| 63 | Analog Input 1 Term 4 Status | 0 | 4092 | | RO | 0 | |
| 64 | Analog Input 2 Term 6 Status | 0 | 4092 | | RO | 0 | |
| 65 | Analog Input 3 Term 8 Status | 0 | 4092 | | RO | 0 | |
| 66 | Analog Input 4 Term 10 Status | 0 | 4092 | | RO | 0 | |
| 67 | Frequency Input 1 Term 1 Destination | 0 | 546 | ICR | | 0 | |
| 68 | Frequency Input 2 Term 2 Destination | 0 | 546 | ICR | | 0 | |
| 69 | Frequency Input 1 Term 1 0% Calibration | 0Hz | 42000Hz | | | 0Hz | |
| 70 | Frequency Input 2 Term 2 0% Calibration | 0Hz | 42000Hz | | | 0Hz | |
| 71 | Frequency Input 1 Term 1 100% Calibration | 0Hz | 42000Hz | | | 42000Hz | |
| 72 | Frequency Input 2 Term 2 100% Calibration | 0Hz | 42000Hz | | | 42000Hz | |
| 73 | Frequency Input 1 Term 1 Bias | -200.00% | 200.00% | | | 0.00% | |
| 74 | Frequency Input 2 Term 2 Bias | -200.00% | 200.00% | | | 0.00% | |
| 75 | Frequency Input 1 Term 1 Gain | -200.00% | 200.00% | | | 100.00% | |
| 76 | Frequency Input 2 Term 2 Gain | -200.00% | 200.00% | | | 100.00% | |
| 77 | Frequency Input 1 Term 1 Filtering | 0 | 15 | | | 0 | |
| 78 | Frequency Input 2 Term 2 Filtering | 0 | 15 | | | 0 | |
| 79 | Frequency Input 1 Term 1 Status | 0Hz | 65535Hz | | RO | 0Hz | |
| 80 | Frequency Input 2 Term 2 Status | 0Hz | 65535Hz | | RO | 0Hz | |
| 81 | Frequency Input 1 Term 1 Mode | 0:Freq | 1:Sonic | | | 0:Freq | |
| 82 | Frequency Input 1 Term 1 Out Of Range | 0:False | 1:True | | RO | 0:False | |
| 83 | Frequency Input 2 Term 2 Revolution Destination | 0 | 546 | ICR | | 0 | |
| 84 | Frequency Input 2 Term 2 Count (LSW) | 0 | 65535 | | RO | 0 | |
| 85 | Frequency Input 2 Term 2 Count (MSW) | 0 | 65535 | | RO | 0 | |
| 86 | Frequency Input 2 Term 2 Count Enable | 0:False | 1:True | | | 0:False | |
| 87 | Frequency Input 2 Term 2 Reset | 0 | 2 | | | 0 | |
| 88 | Frequency Input 2 Term 2 Direction | 0:Down | 1:Up | | | 1:Up | |
| 89 | Frequency Input 2 Term 2 Pulses/Revolution | 1 | 65535 | | | 1 | |
| 90 | Relay Output 1 Term 30-32 Source | 0 | 546 | ICR | | 0 | |
| 91 | Relay Output 2 Term 33-35 Source | 0 | 546 | ICR | | 0 | |
| 92 | Relay Output 1 Term 30-32 Absolute Value | 0:False | 1:True | | | 1:True | |
| 93 | Relay Output 2 Term 33-35 Absolute Value | 0:False | 1:True | | | 1:True | |
| 94 | Relay Output 1 Term 30-32 On Threshold | -200.00% | 200.00% | | | 0.01% | |
| 95 | Relay Output 2 Term 33-35 On Threshold | -200.00% | 200.00% | | | 0.01% | |
| 96 | Relay Output 1 Term 30-32 Off Threshold | -200.00% | 200.00% | | | 0.00% | |
| 97 | Relay Output 2 Term 33-35 Off Threshold | -200.00% | 200.00% | | | 0.00% | |
| 98 | Relay Output 1 Term 30-32 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 99 | Relay Output 2 Term 33-35 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 100 | Analog Output Mode | 0:Unipolar | 1:Bipolar | | | 0:Unipolar | |
| 101 | Analog Output 1 Term 26 Source | 0 | 546 | ICR | | 0 | |
| 102 | Analog Output 2 Term 28 Source | 0 | 546 | ICR | | 0 | |
| 103 | Analog Output 1 Term 26 Gain | -200.00% | 200.00% | | | 100.00% | |
| 104 | Analog Output 2 Term 28 Gain | -200.00% | 200.00% | | | 100.00% | |
| 105 | Analog Output 1 Term 26 Bias | -100.00% | 100.00% | | | 0.00% | |
| 106 | Analog Output 2 Term 28 Bias | -100.00% | 100.00% | | | 0.00% | |
| 107 | Analog Output 1 Term 26 Absolute Value | 0:False | 1:True | | | 0:False | |
| 108 | Analog Output 2 Term 28 Absolute Value | 0:False | 1:True | | | 0:False | |
| 109 | Analog Output 1 Term 26 Status | 0 | 4095 | | RO | 0 | |
| 110 | Analog Output 2 Term 28 Status | 0 | 4095 | | RO | 0 | |
| 111 | Freq/Digital Output 1 Term 38 Mode | 0:Freq | 1:Digital | | | 0:Freq | |
| 112 | Freq/Digital Output 2 Term 43 Mode | 0:Freq | 1:Digital | | | 1:Digital | |
| 113 | Freq/Digital Output 1 Term 38 Source | 0 | 546 | ICR | | 0 | |
| 114 | Freq/Digital Output 2 Term 43 Source | 0 | 546 | ICR | | 0 | |
| 115 | Freq/Digital Output 1 Term 38 Absolute Value | 0:False | 1:True | | | 1:True | |
| 116 | Freq/Digital Output 2 Term 43 Absolute Value | 0:False | 1:True | | | 1:True | |
| 117 | Freq/Digital Output 1 Term 38 On Threshold | -200.00% | 200.00% | | | 1.00% | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|---|----------|---------|-----|----|---------|------|
| 118 | Freq/Digital Output 2 Term 43 On Threshold | -200.00% | 200.00% | | | 1.00% | |
| 119 | Freq/Digital Output 1 Term 38 Off Threshold | -200.00% | 200.00% | | | 0.00% | |
| 120 | Freq/Digital Output 2 Term 43 Off Threshold | -200.00% | 200.00% | | | 0.00% | |
| 121 | Freq/Digital Output 1 Term 38 Invert | 0:False | 1:True | | | 0:False | |
| 122 | Freq/Digital Output 2 Term 43 Invert | 0:False | 1:True | | | 0:False | |
| 123 | Freq/Digital Output 1 Term 38 Status | 0Hz | 5000Hz | | RO | 0Hz | |
| 124 | Freq/Digital Output 2 Term 43 Status | 0Hz | 5000Hz | | RO | 0Hz | |
| 125 | Freq/Digital Output 1 Term 38 Gain | 0.00% | 200.00% | | | 100.00% | |
| 126 | Freq/Digital Output 1 Term 38 Bias | 0.00% | 100.00% | | | 0.00% | |
| 127 | Run LED Source A | 0 | 546 | | | 0 | |
| 128 | Run LED Source B | 0 | 546 | | | 0 | |
| 129 | Run LED Source C | 0 | 546 | | | 0 | |
| 130 | Run LED Source D | 0 | 546 | | | 0 | |
| 131 | Run LED Source E | 0 | 546 | | | 0 | |
| 132 | Run LED Status | 0:False | 1:True | | RO | 0:False | |
| 133 | Fault LED Source A | 0 | 546 | | | 0 | |
| 134 | Fault LED Source B | 0 | 546 | | | 0 | |
| 135 | Fault LED Source C | 0 | 546 | | | 0 | |
| 136 | Fault LED Source D | 0 | 546 | | | 0 | |
| 137 | Fault LED Source E | 0 | 546 | | | 0 | |
| 138 | Fault LED Status | 0:False | 1:True | | RO | 0:False | |
| 139 | Internal Link 1 Source | 0 | 546 | | | 0 | |
| 140 | Internal Link 1 Destination | 0 | 546 | ICR | | 0 | |
| 141 | Internal Link 2 Source | 0 | 546 | | | 0 | |
| 142 | Internal Link 2 Destination | 0 | 546 | ICR | | 0 | |
| 143 | Internal Link 3 Source | 0 | 546 | | | 0 | |
| 144 | Internal Link 3 Destination | 0 | 546 | ICR | | 0 | |
| 145 | Internal Link 4 Source | 0 | 546 | | | 0 | |
| 146 | Internal Link 4 Destination | 0 | 546 | ICR | | 0 | |
| 147 | Internal Link 5 Source | 0 | 546 | | | 0 | |
| 148 | Internal Link 5 Destination | 0 | 546 | ICR | | 0 | |
| 149 | Internal Link 6 Source | 0 | 546 | | | 0 | |
| 150 | Internal Link 6 Destination | 0 | 546 | ICR | | 0 | |
| 151 | Internal Link 7 Source | 0 | 546 | | | 0 | |
| 152 | Internal Link 7 Destination | 0 | 546 | ICR | | 0 | |
| 153 | Internal Link 8 Source | 0 | 546 | | | 0 | |
| 154 | Internal Link 8 Destination | 0 | 546 | ICR | | 0 | |
| 155 | Internal Link 9 Source | 0 | 546 | | | 0 | |
| 156 | Internal Link 9 Destination | 0 | 546 | ICR | | 0 | |
| 157 | Internal Link 10 Source | 0 | 546 | | | 0 | |
| 158 | Internal Link 10 Destination | 0 | 546 | ICR | | 0 | |
| 159 | Internal Link 11 Source | 0 | 546 | | | 0 | |
| 160 | Internal Link 11 Destination | 0 | 546 | ICR | | 0 | |
| 161 | Internal Link 12 Source | 0 | 546 | | | 0 | |
| 162 | Internal Link 12 Destination | 0 | 546 | ICR | | 0 | |
| 163 | Internal Link 13 Source | 0 | 546 | | | 0 | |
| 164 | Internal Link 13 Destination | 0 | 546 | ICR | | 0 | |
| 165 | Internal Link 14 Source | 0 | 546 | | | 0 | |
| 166 | Internal Link 14 Destination | 0 | 546 | ICR | | 0 | |
| 167 | Internal Link 15 Source | 0 | 546 | | | 0 | |
| 168 | Internal Link 15 Destination | 0 | 546 | ICR | | 0 | |
| 169 | Internal Link 16 Source | 0 | 546 | | | 0 | |
| 170 | Internal Link 16 Destination | 0 | 546 | ICR | | 0 | |
| 171 | Internal Link 17 Source | 0 | 546 | | | 0 | |
| 172 | Internal Link 17 Destination | 0 | 546 | ICR | | 0 | |
| 173 | Internal Link 18 Source | 0 | 546 | | | 0 | |
| 174 | Internal Link 18 Destination | 0 | 546 | ICR | | 0 | |
| 175 | Internal Link 19 Source | 0 | 546 | | | 0 | |
| 176 | Internal Link 19 Destination | 0 | 546 | ICR | | 0 | |
| 177 | Internal Link 20 Source | 0 | 546 | | | 0 | |
| 178 | Internal Link 20 Destination | 0 | 546 | ICR | | 0 | |
| 179 | Aux 1 Param | -200.00% | 200.00% | | | 0.00% | |
| 180 | Aux 2 Param | -200.00% | 200.00% | | | 0.00% | |
| 181 | Aux 3 Param | -200.00% | 200.00% | | | 0.00% | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|--------------------------------|--|---------|-----|----|---------|------|
| 182 | Aux 4 Param | -200.00% | 200.00% | | | 0.00% | |
| 183 | Aux 5 Param | -200.00% | 200.00% | | | 0.00% | |
| 184 | Aux 6 Param | -200.00% | 200.00% | | | 0.00% | |
| 185 | Aux 7 Param | -200.00% | 200.00% | | | 0.00% | |
| 186 | Com C Baud Rate | 0:2400,1:4800,2:9600,3:19200,4:38400 | | | | 4:38400 | |
| 187 | Com C Parity | 0 | 2 | | | 0 | |
| 188 | Com C Stop Bits | 1 | 2 | | | 2 | |
| 189 | Com C Addressing Mode | 0 | 1 | | | 1 | |
| 190 | Line Speed | -200.00% | 200.00% | | | 100.00% | |
| 191 | Line Speed Sum | -200.00% | 200.00% | | | 0.00% | |
| 192 | Diameter Select | 0:None, 1:Ext, 2:RollRevs, 3:LineRevs, 4:Line/Roll | | | | 0:None | |
| 193 | Core Diameter | 0.01" | 200.00" | | | 1.00" | |
| 194 | Max Diameter | 0.01" | 200.00" | | | 10.00" | |
| 195 | Material Thickness | 0.001" | 20.000" | | | 0.001" | |
| 196 | Revolutions | 0 | 65535 | | | 0 | |
| 197 | Length/Revolution | 0.01" | 200.00" | | | 0.01" | |
| 198 | External Diameter Ratio | 0.00% | 100.00% | | | 0.00% | |
| 199 | Roll Speed | -200.00% | 200.00% | | RO | 0.00% | |
| 200 | Roll Speed Sum | -100.00% | 100.00% | | | 0.00% | |
| 201 | Core/Diameter Ratio | 0.00% | 100.00% | | RO | 0.00% | |
| 202 | Diameter | 0.01" | 200.00" | | RO | 0.00" | |
| 203 | Taper Tension Setpoint | 0.00% | 100.00% | | | 0.00% | |
| 204 | Taper Diameter | 0.01" | 200.00" | | | 200.00" | |
| 205 | Taper Percentage | 0.00% | 100.00% | | | 0.00% | |
| 206 | Taper Tension Output | 0.00% | 100.00% | | RO | 0.00% | |
| 207 | Reference Select 1 (MSB) | 0 | 1 | | | 0 | |
| 208 | Reference Select 1 (LSB) | 0 | 3 | | | 0 | |
| 209 | Reference Select 1 Reference 0 | -200.00% | 200.00% | | | 0.00% | |
| 210 | Reference Select 1 Reference 1 | -200.00% | 200.00% | | | 0.00% | |
| 211 | Reference Select 1 Reference 2 | -200.00% | 200.00% | | | 0.00% | |
| 212 | Reference Select 1 Reference 3 | -200.00% | 200.00% | | | 0.00% | |
| 213 | Reference Select 1 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 214 | Reference Select 2 (MSB) | 0 | 1 | | | 0 | |
| 215 | Reference Select 2 (LSB) | 0 | 3 | | | 0 | |
| 216 | Reference Select 2 Reference 0 | -200.00% | 200.00% | | | 0.00% | |
| 217 | Reference Select 2 Reference 1 | -200.00% | 200.00% | | | 0.00% | |
| 218 | Reference Select 2 Reference 2 | -200.00% | 200.00% | | | 0.00% | |
| 219 | Reference Select 2 Reference 3 | -200.00% | 200.00% | | | 0.00% | |
| 220 | Reference Select 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 221 | Sum 1 Ratio A | 0.00% | 100.00% | | | 100.00% | |
| 222 | Sum 1 Input A | -200.00% | 200.00% | | | 0.00% | |
| 223 | Sum 1 Invert A | 0:False | 1:True | | | 0:False | |
| 224 | Sum 1 Ratio B | 0.00% | 100.00% | | | 100.00% | |
| 225 | Sum 1 Input B | -200.00% | 200.00% | | | 0.00% | |
| 226 | Sum 1 Invert B | 0:False | 1:True | | | 0:False | |
| 227 | Sum 1 Ratio C | 0.00% | 100.00% | | | 100.00% | |
| 228 | Sum 1 Input C | -200.00% | 200.00% | | | 0.00% | |
| 229 | Sum 1 Invert C | 0:False | 1:True | | | 0:False | |
| 230 | Sum 1 Ratio D | 0.00% | 100.00% | | | 100.00% | |
| 231 | Sum 1 Input D | -200.00% | 200.00% | | | 0.00% | |
| 232 | Sum 1 Invert D | 0:False | 1:True | | | 0:False | |
| 233 | Sum 1 Output | -200.00% | 200.00% | | RO | 0% | |
| 234 | Sum 2 Ratio A | 0.00% | 100.00% | | | 100.00% | |
| 235 | Sum 2 Input A | -200.00% | 200.00% | | | 0.00% | |
| 236 | Sum 2 Invert A | 0:False | 1:True | | | 0:False | |
| 237 | Sum 2 Ratio B | 0.00% | 100.00% | | | 100.00% | |
| 238 | Sum 2 Input B | -200.00% | 200.00% | | | 0.00% | |
| 239 | Sum 2 Invert B | 0:False | 1:True | | | 0:False | |
| 240 | Sum 2 Ratio C | 0.00% | 100.00% | | | 100.00% | |
| 241 | Sum 2 Input C | -200.00% | 200.00% | | | 0.00% | |
| 242 | Sum 2 Invert C | 0:False | 1:True | | | 0:False | |
| 243 | Sum 2 Ratio D | 0.00% | 100.00% | | | 100.00% | |
| 244 | Sum 2 Input D | -200.00% | 200.00% | | | 0.00% | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|------------------------------|----------|-----------|-----|----|----------|------|
| 245 | Sum 2 Invert D | 0:False | 1:True | | | 0:False | |
| 246 | Sum 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 247 | Accel/Decel 1 Ramp Input | -200.00% | 200.00% | | | 0.00% | |
| 248 | Accel/Decel 2 Ramp Input | -200.00% | 200.00% | | | 0.00% | |
| 249 | Accel/Decel 1 Ramp Output | -200.00% | 200.00% | | RO | 0.00% | |
| 250 | Accel/Decel 2 Ramp Output | -200.00% | 200.00% | | RO | 0.00% | |
| 251 | Accel/Decel 1 Ramp Reset | 0:False | 1:True | | | 0:False | |
| 252 | Accel/Decel 2 Ramp Reset | 0:False | 1:True | | | 0:False | |
| 253 | Accel/Decel 1 Ramp Hold | 0:False | 1:True | | | 0:False | |
| 254 | Accel/Decel 2 Ramp Hold | 0:False | 1:True | | | 0:False | |
| 255 | Accel/Decel 1 Ramp Bypass | 0:False | 1:True | | | 0:False | |
| 256 | Accel/Decel 2 Ramp Bypass | 0:False | 1:True | | | 0:False | |
| 257 | Accel/Decel 1 Accel Time | 0.1Secs | 600.0Secs | | | 10.0Secs | |
| 258 | Accel/Decel 2 Accel Time | 0.1Secs | 600.0Secs | | | 10.0Secs | |
| 259 | Accel/Decel 1 Decel Time | 0.1Secs | 600.0Secs | | | 10.0Secs | |
| 260 | Accel/Decel 2 Decel Time | 0.1Secs | 600.0Secs | | | 10.0Secs | |
| 261 | Accel/Decel 1 Ramp Threshold | 0.00% | 100.00% | | | 100.00% | |
| 262 | Accel/Decel 2 Ramp Threshold | 0.00% | 100.00% | | | 100.00% | |
| 263 | Accel/Decel 1 Ramping Status | 0:False | 1:True | | RO | 0:False | |
| 264 | Accel/Decel 2 Ramping Status | 0:False | 1:True | | RO | 0:False | |
| 265 | Logic Switch 1 Coil | 0:False | 1:True | | | 0:False | |
| 266 | Logic Switch 2 Coil | 0:False | 1:True | | | 0:False | |
| 267 | Logic Switch 3 Coil | 0:False | 1:True | | | 0:False | |
| 268 | Logic Switch 4 Coil | 0:False | 1:True | | | 0:False | |
| 269 | Logic Switch 1 On Value | -200.00% | 200.00% | | | 0.00% | |
| 270 | Logic Switch 2 On Value | -200.00% | 200.00% | | | 0.00% | |
| 271 | Logic Switch 3 On Value | -200.00% | 200.00% | | | 0.00% | |
| 272 | Logic Switch 4 On Value | -200.00% | 200.00% | | | 0.00% | |
| 273 | Logic Switch 1 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 274 | Logic Switch 2 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 275 | Logic Switch 3 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 276 | Logic Switch 4 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 277 | Logic Switch 1 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 278 | Logic Switch 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 279 | Logic Switch 3 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 280 | Logic Switch 4 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 281 | Threshold 1 On Value | -200.00% | 200.00% | | | 0.01% | |
| 282 | Threshold 2 On Value | -200.00% | 200.00% | | | 0.01% | |
| 283 | Threshold 3 On Value | -200.00% | 200.00% | | | 0.01% | |
| 284 | Threshold 4 On Value | -200.00% | 200.00% | | | 0.01% | |
| 285 | Threshold 1 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 286 | Threshold 2 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 287 | Threshold 3 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 288 | Threshold 4 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 289 | Threshold 1 On Threshold | 0.00% | 200.00% | | | 0.01% | |
| 290 | Threshold 2 On Threshold | 0.00% | 200.00% | | | 0.01% | |
| 291 | Threshold 3 On Threshold | 0.00% | 200.00% | | | 0.01% | |
| 292 | Threshold 4 On Threshold | 0.00% | 200.00% | | | 0.01% | |
| 293 | Threshold 1 Off Threshold | 0.00% | 200.00% | | | 0.00% | |
| 294 | Threshold 2 Off Threshold | 0.00% | 200.00% | | | 0.00% | |
| 295 | Threshold 3 Off Threshold | 0.00% | 200.00% | | | 0.00% | |
| 296 | Threshold 4 Off Threshold | 0.00% | 200.00% | | | 0.00% | |
| 297 | Threshold 1 Absolute Value | 0:False | 1:True | | | 0:False | |
| 298 | Threshold 2 Absolute Value | 0:False | 1:True | | | 0:False | |
| 299 | Threshold 3 Absolute Value | 0:False | 1:True | | | 0:False | |
| 300 | Threshold 4 Absolute Value | 0:False | 1:True | | | 0:False | |
| 301 | Threshold 1 Input | -200.00% | 200.00% | | | 0.00% | |
| 302 | Threshold 2 Input | -200.00% | 200.00% | | | 0.00% | |
| 303 | Threshold 3 Input | -200.00% | 200.00% | | | 0.00% | |
| 304 | Threshold 4 Input | -200.00% | 200.00% | | | 0.00% | |
| 305 | Threshold 1 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 306 | Threshold 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 307 | Threshold 3 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 308 | Threshold 4 Output | -200.00% | 200.00% | | RO | 0.00% | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|-------------------------|--|------------|-----|----|------------|------|
| 309 | Timer 1 Value A | -200.00% | 200.00% | | | 1.00% | |
| 310 | Timer 2 Value A | -200.00% | 200.00% | | | 1.00% | |
| 311 | Timer 3 Value A | -200.00% | 200.00% | | | 1.00% | |
| 312 | Timer 4 Value A | -200.00% | 200.00% | | | 1.00% | |
| 313 | Timer 1 Value B | -200.00% | 200.00% | | | 0.00% | |
| 314 | Timer 2 Value B | -200.00% | 200.00% | | | 0.00% | |
| 315 | Timer 3 Value B | -200.00% | 200.00% | | | 0.00% | |
| 316 | Timer 4 Value B | -200.00% | 200.00% | | | 0.00% | |
| 317 | Timer 1 Mode | 0:OnDelay, 1:OffDelay, 2:OneShot, 3:RetriggerableOneShot, 4:SingleCycle, 5:RepeatCycle,6:DelayedStartRepeatCycle | | | | 0:OnDelay | |
| 318 | Timer 2 Mode | 0:OnDelay, 1:OffDelay, 2:OneShot, 3:RetriggerableOneShot, 4:SingleCycle, 5:RepeatCycle,6:DelayedStartRepeatCycle | | | | 0:OnDelay | |
| 319 | Timer 3 Mode | 0:OnDelay, 1:OffDelay, 2:OneShot, 3:RetriggerableOneShot, 4:SingleCycle, 5:RepeatCycle,6:DelayedStartRepeatCycle | | | | 0:OnDelay | |
| 320 | Timer 4 Mode | 0:OnDelay, 1:OffDelay, 2:OneShot, 3:RetriggerableOneShot, 4:SingleCycle, 5:RepeatCycle,6:DelayedStartRepeatCycle | | | | 0:OnDelay | |
| 321 | Timer 1 Delay Time 1 | 0.0Secs | 300.0Secs | | | 0.1Secs | |
| 322 | Timer 2 Delay Time 1 | 0.0Secs | 300.0Secs | | | 0.1Secs | |
| 323 | Timer 3 Delay Time 1 | 0.0Secs | 300.0Secs | | | 0.1Secs | |
| 324 | Timer 4 Delay Time 1 | 0.0Secs | 300.0Secs | | | 0.1Secs | |
| 325 | Timer 1 Delay Time 2 | 0.0Secs | 300.0Secs | | | 0.1Secs | |
| 326 | Timer 2 Delay Time 2 | 0.0Secs | 300.0Secs | | | 0.1Secs | |
| 327 | Timer 3 Delay Time 2 | 0.0Secs | 300.0Secs | | | 0.1Secs | |
| 328 | Timer 4 Delay Time 2 | 0.0Secs | 300.0Secs | | | 0.1Secs | |
| 329 | Timer 1 Input | 0:False | 1:True | | | 0:False | |
| 330 | Timer 2 Input | 0:False | 1:True | | | 0:False | |
| 331 | Timer 3 Input | 0:False | 1:True | | | 0:False | |
| 332 | Timer 4 Input | 0:False | 1:True | | | 0:False | |
| 333 | Timer 1 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 334 | Timer 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 335 | Timer 3 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 336 | Timer 4 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 337 | Timer 1 Value | 0.0Secs | 300.0Secs | | RO | 0.0Secs | |
| 338 | Timer 2 Value | 0.0Secs | 300.0Secs | | RO | 0.0Secs | |
| 339 | Timer 3 Value | 0.0Secs | 300.0Secs | | RO | 0.0Secs | |
| 340 | Timer 4 Value | 0.0Secs | 300.0Secs | | RO | 0.0Secs | |
| 341 | Timer 1 Status | 0:False | 1:True | | RO | 0:False | |
| 342 | Timer 2 Status | 0:False | 1:True | | RO | 0:False | |
| 343 | Timer 3 Status | 0:False | 1:True | | RO | 0:False | |
| 344 | Timer 4 Status | 0:False | 1:True | | RO | 0:False | |
| 345 | Max Length (LSW) | 0 | 655.35 | | | 0 | |
| 346 | Max Length (MSW) | 0 | 65535 | | | 0 | |
| 347 | Length/Revolution | 0.01" | 200.00" | | | 0.01" | |
| 348 | Revolutions | 0 | 65535 | | | 1 | |
| 349 | Length (LSW) | 0 | 65535 | | RO | 0 | |
| 350 | Length (MSW) | 0 | 65535 | | RO | 0 | |
| 351 | Length Ratio | 0.00% | 100.00% | | RO | 0.00% | |
| 352 | PID 1 Enable | 0:False | 1:True | | | 0:False | |
| 353 | PID 1 Proportional Gain | 0.00 | 10.00 | | | 5.00 | |
| 354 | PID 1 Integral Time | 0.010Secs | 60.000Secs | | | 10.000Secs | |
| 355 | PID 1 Derivative Gain | 0.00 | 10.00 | | | 0.00 | |
| 356 | PID 1 Integral Clamp | 0:False | 1:True | | | 0:False | |
| 357 | PID 1 Integral Polarity | 0:False | 1:True | | | 0:False | |
| 358 | PID 1 Deadband | 0.00% | 30.00% | | | 0.00% | |
| 359 | PID 1 Setpoint | -100.00% | 100.00% | | | 0.00% | |
| 360 | PID 1 Feedback | -100.00% | 100.00% | | | 0.00% | |
| 361 | PID 1 Error | -200.00% | 200.00% | | RO | 0.00% | |
| 362 | PID 1 Reset | 0:False | 1:True | | | 0:False | |
| 363 | PID 1 Scale | -100.00% | 100.00% | | | 100.00% | |
| 364 | PID 1 Min Scale | 0.00% | 100.00% | | | 10.00% | |
| 365 | PID 1 Trim | -100.00% | 100.00% | | | 100.00% | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|--------------------------------------|--|---------|-----|----|-------------------|------|
| 366 | PID 1 Proportional Status | -100.00% | 100.00% | | RO | 0.00% | |
| 367 | PID 1 Integral Status | -100.00% | 100.00% | | RO | 0.00% | |
| 368 | PID 1 Derivative Status | -100.00% | 100.00% | | RO | 0.00% | |
| 369 | PID 1 Output | -100.00% | 100.00% | | RO | 0.00% | |
| 370 | PID 1 Integral Saturation Status | 0:False | 1:True | | RO | 0:False | |
| 371 | Turret Roll 1 Tension Enable | 0:False | 1:True | | | 0:False | |
| 372 | Turret Roll 2 Tension Enable | 0:False | 1:True | | | 0:False | |
| 373 | Turret Roll 1 Hold Speed | 0:False | 1:True | | RO | 0:False | |
| 374 | Turret Roll 2 Hold Speed | 0:False | 1:True | | RO | 0:False | |
| 375 | Turret Roll 1 Delayed Tension Enable | 0:False | 1:True | | RO | 0:False | |
| 376 | Turret Roll 2 Delayed Tension Enable | 0:False | 1:True | | RO | 0:False | |
| 377 | Turret PID Reset | 0:False | 1:True | | RO | 0:False | |
| 378 | Logic Gate 1 Mode | 0:AND, 1:NAND, 2:OR, 3:NOR, 4:XOR, 5:XOR, 6:NOT, 7:GT, 8:GEQ, 9:LT, 10:LEQ, 11:EQUAL, 12:NOT EQUAL, 13:ABS, 14:NEG ABS,15:INVERT, 16:SUM, 17:DIFFERENCE, 18:RATIO, 19:FILTER, 20:SET/RESET LATCH , 21:POSITIVE EDGE LATCH ,22: NEGATIVE EDGE LATCH | | | | 15:INVERT | |
| 379 | Logic Gate 2 Mode | 0:AND, 1:NAND, 2:OR, 3:NOR, 4:XOR, 5:XOR, 6:NOT, 7:GT, 8:GEQ, 9:LT, 10:LEQ, 11:EQUAL, 12:NOT EQUAL, 13:ABS, 14:NEG ABS,15:INVERT, 16:SUM, 17:DIFFERENCE, 18:RATIO, 19:FILTER, 20:SET/RESET LATCH , 21:POSITIVE EDGE LATCH ,22: NEGATIVE EDGE LATCH | | | | 15:INVERT | |
| 380 | Logic Gate 3 Mode | 0:AND, 1:NAND, 2:OR, 3:NOR, 4:XOR, 5:XOR, 6:NOT, 7:GT, 8:GEQ, 9:LT, 10:LEQ, 11:EQUAL, 12:NOT EQUAL, 13:ABS, 14:NEG ABS,15:INVERT, 16:SUM, 17:DIFFERENCE, 18:RATIO, 19:FILTER, 20:SET/RESET LATCH , 21:POSITIVE EDGE LATCH ,22: NEGATIVE EDGE LATCH | | | | 15:INVERT | |
| 381 | Logic Gate 4 Mode | 0:AND, 1:NAND, 2:OR, 3:NOR, 4:XOR, 5:XOR, 6:NOT, 7:GT, 8:GEQ, 9:LT, 10:LEQ, 11:EQUAL, 12:NOT EQUAL, 13:ABS, 14:NEG ABS,15:INVERT, 16:SUM, 17:DIFFERENCE, 18:RATIO, 19:FILTER, 20:SET/RESET LATCH , 21:POSITIVE EDGE LATCH ,22: NEGATIVE EDGE LATCH | | | | 15:INVERT | |
| 382 | Logic Gate 1 Input A | -200.00% | 200.00% | | | 0.00% | |
| 383 | Logic Gate 2 Input A | -200.00% | 200.00% | | | 0.00% | |
| 384 | Logic Gate 3 Input A | -200.00% | 200.00% | | | 0.00% | |
| 385 | Logic Gate 4 Input A | -200.00% | 200.00% | | | 0.00% | |
| 386 | Logic Gate 1 Input B | -200.00% | 200.00% | | | 0.00% | |
| 387 | Logic Gate 2 Input B | -200.00% | 200.00% | | | 0.00% | |
| 388 | Logic Gate 3 Input B | -200.00% | 200.00% | | | 0.00% | |
| 389 | Logic Gate 4 Input B | -200.00% | 200.00% | | | 0.00% | |
| 390 | Logic Gate 1 Output | -200.00% | 200.00% | | | 0.00% | |
| 391 | Logic Gate 2 Output | -200.00% | 200.00% | | | 0.00% | |
| 392 | Logic Gate 3 Output | -200.00% | 200.00% | | | 0.00% | |
| 393 | Logic Gate 4 Output | -200.00% | 200.00% | | | 0.00% | |
| 394 | Block 1 | 0 | 100 | | | App. Calculator | |
| 395 | Block 2 | 0 | 100 | | | PID1 | |
| 396 | Block 3 | 0 | 100 | | | Sum1 | |
| 397 | Block 4 | 0 | 100 | | | RefSelect1 | |
| 398 | Block 5 | 0 | 100 | | | RefSelect2 | |
| 399 | Block 6 | 0 | 100 | | | Length Calculator | |
| 400 | Block 7 | 0 | 100 | | | Sum2 | |
| 401 | Block 8 | 0 | 100 | | | Threshold 1 | |
| 402 | Block 9 | 0 | 100 | | | Threshold 2 | |
| 403 | Block 10 | 0 | 100 | | | Threshold 3 | |
| 404 | Block 11 | 0 | 100 | | | Threshold 4 | |
| 405 | Block 12 | 0 | 100 | | | Logic Sw 1 | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|------------------------------------|--------------------------------------|--------|-----|----|--------------|------|
| 406 | Block 13 | 0 | 100 | | | Logic Sw 2 | |
| 407 | Block 14 | 0 | 100 | | | Logic Sw 3 | |
| 408 | Block 15 | 0 | 100 | | | Logic Sw 4 | |
| 409 | Block 16 | 0 | 100 | | | Timer 1 | |
| 410 | Block 17 | 0 | 100 | | | Timer 2 | |
| 411 | Block 18 | 0 | 100 | | | Timer 3 | |
| 412 | Block 19 | 0 | 100 | | | Timer 4 | |
| 413 | Block 20 | 0 | 100 | | | Int Link 1 | |
| 414 | Block 21 | 0 | 100 | | | Int Link 2 | |
| 415 | Block 22 | 0 | 100 | | | Int Link 3 | |
| 416 | Block 23 | 0 | 100 | | | Int Link 4 | |
| 417 | Block 24 | 0 | 100 | | | Int Link 5 | |
| 418 | Block 25 | 0 | 100 | | | Int Link 6 | |
| 419 | Block 26 | 0 | 100 | | | Int Link 7 | |
| 420 | Block 27 | 0 | 100 | | | Int Link 8 | |
| 421 | Block 28 | 0 | 100 | | | Int Link 9 | |
| 422 | Block 29 | 0 | 100 | | | Int Link 10 | |
| 423 | Block 30 | 0 | 100 | | | Int Link 11 | |
| 424 | Block 31 | 0 | 100 | | | Int Link 12 | |
| 425 | Block 32 | 0 | 100 | | | Int Link 13 | |
| 426 | Block 33 | 0 | 100 | | | Int Link 14 | |
| 427 | Block 34 | 0 | 100 | | | Int Link 15 | |
| 428 | Block 35 | 0 | 100 | | | Int Link 16 | |
| 429 | Block 36 | 0 | 100 | | | Int Link 17 | |
| 430 | Block 37 | 0 | 100 | | | Int Link 18 | |
| 431 | Block 38 | 0 | 100 | | | Int Link 19 | |
| 432 | Block 39 | 0 | 100 | | | Int Link 20 | |
| 433 | Block 40 | 0 | 100 | | | Turret Logic | |
| 434 | Block 41 | 0 | 100 | | | Logic Gate 1 | |
| 435 | Block 42 | 0 | 100 | | | Logic Gate 2 | |
| 436 | Block 43 | 0 | 100 | | | Logic Gate 3 | |
| 437 | Block 44 | 0 | 100 | | | Logic Gate 4 | |
| 438 | Block 45 | 0 | 65535 | | | PID2 | |
| 439 | Block 46 | 0 | 65535 | | | Brake Letoff | |
| 440 | Reserved | 0 | 65535 | | | 0 | |
| 441 | Reserved | 0 | 65535 | | | 0 | |
| 442 | Reserved | 0 | 65535 | | | 0 | |
| 443 | Reserved | 0 | 65535 | | | 0 | |
| 444 | Reserved | 0 | 65535 | | | 0 | |
| 445 | Reserved | 0 | 65535 | | | 0 | |
| 446 | Reserved | 0 | 65535 | | | 0 | |
| 447 | Reserved | 0 | 65535 | | | 0 | |
| 448 | Reserved | 0 | 65535 | | | 0 | |
| 449 | Reserved | 0 | 65535 | | | 0 | |
| 450 | Reserved | 0 | 65535 | | | 0 | |
| 451 | Reserved | 0 | 65535 | | | 0 | |
| 452 | Reserved | 0 | 65535 | | | 0 | |
| 453 | Reserved | 0 | 65535 | | | 0 | |
| 454 | Reserved | 0 | 65535 | | | 0 | |
| 455 | Reserved | 0 | 65535 | | | 0 | |
| 456 | Reserved | 0 | 65535 | | | 0 | |
| 457 | Reserved | 0 | 65535 | | | 0 | |
| 458 | Network Address | 1 | 255 | | | 1 | |
| 459 | Com A Status | 0:False | 1:True | | RO | 0:False | |
| 460 | Com A Baud Rate | 0:2400,1:4800,2:9600,3:19200,4:38400 | | | | 4:38400 | |
| 461 | Com A Firmware Version Major | 0 | 65535 | | RO | 0 | |
| 462 | Com A Firmware Version Minor | 0 | 65535 | | RO | 0 | |
| 463 | Com A Firmware Version Revision | 0 | 65535 | | RO | 0 | |
| 464 | Com A Firmware Version SubRevision | 0 | 65535 | | RO | 0 | |
| 465 | Turret Roll 1 Run | 0:False | 1:True | | | 0:False | |
| 466 | Turret Roll 2 Run | 0:False | 1:True | | | 0:False | |
| 467 | Turret Roll 1 Speed Match | 0:False | 1:True | | RO | 0:False | |
| 468 | Turret Roll 2 Speed Match | 0:False | 1:True | | RO | 0:False | |
| 469 | Turret Diameter Reset | 0:False | 1:True | | RO | 0:False | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|---------------------------------------|--|------------|-----|----|------------|------|
| 470 | PID 2 Enable | 0:False | 1:True | | | 0:False | |
| 471 | PID 2 Proportional Gain | 0.00 | 10.00 | | | 5.00 | |
| 472 | PID 2 Integral Time | 0.010Secs | 60.000Secs | | | 10.000Secs | |
| 473 | PID 2 Derivative Gain | 0.00 | 10.00 | | | 0.00 | |
| 474 | PID 2 Integral Clamp | 0:False | 1:True | | | 0:False | |
| 475 | PID 2 Integral Polarity | 0:False | 1:True | | | 0:False | |
| 476 | PID 2 Deadband | 0.00% | 30.00% | | | 0.00% | |
| 477 | PID 2 Setpoint | -100.00% | 100.00% | | | 0.00% | |
| 478 | PID 2 Feedback | -100.00% | 100.00% | | | 0.00% | |
| 479 | PID 2 Error | -200.00% | 200.00% | | RO | 0.00% | |
| 480 | PID 2 Reset | 0:False | 1:True | | | 0:False | |
| 481 | PID 2 Scale | -100.00% | 100.00% | | | 100.00% | |
| 482 | PID 2 Min Scale | 0.00% | 100.00% | | | 10.00% | |
| 483 | PID 2 Trim | -100.00% | 100.00% | | | 100.00% | |
| 484 | PID 2 Proportional Status | -100.00% | 100.00% | | RO | 0.00% | |
| 485 | PID 2 Integral Status | -100.00% | 100.00% | | RO | 0.00% | |
| 486 | PID 2 Derivative Status | -100.00% | 100.00% | | RO | 0.00% | |
| 487 | PID 2 Output | -100.00% | 100.00% | | RO | 0.00% | |
| 488 | PID 2 Integral Saturation Status | 0:False | 1:True | | RO | 0:False | |
| 489 | Frequency Input 2 Term 2 Mode | 0:Freq | 1:Sonic | | | 0:Freq | |
| 490 | Frequency Input 2 Term 2 Out Of Range | 0:False | 1:True | | RO | 0:False | |
| 491 | Parameters Changed | 0:False | 1:True | | RO | 0:False | |
| 492 | General Param 1 | 0 | 65535 | | | 0 | |
| 493 | General Param 2 | 0 | 65535 | | | 0 | |
| 494 | General Param 3 | 0 | 65535 | | | 0 | |
| 495 | General Param 4 | 0 | 65535 | | | 0 | |
| 496 | General Param 5 | 0 | 65535 | | | 0 | |
| 497 | General Param 6 | 0 | 65535 | | | 0 | |
| 498 | General Param 7 | 0 | 65535 | | | 0 | |
| 499 | General Param 8 | 0 | 65535 | | | 0 | |
| 500 | General Param 9 | 0 | 65535 | | | 0 | |
| 501 | General Param 10 | 0 | 65535 | | | 0 | |
| 502 | General Param 11 | 0 | 65535 | | | 0 | |
| 503 | General Param 12 | 0 | 65535 | | | 0 | |
| 504 | External Roll Speed | -100.00% | 100.00% | | | 0.00% | |
| 505 | Diameter Memory Reset | 0:False | 1:True | | | 1:True | |
| 506 | Diameter/Max Ratio | 0.00% | 100.00% | | | 0.00% | |
| 507 | Inertia Compensation | 0.00% | 100.00% | | | 0.00% | |
| 508 | Friction Compensation | 0.00% | 100.00% | | | 0.00% | |
| 509 | Pulse Threshold | 0.00% | 100.00% | | | 0.00% | |
| 510 | Pulse Torque Level | 0.00% | 100.00% | | | 0.00% | |
| 511 | Pulse Torque Time | 0.0 Secs | 10.0 Secs | | | 0.0 Secs | |
| 512 | Diameter Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 513 | Inertia Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 514 | Friction Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 515 | Static Friction Torque | 0.00% | 100.00% | | | 0.00% | |
| 516 | Pulse Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 517 | Total Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 518 | Torque Sum | -100.00% | 100.00% | | | 0.00% | |
| 519 | Inertia Mode | 0:Accel | 1:Decel | | | 0:Accel | |
| 520 | Inertia Sensitivity | 1 | 10 | | | 1 | |
| 521 | Line Speed Status | 0:Decelerating, 1:Steady, 2:Accelerating | | | | 1:Steady | |
| 522 | Stall | 0:False | 1:True | | | 0:False | |
| 523 | Run | 0:False | 1:True | | | 0:False | |
| 524 | Auto | 0:False | 1:True | | | 0:False | |
| 525 | Emergency Stop | 0:False | 1:True | | | 0:False | |
| 526 | Run Delay Mode | 0:Timer, 1:Speed, 2:Either, 3:Both | | | | 0:Timer | |
| 527 | Run Delay Time | 0.0 Secs | 300.0 Secs | | | 5.0 Secs | |
| 528 | Stop Delay Mode | 0:Timer, 1:Speed, 2:Either, 3:Both | | | | 0:Timer | |
| 529 | Stop Delay Time | 0.0 Secs | 300.0 Secs | | | 5.0 Secs | |
| 530 | Zero Speed Threshold | 1.00% | 100.00% | | | 5.00% | |
| 531 | Ramp Reset | 0:False | 1:True | | RO | 1:True | |
| 532 | Ramp Bypass | 0:False | 1:True | | RO | 0:False | |
| 533 | Torque Select | 0 | 3 | | RO | 0 | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|------------------------------------|--|------------|-----|----|----------|------|
| 534 | Inertia Enable | 0:False | 1:True | | RO | 0:False | |
| 535 | Brake Mode | 0:EStop,1:Off,2:Stall,3:Initial Run,4:Initial Auto Run,5:Manual Run,6:Auto Run, 7:Stop Delay | | | RO | 0:EStop | |
| 536 | Diameter Torque Trim | 0.00% | 100.00% | | | 100.00% | |
| 537 | PID 1 Integrator Hold Source | 0 | 546 | | | 0 | |
| 538 | PID 2 Integrator Hold Source | 0 | 546 | | | 0 | |
| 539 | Com B Status | 0:False | 1:True | | RO | 0:False | |
| 540 | Com B Baud Rate | 0:2400,1:4800,2:9600,3:19200,4:38400 | | | | 4:38400 | |
| 541 | Com B Firmware Version Major | 0 | 65535 | | RO | 0 | |
| 524 | Com B Firmware Version Minor | 0 | 65535 | | RO | 0 | |
| 543 | Com B Firmware Version Revision | 0 | 65535 | | RO | 0 | |
| 544 | Com B Firmware Version SubRevision | 0 | 65535 | | RO | 0 | |
| 545 | PID 1 Integration Mode | 0:Linear | 1:Standard | | | 0:Linear | |
| 546 | PID 2 Integration Mode | 0:Linear | 1:Standard | | | 0:Linear | |

Table 11: Parameters by Name

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|---|------------|-----------|-----|----|------------|------|
| 257 | Accel/Decel 1 Accel Time | 0.1Secs | 600.0Secs | | | 10.0Secs | |
| 259 | Accel/Decel 1 Decel Time | 0.1Secs | 600.0Secs | | | 10.0Secs | |
| 255 | Accel/Decel 1 Ramp Bypass | 0:False | 1:True | | | 0:False | |
| 253 | Accel/Decel 1 Ramp Hold | 0:False | 1:True | | | 0:False | |
| 247 | Accel/Decel 1 Ramp Input | -200.00% | 200.00% | | | 0.00% | |
| 249 | Accel/Decel 1 Ramp Output | -200.00% | 200.00% | | RO | 0.00% | |
| 251 | Accel/Decel 1 Ramp Reset | 0:False | 1:True | | | 0:False | |
| 261 | Accel/Decel 1 Ramp Threshold | 0.00% | 100.00% | | | 100.00% | |
| 263 | Accel/Decel 1 Ramping Status | 0:False | 1:True | | RO | 0:False | |
| 258 | Accel/Decel 2 Accel Time | 0.1Secs | 600.0Secs | | | 10.0Secs | |
| 260 | Accel/Decel 2 Decel Time | 0.1Secs | 600.0Secs | | | 10.0Secs | |
| 256 | Accel/Decel 2 Ramp Bypass | 0:False | 1:True | | | 0:False | |
| 254 | Accel/Decel 2 Ramp Hold | 0:False | 1:True | | | 0:False | |
| 248 | Accel/Decel 2 Ramp Input | -200.00% | 200.00% | | | 0.00% | |
| 250 | Accel/Decel 2 Ramp Output | -200.00% | 200.00% | | RO | 0.00% | |
| 252 | Accel/Decel 2 Ramp Reset | 0:False | 1:True | | | 0:False | |
| 262 | Accel/Decel 2 Ramp Threshold | 0.00% | 100.00% | | | 100.00% | |
| 264 | Accel/Decel 2 Ramping Status | 0:False | 1:True | | RO | 0:False | |
| 1 | Addressing Mode Test 1 | 0 | 65535 | | RO | 21845 | |
| 2 | Addressing Mode Test 2 | 0 | 65535 | | RO | 43690 | |
| 43 | Analog Input 1 Term 4 0% Calibration | 0 | 4092 | | | 0 | |
| 47 | Analog Input 1 Term 4 100% Calibration | 0 | 4092 | | | 4092 | |
| 51 | Analog Input 1 Term 4 Bias | 0.00% | 200.00% | | | 0.00% | |
| 39 | Analog Input 1 Term 4 Destination | 0 | 546 | ICR | | 0 | |
| 59 | Analog Input 1 Term 4 Filtering | 0 | 15 | | | 0 | |
| 55 | Analog Input 1 Term 4 Gain | 0.00% | 200.00% | | | 100.00% | |
| 63 | Analog Input 1 Term 4 Status | 0 | 4092 | | RO | 0 | |
| 44 | Analog Input 2 Term 6 0% Calibration | 0 | 4092 | | | 0 | |
| 48 | Analog Input 2 Term 6 100% Calibration | 0 | 4092 | | | 4092 | |
| 52 | Analog Input 2 Term 6 Bias | 0.00% | 200.00% | | | 0.00% | |
| 40 | Analog Input 2 Term 6 Destination | 0 | 546 | ICR | | 0 | |
| 60 | Analog Input 2 Term 6 Filtering | 0 | 15 | | | 0 | |
| 56 | Analog Input 2 Term 6 Gain | 0.00% | 200.00% | | | 100.00% | |
| 64 | Analog Input 2 Term 6 Status | 0 | 4092 | | RO | 0 | |
| 45 | Analog Input 3 Term 8 0% Calibration | 0 | 4092 | | | 0 | |
| 49 | Analog Input 3 Term 8 100% Calibration | 0 | 4092 | | | 4092 | |
| 53 | Analog Input 3 Term 8 Bias | 0.00% | 200.00% | | | 0.00% | |
| 41 | Analog Input 3 Term 8 Destination | 0 | 546 | ICR | | 0 | |
| 61 | Analog Input 3 Term 8 Filtering | 0 | 15 | | | 0 | |
| 57 | Analog Input 3 Term 8 Gain | 0.00% | 200.00% | | | 100.00% | |
| 65 | Analog Input 3 Term 8 Status | 0 | 4092 | | RO | 0 | |
| 46 | Analog Input 4 Term 10 0% Calibration | 0 | 4092 | | | 0 | |
| 50 | Analog Input 4 Term 10 100% Calibration | 0 | 4092 | | | 4092 | |
| 54 | Analog Input 4 Term 10 Bias | 0.00% | 200.00% | | | 0.00% | |
| 42 | Analog Input 4 Term 10 Destination | 0 | 546 | ICR | | 0 | |
| 62 | Analog Input 4 Term 10 Filtering | 0 | 15 | | | 0 | |
| 58 | Analog Input 4 Term 10 Gain | 0.00% | 200.00% | | | 100.00% | |
| 66 | Analog Input 4 Term 10 Status | 0 | 4092 | | RO | 0 | |
| 107 | Analog Output 1 Term 26 Absolute Value | 0:False | 1:True | | | 0:False | |
| 105 | Analog Output 1 Term 26 Bias | -100.00% | 100.00% | | | 0.00% | |
| 103 | Analog Output 1 Term 26 Gain | -200.00% | 200.00% | | | 100.00% | |
| 101 | Analog Output 1 Term 26 Source | 0 | 546 | ICR | | 0 | |
| 109 | Analog Output 1 Term 26 Status | 0 | 4095 | | RO | 0 | |
| 108 | Analog Output 2 Term 28 Absolute Value | 0:False | 1:True | | | 0:False | |
| 106 | Analog Output 2 Term 28 Bias | -100.00% | 100.00% | | | 0.00% | |
| 104 | Analog Output 2 Term 28 Gain | -200.00% | 200.00% | | | 100.00% | |
| 102 | Analog Output 2 Term 28 Source | 0 | 546 | ICR | | 0 | |
| 110 | Analog Output 2 Term 28 Status | 0 | 4095 | | RO | 0 | |
| 100 | Analog Output Mode | 0:Unipolar | 1:Bipolar | | | 0:Unipolar | |
| 524 | Auto | 0:False | 1:True | | | 0:False | |
| 179 | Aux 1 Param | -200.00% | 200.00% | | | 0.00% | |
| 180 | Aux 2 Param | -200.00% | 200.00% | | | 0.00% | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|------------------------------------|--|---------|-----|---------|-------------------|------|
| 181 | Aux 3 Param | -200.00% | 200.00% | | | 0.00% | |
| 182 | Aux 4 Param | -200.00% | 200.00% | | | 0.00% | |
| 183 | Aux 5 Param | -200.00% | 200.00% | | | 0.00% | |
| 184 | Aux 6 Param | -200.00% | 200.00% | | | 0.00% | |
| 185 | Aux 7 Param | -200.00% | 200.00% | | | 0.00% | |
| 394 | Block 1 | 0 | 100 | | | App. Calculator | |
| 403 | Block 10 | 0 | 100 | | | Threshold 3 | |
| 404 | Block 11 | 0 | 100 | | | Threshold 4 | |
| 405 | Block 12 | 0 | 100 | | | Logic Sw 1 | |
| 406 | Block 13 | 0 | 100 | | | Logic Sw 2 | |
| 407 | Block 14 | 0 | 100 | | | Logic Sw 3 | |
| 408 | Block 15 | 0 | 100 | | | Logic Sw 4 | |
| 409 | Block 16 | 0 | 100 | | | Timer 1 | |
| 410 | Block 17 | 0 | 100 | | | Timer 2 | |
| 411 | Block 18 | 0 | 100 | | | Timer 3 | |
| 412 | Block 19 | 0 | 100 | | | Timer 4 | |
| 395 | Block 2 | 0 | 100 | | | PID1 | |
| 413 | Block 20 | 0 | 100 | | | Int Link 1 | |
| 414 | Block 21 | 0 | 100 | | | Int Link 2 | |
| 415 | Block 22 | 0 | 100 | | | Int Link 3 | |
| 416 | Block 23 | 0 | 100 | | | Int Link 4 | |
| 417 | Block 24 | 0 | 100 | | | Int Link 5 | |
| 418 | Block 25 | 0 | 100 | | | Int Link 6 | |
| 419 | Block 26 | 0 | 100 | | | Int Link 7 | |
| 420 | Block 27 | 0 | 100 | | | Int Link 8 | |
| 421 | Block 28 | 0 | 100 | | | Int Link 9 | |
| 422 | Block 29 | 0 | 100 | | | Int Link 10 | |
| 396 | Block 3 | 0 | 100 | | | Sum1 | |
| 423 | Block 30 | 0 | 100 | | | Int Link 11 | |
| 424 | Block 31 | 0 | 100 | | | Int Link 12 | |
| 425 | Block 32 | 0 | 100 | | | Int Link 13 | |
| 426 | Block 33 | 0 | 100 | | | Int Link 14 | |
| 427 | Block 34 | 0 | 100 | | | Int Link 15 | |
| 428 | Block 35 | 0 | 100 | | | Int Link 16 | |
| 429 | Block 36 | 0 | 100 | | | Int Link 17 | |
| 430 | Block 37 | 0 | 100 | | | Int Link 18 | |
| 431 | Block 38 | 0 | 100 | | | Int Link 19 | |
| 432 | Block 39 | 0 | 100 | | | Int Link 20 | |
| 397 | Block 4 | 0 | 100 | | | RefSelect1 | |
| 433 | Block 40 | 0 | 100 | | | Turret Logic | |
| 434 | Block 41 | 0 | 100 | | | Logic Gate 1 | |
| 435 | Block 42 | 0 | 100 | | | Logic Gate 2 | |
| 436 | Block 43 | 0 | 100 | | | Logic Gate 3 | |
| 437 | Block 44 | 0 | 100 | | | Logic Gate 4 | |
| 438 | Block 45 | 0 | 65535 | | | PID2 | |
| 439 | Block 46 | 0 | 65535 | | | Brake Letoff | |
| 398 | Block 5 | 0 | 100 | | | RefSelect2 | |
| 399 | Block 6 | 0 | 100 | | | Length Calculator | |
| 400 | Block 7 | 0 | 100 | | | Sum2 | |
| 401 | Block 8 | 0 | 100 | | | Threshold 1 | |
| 402 | Block 9 | 0 | 100 | | | Threshold 2 | |
| 535 | Brake Mode | 0:EStop,1:Off,2:Stall,3:Initial Run,4:Initial Auto Run,5:Manual Run,6:Auto Run, 7:Stop Delay | | | RO | 0:EStop | |
| 460 | Com A Baud Rate | 0:2400,1:4800,2:9600,3:19200,4:38400 | | | | 4:38400 | |
| 461 | Com A Firmware Version Major | 0 | 65535 | | RO | 0 | |
| 462 | Com A Firmware Version Minor | 0 | 65535 | | RO | 0 | |
| 463 | Com A Firmware Version Revision | 0 | 65535 | | RO | 0 | |
| 464 | Com A Firmware Version SubRevision | 0 | 65535 | | RO | 0 | |
| 459 | Com A Status | 0:False | 1:True | | RO | 0:False | |
| 540 | Com B Baud Rate | 0:2400,1:4800,2:9600,3:19200,4:38400 | | | 4:38400 | | |
| 541 | Com B Firmware Version Major | 0 | 65535 | | RO | 0 | |
| 524 | Com B Firmware Version Minor | 0 | 65535 | | RO | 0 | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|--|--|-----------|-----|----|---------|------|
| 543 | Com B Firmware Version Revision | 0 | 65535 | | RO | 0 | |
| 544 | Com B Firmware Version SubRevision | 0 | 65535 | | RO | 0 | |
| 539 | Com B Status | 0:False | 1:True | | RO | 0:False | |
| 189 | Com C Addressing Mode | 0 | 1 | | | 1 | |
| 186 | Com C Baud Rate | 0:2400,1:4800,2:9600,3:19200,4:38400 | | | | 4:38400 | |
| 187 | Com C Parity | 0 | 2 | | | 0 | |
| 188 | Com C Stop Bits | 1 | 2 | | | 2 | |
| 9 | Command Entry | 0 | 65535 | | | 0 | |
| 10 | Command Status | 0 | 3 | | RO | 0 | |
| 3 | Configuration Code | 0 | 65535 | | RO | - | |
| 193 | Core Diameter | 0.01" | 200.00" | | | 1.00" | |
| 201 | Core/Diameter Ratio | 0.00% | 100.00% | | RO | 0.00% | |
| 4 | Customization Code (LSW) | 0 | 65535 | | RO | - | |
| 5 | Customization Code (MSW) | 0 | 65535 | | RO | - | |
| 202 | Diameter | 0.01" | 200.00" | | RO | 0.00" | |
| 505 | Diameter Memory Reset | 0:False | 1:True | | | 1:True | |
| 192 | Diameter Select | 0:None, 1:Ext, 2:RollRevs, 3:LineRevs, 4:Line/Roll | | | | 0:None | |
| 512 | Diameter Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 536 | Diameter Torque Trim | 0.00% | 100.00% | | | 100.00% | |
| 506 | Diameter/Max Ratio | 0.00% | 100.00% | | | 0.00% | |
| 29 | Digital Input 1 Term 13 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 19 | Digital Input 1 Term 13 Destination | 0 | 546 | ICR | | 0 | |
| 24 | Digital Input 1 Term 13 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 34 | Digital Input 1 Term 13 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 30 | Digital Input 2 Term 14 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 20 | Digital Input 2 Term 14 Destination | 0 | 546 | ICR | | 0 | |
| 25 | Digital Input 2 Term 14 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 35 | Digital Input 2 Term 14 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 31 | Digital Input 3 Term 16 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 21 | Digital Input 3 Term 16 Destination | 0 | 546 | ICR | | 0 | |
| 26 | Digital Input 3 Term 16 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 36 | Digital Input 3 Term 16 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 32 | Digital Input 4 Term 17 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 22 | Digital Input 4 Term 17 Destination | 0 | 546 | ICR | | 0 | |
| 27 | Digital Input 4 Term 17 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 37 | Digital Input 4 Term 17 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 33 | Digital Input 5 Term 19 Closed Value | -200.00% | 200.00% | | | 1.00% | |
| 23 | Digital Input 5 Term 19 Destination | 0 | 546 | ICR | | 0 | |
| 28 | Digital Input 5 Term 19 Open Value | -200.00% | 200.00% | | | 0.00% | |
| 38 | Digital Input 5 Term 19 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 525 | Emergency Stop | 0:False | 1:True | | | 0:False | |
| 198 | External Diameter Ratio | 0.00% | 100.00% | | | 0.00% | |
| 504 | External Roll Speed | -100.00% | 100.00% | | | 0.00% | |
| 133 | Fault LED Source A | 0 | 546 | | | 0 | |
| 134 | Fault LED Source B | 0 | 546 | | | 0 | |
| 135 | Fault LED Source C | 0 | 546 | | | 0 | |
| 136 | Fault LED Source D | 0 | 546 | | | 0 | |
| 137 | Fault LED Source E | 0 | 546 | | | 0 | |
| 138 | Fault LED Status | 0:False | 1:True | | RO | 0:False | |
| 6 | Firmware Version Major | 0 | 255 | | RO | - | |
| 7 | Firmware Version Minor | 0 | 255 | | RO | - | |
| 8 | Firmware Version Revision | 0 | 255 | | RO | - | |
| 115 | Freq/Digital Output 1 Term 38 Absolute Value | 0:False | 1:True | | | 1:True | |
| 126 | Freq/Digital Output 1 Term 38 Bias | 0.00% | 100.00% | | | 0.00% | |
| 125 | Freq/Digital Output 1 Term 38 Gain | 0.00% | 200.00% | | | 100.00% | |
| 121 | Freq/Digital Output 1 Term 38 Invert | 0:False | 1:True | | | 0:False | |
| 111 | Freq/Digital Output 1 Term 38 Mode | 0:Freq | 1:Digital | | | 0:Freq | |
| 119 | Freq/Digital Output 1 Term 38 Off Threshold | -200.00% | 200.00% | | | 0.00% | |
| 117 | Freq/Digital Output 1 Term 38 On Threshold | -200.00% | 200.00% | | | 1.00% | |
| 113 | Freq/Digital Output 1 Term 38 Source | 0 | 546 | ICR | | 0 | |
| 123 | Freq/Digital Output 1 Term 38 Status | 0Hz | 5000Hz | | RO | 0Hz | |
| 116 | Freq/Digital Output 2 Term 43 Absolute Value | 0:False | 1:True | | | 1:True | |
| 122 | Freq/Digital Output 2 Term 43 Invert | 0:False | 1:True | | | 0:False | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|---|----------|-----------|-----|----|-----------|------|
| 112 | Freq/Digital Output 2 Term 43 Mode | 0:Freq | 1:Digital | | | 1:Digital | |
| 120 | Freq/Digital Output 2 Term 43 Off Threshold | -200.00% | 200.00% | | | 0.00% | |
| 118 | Freq/Digital Output 2 Term 43 On Threshold | -200.00% | 200.00% | | | 1.00% | |
| 114 | Freq/Digital Output 2 Term 43 Source | 0 | 546 | ICR | | 0 | |
| 124 | Freq/Digital Output 2 Term 43 Status | 0Hz | 5000Hz | | RO | 0Hz | |
| 69 | Frequency Input 1 Term 1 0% Calibration | 0Hz | 42000Hz | | | 0Hz | |
| 67 | Frequency Input 1 Term 1 Destination | 0 | 546 | ICR | | 0 | |
| 77 | Frequency Input 1 Term 1 Filtering | 0 | 15 | | | 0 | |
| 75 | Frequency Input 1 Term 1 Gain | -200.00% | 200.00% | | | 100.00% | |
| 81 | Frequency Input 1 Term 1 Mode | 0:Freq | 1:Sonic | | | 0:Freq | |
| 82 | Frequency Input 1 Term 1 Out Of Range | 0:False | 1:True | | RO | 0:False | |
| 79 | Frequency Input 1 Term 1 Status | 0Hz | 65535Hz | | RO | 0Hz | |
| 71 | Frequency Input 1 Term 1 100% Calibration | 0Hz | 42000Hz | | | 42000Hz | |
| 73 | Frequency Input 1 Term 1 Bias | -200.00% | 200.00% | | | 0.00% | |
| 70 | Frequency Input 2 Term 2 0% Calibration | 0Hz | 42000Hz | | | 0Hz | |
| 72 | Frequency Input 2 Term 2 100% Calibration | 0Hz | 42000Hz | | | 42000Hz | |
| 74 | Frequency Input 2 Term 2 Bias | -200.00% | 200.00% | | | 0.00% | |
| 84 | Frequency Input 2 Term 2 Count (LSW) | 0 | 65535 | | RO | 0 | |
| 85 | Frequency Input 2 Term 2 Count (MSW) | 0 | 65535 | | RO | 0 | |
| 86 | Frequency Input 2 Term 2 Count Enable | 0:False | 1:True | | | 0:False | |
| 68 | Frequency Input 2 Term 2 Destination | 0 | 546 | ICR | | 0 | |
| 88 | Frequency Input 2 Term 2 Direction | 0:Down | 1:Up | | | 1:Up | |
| 78 | Frequency Input 2 Term 2 Filtering | 0 | 15 | | | 0 | |
| 76 | Frequency Input 2 Term 2 Gain | -200.00% | 200.00% | | | 100.00% | |
| 489 | Frequency Input 2 Term 2 Mode | 0:Freq | 1:Sonic | | | 0:Freq | |
| 490 | Frequency Input 2 Term 2 Out Of Range | 0:False | 1:True | | RO | 0:False | |
| 89 | Frequency Input 2 Term 2 Pulses/Revolution | 1 | 65535 | | | 1 | |
| 87 | Frequency Input 2 Term 2 Reset | 0 | 2 | | | 0 | |
| 83 | Frequency Input 2 Term 2 Revolution Destination | 0 | 546 | ICR | | 0 | |
| 80 | Frequency Input 2 Term 2 Status | 0Hz | 65535Hz | | RO | 0Hz | |
| 508 | Friction Compensation | 0.00% | 100.00% | | | 0.00% | |
| 514 | Friction Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 492 | General Param 1 | 0 | 65535 | | | 0 | |
| 501 | General Param 10 | 0 | 65535 | | | 0 | |
| 502 | General Param 11 | 0 | 65535 | | | 0 | |
| 503 | General Param 12 | 0 | 65535 | | | 0 | |
| 493 | General Param 2 | 0 | 65535 | | | 0 | |
| 494 | General Param 3 | 0 | 65535 | | | 0 | |
| 495 | General Param 4 | 0 | 65535 | | | 0 | |
| 496 | General Param 5 | 0 | 65535 | | | 0 | |
| 497 | General Param 6 | 0 | 65535 | | | 0 | |
| 498 | General Param 7 | 0 | 65535 | | | 0 | |
| 499 | General Param 8 | 0 | 65535 | | | 0 | |
| 500 | General Param 9 | 0 | 65535 | | | 0 | |
| 507 | Inertia Compensation | 0.00% | 100.00% | | | 0.00% | |
| 534 | Inertia Enable | 0:False | 1:True | | RO | 0:False | |
| 519 | Inertia Mode | 0:Accel | 1:Decel | | | 0:Accel | |
| 520 | Inertia Sensitivity | 1 | 10 | | | 1 | |
| 513 | Inertia Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 140 | Internal Link 1 Destination | 0 | 546 | ICR | | 0 | |
| 139 | Internal Link 1 Source | 0 | 546 | | | 0 | |
| 158 | Internal Link 10 Destination | 0 | 546 | ICR | | 0 | |
| 157 | Internal Link 10 Source | 0 | 546 | | | 0 | |
| 160 | Internal Link 11 Destination | 0 | 546 | ICR | | 0 | |
| 159 | Internal Link 11 Source | 0 | 546 | | | 0 | |
| 162 | Internal Link 12 Destination | 0 | 546 | ICR | | 0 | |
| 161 | Internal Link 12 Source | 0 | 546 | | | 0 | |
| 164 | Internal Link 13 Destination | 0 | 546 | ICR | | 0 | |
| 163 | Internal Link 13 Source | 0 | 546 | | | 0 | |
| 166 | Internal Link 14 Destination | 0 | 546 | ICR | | 0 | |
| 165 | Internal Link 14 Source | 0 | 546 | | | 0 | |
| 168 | Internal Link 15 Destination | 0 | 546 | ICR | | 0 | |
| 167 | Internal Link 15 Source | 0 | 546 | | | 0 | |
| 170 | Internal Link 16 Destination | 0 | 546 | ICR | | 0 | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|------------------------------|--|---------|-----|----|-----------|------|
| 169 | Internal Link 16 Source | 0 | 546 | | | 0 | |
| 172 | Internal Link 17 Destination | 0 | 546 | ICR | | 0 | |
| 171 | Internal Link 17 Source | 0 | 546 | | | 0 | |
| 174 | Internal Link 18 Destination | 0 | 546 | ICR | | 0 | |
| 173 | Internal Link 18 Source | 0 | 546 | | | 0 | |
| 176 | Internal Link 19 Destination | 0 | 546 | ICR | | 0 | |
| 175 | Internal Link 19 Source | 0 | 546 | | | 0 | |
| 142 | Internal Link 2 Destination | 0 | 546 | ICR | | 0 | |
| 141 | Internal Link 2 Source | 0 | 546 | | | 0 | |
| 178 | Internal Link 20 Destination | 0 | 546 | ICR | | 0 | |
| 177 | Internal Link 20 Source | 0 | 546 | | | 0 | |
| 144 | Internal Link 3 Destination | 0 | 546 | ICR | | 0 | |
| 143 | Internal Link 3 Source | 0 | 546 | | | 0 | |
| 146 | Internal Link 4 Destination | 0 | 546 | ICR | | 0 | |
| 145 | Internal Link 4 Source | 0 | 546 | | | 0 | |
| 148 | Internal Link 5 Destination | 0 | 546 | ICR | | 0 | |
| 147 | Internal Link 5 Source | 0 | 546 | | | 0 | |
| 150 | Internal Link 6 Destination | 0 | 546 | ICR | | 0 | |
| 149 | Internal Link 6 Source | 0 | 546 | | | 0 | |
| 152 | Internal Link 7 Destination | 0 | 546 | ICR | | 0 | |
| 151 | Internal Link 7 Source | 0 | 546 | | | 0 | |
| 154 | Internal Link 8 Destination | 0 | 546 | ICR | | 0 | |
| 153 | Internal Link 8 Source | 0 | 546 | | | 0 | |
| 156 | Internal Link 9 Destination | 0 | 546 | ICR | | 0 | |
| 155 | Internal Link 9 Source | 0 | 546 | | | 0 | |
| 349 | Length (LSW) | 0 | 65535 | | RO | 0 | |
| 350 | Length (MSW) | 0 | 65535 | | RO | 0 | |
| 351 | Length Ratio | 0.00% | 100.00% | | RO | 0.00% | |
| 197 | Length/Revolution | 0.01" | 200.00" | | | 0.01" | |
| 347 | Length/Revolution | 0.01" | 200.00" | | | 0.01" | |
| 190 | Line Speed | -200.00% | 200.00% | | | 100.00% | |
| 521 | Line Speed Status | 0:Decelerating, 1:Steady, 2:Accelerating | | | | 1:Steady | |
| 191 | Line Speed Sum | -200.00% | 200.00% | | | 0.00% | |
| 382 | Logic Gate 1 Input A | -200.00% | 200.00% | | | 0.00% | |
| 386 | Logic Gate 1 Input B | -200.00% | 200.00% | | | 0.00% | |
| 378 | Logic Gate 1 Mode | 0:AND, 1:NAND, 2:OR, 3:NOR, 4:XOR, 5:XOR, 6:NOT, 7:GT, 8:GEQ, 9:LT, 10:LEQ, 11:EQUAL, 12:NOT EQUAL, 13:ABS, 14:NEG ABS,15:INVERT, 16:SUM, 17:DIFFERENCE, 18:RATIO, 19:FILTER, 20:SET/RESET LATCH , 21:POSITIVE EDGE LATCH ,22: NEGATIVE EDGE LATCH | | | | 15:INVERT | |
| 390 | Logic Gate 1 Output | -200.00% | 200.00% | | | 0.00% | |
| 383 | Logic Gate 2 Input A | -200.00% | 200.00% | | | 0.00% | |
| 387 | Logic Gate 2 Input B | -200.00% | 200.00% | | | 0.00% | |
| 379 | Logic Gate 2 Mode | 0:AND, 1:NAND, 2:OR, 3:NOR, 4:XOR, 5:XOR, 6:NOT, 7:GT, 8:GEQ, 9:LT, 10:LEQ, 11:EQUAL, 12:NOT EQUAL, 13:ABS, 14:NEG ABS,15:INVERT, 16:SUM, 17:DIFFERENCE, 18:RATIO, 19:FILTER, 20:SET/RESET LATCH , 21:POSITIVE EDGE LATCH ,22: NEGATIVE EDGE LATCH | | | | 15:INVERT | |
| 391 | Logic Gate 2 Output | -200.00% | 200.00% | | | 0.00% | |
| 384 | Logic Gate 3 Input A | -200.00% | 200.00% | | | 0.00% | |
| 388 | Logic Gate 3 Input B | -200.00% | 200.00% | | | 0.00% | |
| 380 | Logic Gate 3 Mode | 0:AND, 1:NAND, 2:OR, 3:NOR, 4:XOR, 5:XOR, 6:NOT, 7:GT, 8:GEQ, 9:LT, 10:LEQ, 11:EQUAL, 12:NOT EQUAL, 13:ABS, 14:NEG ABS,15:INVERT, 16:SUM, 17:DIFFERENCE, 18:RATIO, 19:FILTER, 20:SET/RESET LATCH , 21:POSITIVE EDGE LATCH ,22: NEGATIVE EDGE LATCH | | | | 15:INVERT | |
| 392 | Logic Gate 3 Output | -200.00% | 200.00% | | | 0.00% | |
| 385 | Logic Gate 4 Input A | -200.00% | 200.00% | | | 0.00% | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|----------------------------------|--|------------|-----|----|------------|-----------|
| 389 | Logic Gate 4 Input B | -200.00% | 200.00% | | | 0.00% | |
| 381 | Logic Gate 4 Mode | 0:AND, 1:NAND, 2:OR, 3:NOR, 4:XOR, 5:XOR, 6:NOT, 7:GT, 8:GEQ, 9:LT, 10:LEQ, 11:EQUAL, 12:NOT EQUAL, 13:ABS, 14:NEG ABS,15:INVERT, 16:SUM, 17:DIFFERENCE, 18:RATIO, 19:FILTER, 20:SET/RESET LATCH , 21:POSITIVE EDGE LATCH ,22: NEGATIVE EDGE LATCH | | | | | 15:INVERT |
| 393 | Logic Gate 4 Output | -200.00% | 200.00% | | | 0.00% | |
| 265 | Logic Switch 1 Coil | 0:False | 1:True | | | 0:False | |
| 273 | Logic Switch 1 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 269 | Logic Switch 1 On Value | -200.00% | 200.00% | | | 0.00% | |
| 277 | Logic Switch 1 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 266 | Logic Switch 2 Coil | 0:False | 1:True | | | 0:False | |
| 274 | Logic Switch 2 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 270 | Logic Switch 2 On Value | -200.00% | 200.00% | | | 0.00% | |
| 278 | Logic Switch 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 267 | Logic Switch 3 Coil | 0:False | 1:True | | | 0:False | |
| 275 | Logic Switch 3 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 271 | Logic Switch 3 On Value | -200.00% | 200.00% | | | 0.00% | |
| 279 | Logic Switch 3 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 268 | Logic Switch 4 Coil | 0:False | 1:True | | | 0:False | |
| 276 | Logic Switch 4 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 272 | Logic Switch 4 On Value | -200.00% | 200.00% | | | 0.00% | |
| 280 | Logic Switch 4 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 195 | Material Thickness | 0.001" | 20.000" | | | 0.001" | |
| 194 | Max Diameter | 0.01" | 200.00" | | | 10.00" | |
| 345 | Max Length (LSW) | 0 | 655.35 | | | 0 | |
| 346 | Max Length (MSW) | 0 | 65535 | | | 0 | |
| 458 | Network Address | 1 | 255 | | | 1 | |
| 491 | Parameters Changed | 0:False | 1:True | | RO | 0:False | |
| 358 | PID 1 Deadband | 0.00% | 30.00% | | | 0.00% | |
| 355 | PID 1 Derivative Gain | 0.00 | 10.00 | | | 0.00 | |
| 368 | PID 1 Derivative Status | -100.00% | 100.00% | | RO | 0.00% | |
| 352 | PID 1 Enable | 0:False | 1:True | | | 0:False | |
| 361 | PID 1 Error | -200.00% | 200.00% | | RO | 0.00% | |
| 360 | PID 1 Feedback | -100.00% | 100.00% | | | 0.00% | |
| 356 | PID 1 Integral Clamp | 0:False | 1:True | | | 0:False | |
| 357 | PID 1 Integral Polarity | 0:False | 1:True | | | 0:False | |
| 370 | PID 1 Integral Saturation Status | 0:False | 1:True | | RO | 0:False | |
| 367 | PID 1 Integral Status | -100.00% | 100.00% | | RO | 0.00% | |
| 354 | PID 1 Integral Time | 0.010Secs | 60.000Secs | | | 10.000Secs | |
| 545 | PID 1 Integration Mode | 0:Linear | 1:Standard | | | 0:Linear | |
| 537 | PID 1 Integrator Hold Source | 0 | 538 | | | 0 | |
| 364 | PID 1 Min Scale | 0.00% | 100.00% | | | 10.00% | |
| 369 | PID 1 Output | -100.00% | 100.00% | | RO | 0.00% | |
| 353 | PID 1 Proportional Gain | 0.00 | 10.00 | | | 5.00 | |
| 366 | PID 1 Proportional Status | -100.00% | 100.00% | | RO | 0.00% | |
| 362 | PID 1 Reset | 0:False | 1:True | | | 0:False | |
| 363 | PID 1 Scale | -100.00% | 100.00% | | | 100.00% | |
| 359 | PID 1 Setpoint | -100.00% | 100.00% | | | 0.00% | |
| 365 | PID 1 Trim | -100.00% | 100.00% | | | 100.00% | |
| 476 | PID 2 Deadband | 0.00% | 30.00% | | | 0.00% | |
| 473 | PID 2 Derivative Gain | 0.00 | 10.00 | | | 0.00 | |
| 486 | PID 2 Derivative Status | -100.00% | 100.00% | | RO | 0.00% | |
| 470 | PID 2 Enable | 0:False | 1:True | | | 0:False | |
| 479 | PID 2 Error | -200.00% | 200.00% | | RO | 0.00% | |
| 478 | PID 2 Feedback | -100.00% | 100.00% | | | 0.00% | |
| 474 | PID 2 Integral Clamp | 0:False | 1:True | | | 0:False | |
| 475 | PID 2 Integral Polarity | 0:False | 1:True | | | 0:False | |
| 488 | PID 2 Integral Saturation Status | 0:False | 1:True | | RO | 0:False | |
| 485 | PID 2 Integral Status | -100.00% | 100.00% | | RO | 0.00% | |
| 546 | PID 2 Integration Mode | 0:Linear | 1:Standard | | | 0:Linear | |
| 472 | PID 2 Integral Time | 0.010Secs | 60.000Secs | | | 10.000Secs | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|--|----------|-----------|-----|----|----------|------|
| 538 | PID 2 Integrator Hold Source | 0 | 538 | | | 0 | |
| 482 | PID 2 Min Scale | 0.00% | 100.00% | | | 10.00% | |
| 487 | PID 2 Output | -100.00% | 100.00% | | RO | 0.00% | |
| 471 | PID 2 Proportional Gain | 0.00 | 10.00 | | | 5.00 | |
| 484 | PID 2 Proportional Status | -100.00% | 100.00% | | RO | 0.00% | |
| 480 | PID 2 Reset | 0:False | 1:True | | | 0:False | |
| 481 | PID 2 Scale | -100.00% | 100.00% | | | 100.00% | |
| 477 | PID 2 Setpoint | -100.00% | 100.00% | | | 0.00% | |
| 483 | PID 2 Trim | -100.00% | 100.00% | | | 100.00% | |
| 509 | Pulse Threshold | 0.00% | 100.00% | | | 0.00% | |
| 516 | Pulse Torque | 0.00% | 100.00% | | RO | 0.00% | |
| 510 | Pulse Torque Level | 0.00% | 100.00% | | | 0.00% | |
| 511 | Pulse Torque Time | 0.0 Secs | 10.0 Secs | | | 0.0 Secs | |
| 532 | Ramp Bypass | 0:False | 1:True | | RO | 0:False | |
| 531 | Ramp Reset | 0:False | 1:True | | RO | 1:True | |
| 208 | Reference Select 1 (LSB) | 0 | 3 | | | 0 | |
| 207 | Reference Select 1 (MSB) | 0 | 1 | | | 0 | |
| 213 | Reference Select 1 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 209 | Reference Select 1 Reference 0 | -200.00% | 200.00% | | | 0.00% | |
| 210 | Reference Select 1 Reference 1 | -200.00% | 200.00% | | | 0.00% | |
| 211 | Reference Select 1 Reference 2 | -200.00% | 200.00% | | | 0.00% | |
| 212 | Reference Select 1 Reference 3 | -200.00% | 200.00% | | | 0.00% | |
| 215 | Reference Select 2 (LSB) | 0 | 3 | | | 0 | |
| 214 | Reference Select 2 (MSB) | 0 | 1 | | | 0 | |
| 220 | Reference Select 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 216 | Reference Select 2 Reference 0 | -200.00% | 200.00% | | | 0.00% | |
| 217 | Reference Select 2 Reference 1 | -200.00% | 200.00% | | | 0.00% | |
| 218 | Reference Select 2 Reference 2 | -200.00% | 200.00% | | | 0.00% | |
| 219 | Reference Select 2 Reference 3 | -200.00% | 200.00% | | | 0.00% | |
| 92 | Relay Output 1 Term 30-32 Absolute Value | 0:False | 1:True | | | 1:True | |
| 96 | Relay Output 1 Term 30-32 Off Threshold | -200.00% | 200.00% | | | 0.00% | |
| 94 | Relay Output 1 Term 30-32 On Threshold | -200.00% | 200.00% | | | 0.01% | |
| 90 | Relay Output 1 Term 30-32 Source | 0 | 546 | ICR | | 0 | |
| 98 | Relay Output 1 Term 30-32 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 93 | Relay Output 2 Term 33-35 Absolute Value | 0:False | 1:True | | | 1:True | |
| 97 | Relay Output 2 Term 33-35 Off Threshold | -200.00% | 200.00% | | | 0.00% | |
| 95 | Relay Output 2 Term 33-35 On Threshold | -200.00% | 200.00% | | | 0.01% | |
| 91 | Relay Output 2 Term 33-35 Source | 0 | 546 | ICR | | 0 | |
| 99 | Relay Output 2 Term 33-35 Status | 0:Open | 1:Closed | | RO | 0:Open | |
| 11 | Reserved | 0 | 65535 | | | 0 | |
| 12 | Reserved | 0 | 65535 | | | 0 | |
| 13 | Reserved | 0 | 65535 | | | 0 | |
| 14 | Reserved | 0 | 65535 | | | 0 | |
| 15 | Reserved | 0 | 65535 | | | 0 | |
| 16 | Reserved | 0 | 65535 | | | 0 | |
| 17 | Reserved | 0 | 65535 | | | 0 | |
| 18 | Reserved | 0 | 65535 | | | 0 | |
| 440 | Reserved | 0 | 65535 | | | 0 | |
| 441 | Reserved | 0 | 65535 | | | 0 | |
| 442 | Reserved | 0 | 65535 | | | 0 | |
| 443 | Reserved | 0 | 65535 | | | 0 | |
| 444 | Reserved | 0 | 65535 | | | 0 | |
| 445 | Reserved | 0 | 65535 | | | 0 | |
| 446 | Reserved | 0 | 65535 | | | 0 | |
| 447 | Reserved | 0 | 65535 | | | 0 | |
| 448 | Reserved | 0 | 65535 | | | 0 | |
| 449 | Reserved | 0 | 65535 | | | 0 | |
| 450 | Reserved | 0 | 65535 | | | 0 | |
| 451 | Reserved | 0 | 65535 | | | 0 | |
| 452 | Reserved | 0 | 65535 | | | 0 | |
| 453 | Reserved | 0 | 65535 | | | 0 | |
| 454 | Reserved | 0 | 65535 | | | 0 | |
| 455 | Reserved | 0 | 65535 | | | 0 | |
| 456 | Reserved | 0 | 65535 | | | 0 | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|----------------------------|------------------------------------|------------|-----|----|----------|------|
| 457 | Reserved | 0 | 65535 | | | 0 | |
| 196 | Revolutions | 0 | 65535 | | | 0 | |
| 348 | Revolutions | 0 | 65535 | | | 1 | |
| 199 | Roll Speed | -200.00% | 200.00% | | RO | 0.00% | |
| 200 | Roll Speed Sum | -100.00% | 100.00% | | | 0.00% | |
| 523 | Run | 0:False | 1:True | | | 0:False | |
| 526 | Run Delay Mode | 0:Timer, 1:Speed, 2:Either, 3:Both | | | | 0:Timer | |
| 527 | Run Delay Time | 0.0 Secs | 300.0 Secs | | | 5.0 Secs | |
| 127 | Run LED Source A | 0 | 546 | | | 0 | |
| 128 | Run LED Source B | 0 | 546 | | | 0 | |
| 129 | Run LED Source C | 0 | 546 | | | 0 | |
| 130 | Run LED Source D | 0 | 546 | | | 0 | |
| 131 | Run LED Source E | 0 | 546 | | | 0 | |
| 132 | Run LED Status | 0:False | 1:True | | RO | 0:False | |
| 522 | Stall | 0:False | 1:True | | | 0:False | |
| 515 | Static Friction Torque | 0.00% | 100.00% | | | 0.00% | |
| 528 | Stop Delay Mode | 0:Timer, 1:Speed, 2:Either, 3:Both | | | | 0:Timer | |
| 529 | Stop Delay Time | 0.0 Secs | 300.0 Secs | | | 5.0 Secs | |
| 222 | Sum 1 Input A | -200.00% | 200.00% | | | 0.00% | |
| 225 | Sum 1 Input B | -200.00% | 200.00% | | | 0.00% | |
| 228 | Sum 1 Input C | -200.00% | 200.00% | | | 0.00% | |
| 231 | Sum 1 Input D | -200.00% | 200.00% | | | 0.00% | |
| 223 | Sum 1 Invert A | 0:False | 1:True | | | 0:False | |
| 226 | Sum 1 Invert B | 0:False | 1:True | | | 0:False | |
| 229 | Sum 1 Invert C | 0:False | 1:True | | | 0:False | |
| 232 | Sum 1 Invert D | 0:False | 1:True | | | 0:False | |
| 233 | Sum 1 Output | -200.00% | 200.00% | | RO | 0% | |
| 221 | Sum 1 Ratio A | 0.00% | 100.00% | | | 100.00% | |
| 224 | Sum 1 Ratio B | 0.00% | 100.00% | | | 100.00% | |
| 227 | Sum 1 Ratio C | 0.00% | 100.00% | | | 100.00% | |
| 230 | Sum 1 Ratio D | 0.00% | 100.00% | | | 100.00% | |
| 235 | Sum 2 Input A | -200.00% | 200.00% | | | 0.00% | |
| 238 | Sum 2 Input B | -200.00% | 200.00% | | | 0.00% | |
| 241 | Sum 2 Input C | -200.00% | 200.00% | | | 0.00% | |
| 244 | Sum 2 Input D | -200.00% | 200.00% | | | 0.00% | |
| 236 | Sum 2 Invert A | 0:False | 1:True | | | 0:False | |
| 239 | Sum 2 Invert B | 0:False | 1:True | | | 0:False | |
| 242 | Sum 2 Invert C | 0:False | 1:True | | | 0:False | |
| 245 | Sum 2 Invert D | 0:False | 1:True | | | 0:False | |
| 246 | Sum 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 234 | Sum 2 Ratio A | 0.00% | 100.00% | | | 100.00% | |
| 237 | Sum 2 Ratio B | 0.00% | 100.00% | | | 100.00% | |
| 240 | Sum 2 Ratio C | 0.00% | 100.00% | | | 100.00% | |
| 243 | Sum 2 Ratio D | 0.00% | 100.00% | | | 100.00% | |
| 204 | Taper Diameter | 0.01" | 200.00" | | | 200.00" | |
| 205 | Taper Percentage | 0.00% | 100.00% | | | 0.00% | |
| 206 | Taper Tension Output | 0.00% | 100.00% | | RO | 0.00% | |
| 203 | Taper Tension Setpoint | 0.00% | 100.00% | | | 0.00% | |
| 518 | Tension Sum | -100.00% | 100.00% | | | 0.00% | |
| 297 | Threshold 1 Absolute Value | 0:False | 1:True | | | 0:False | |
| 301 | Threshold 1 Input | -200.00% | 200.00% | | | 0.00% | |
| 293 | Threshold 1 Off Threshold | 0.00% | 200.00% | | | 0.00% | |
| 285 | Threshold 1 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 289 | Threshold 1 On Threshold | 0.00% | 200.00% | | | 0.01% | |
| 281 | Threshold 1 On Value | -200.00% | 200.00% | | | 0.01% | |
| 305 | Threshold 1 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 298 | Threshold 2 Absolute Value | 0:False | 1:True | | | 0:False | |
| 302 | Threshold 2 Input | -200.00% | 200.00% | | | 0.00% | |
| 294 | Threshold 2 Off Threshold | 0.00% | 200.00% | | | 0.00% | |
| 286 | Threshold 2 Off Value | -200.00% | 200.00% | | | 0.00% | |
| 290 | Threshold 2 On Threshold | 0.00% | 200.00% | | | 0.01% | |
| 282 | Threshold 2 On Value | -200.00% | 200.00% | | | 0.01% | |
| 306 | Threshold 2 Output | -200.00% | 200.00% | | RO | 0.00% | |
| 299 | Threshold 3 Absolute Value | 0:False | 1:True | | | 0:False | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User | |
|-----|--------------------------------------|---|-----------|-----|----|---------|-----------|--|
| 303 | Threshold 3 Input | -200.00% | 200.00% | | | 0.00% | | |
| 295 | Threshold 3 Off Threshold | 0.00% | 200.00% | | | 0.00% | | |
| 287 | Threshold 3 Off Value | -200.00% | 200.00% | | | 0.00% | | |
| 291 | Threshold 3 On Threshold | 0.00% | 200.00% | | | 0.01% | | |
| 283 | Threshold 3 On Value | -200.00% | 200.00% | | | 0.01% | | |
| 307 | Threshold 3 Output | -200.00% | 200.00% | | RO | 0.00% | | |
| 300 | Threshold 4 Absolute Value | 0:False | 1:True | | | 0:False | | |
| 304 | Threshold 4 Input | -200.00% | 200.00% | | | 0.00% | | |
| 296 | Threshold 4 Off Threshold | 0.00% | 200.00% | | | 0.00% | | |
| 288 | Threshold 4 Off Value | -200.00% | 200.00% | | | 0.00% | | |
| 292 | Threshold 4 On Threshold | 0.00% | 200.00% | | | 0.01% | | |
| 284 | Threshold 4 On Value | -200.00% | 200.00% | | | 0.01% | | |
| 308 | Threshold 4 Output | -200.00% | 200.00% | | RO | 0.00% | | |
| 321 | Timer 1 Delay Time 1 | 0.0Secs | 300.0Secs | | | 0.1Secs | | |
| 325 | Timer 1 Delay Time 2 | 0.0Secs | 300.0Secs | | | 0.1Secs | | |
| 329 | Timer 1 Input | 0:False | 1:True | | | 0:False | | |
| 317 | Timer 1 Mode | 0:OnDelay, 1:OffDelay, 2:OneShot, 3:RetriggerableOneShot, 4:SingleCycle, 5:RepeatCycle, 6:DelayedStartRepeatCycle | | | | | 0:OnDelay | |
| 333 | Timer 1 Output | -200.00% | 200.00% | | RO | 0.00% | | |
| 341 | Timer 1 Status | 0:False | 1:True | | RO | 0:False | | |
| 337 | Timer 1 Value | 0.0Secs | 300.0Secs | | RO | 0.0Secs | | |
| 309 | Timer 1 Value A | -200.00% | 200.00% | | | 1.00% | | |
| 313 | Timer 1 Value B | -200.00% | 200.00% | | | 0.00% | | |
| 322 | Timer 2 Delay Time 1 | 0.0Secs | 300.0Secs | | | 0.1Secs | | |
| 326 | Timer 2 Delay Time 2 | 0.0Secs | 300.0Secs | | | 0.1Secs | | |
| 330 | Timer 2 Input | 0:False | 1:True | | | 0:False | | |
| 318 | Timer 2 Mode | 0:OnDelay, 1:OffDelay, 2:OneShot, 3:RetriggerableOneShot, 4:SingleCycle, 5:RepeatCycle, 6:DelayedStartRepeatCycle | | | | | 0:OnDelay | |
| 334 | Timer 2 Output | -200.00% | 200.00% | | RO | 0.00% | | |
| 342 | Timer 2 Status | 0:False | 1:True | | RO | 0:False | | |
| 338 | Timer 2 Value | 0.0Secs | 300.0Secs | | RO | 0.0Secs | | |
| 310 | Timer 2 Value A | -200.00% | 200.00% | | | 1.00% | | |
| 314 | Timer 2 Value B | -200.00% | 200.00% | | | 0.00% | | |
| 323 | Timer 3 Delay Time 1 | 0.0Secs | 300.0Secs | | | 0.1Secs | | |
| 327 | Timer 3 Delay Time 2 | 0.0Secs | 300.0Secs | | | 0.1Secs | | |
| 331 | Timer 3 Input | 0:False | 1:True | | | 0:False | | |
| 319 | Timer 3 Mode | 0:OnDelay, 1:OffDelay, 2:OneShot, 3:RetriggerableOneShot, 4:SingleCycle, 5:RepeatCycle, 6:DelayedStartRepeatCycle | | | | | 0:OnDelay | |
| 335 | Timer 3 Output | -200.00% | 200.00% | | RO | 0.00% | | |
| 343 | Timer 3 Status | 0:False | 1:True | | RO | 0:False | | |
| 339 | Timer 3 Value | 0.0Secs | 300.0Secs | | RO | 0.0Secs | | |
| 311 | Timer 3 Value A | -200.00% | 200.00% | | | 1.00% | | |
| 315 | Timer 3 Value B | -200.00% | 200.00% | | | 0.00% | | |
| 324 | Timer 4 Delay Time 1 | 0.0Secs | 300.0Secs | | | 0.1Secs | | |
| 328 | Timer 4 Delay Time 2 | 0.0Secs | 300.0Secs | | | 0.1Secs | | |
| 332 | Timer 4 Input | 0:False | 1:True | | | 0:False | | |
| 320 | Timer 4 Mode | 0:OnDelay, 1:OffDelay, 2:OneShot, 3:RetriggerableOneShot, 4:SingleCycle, 5:RepeatCycle, 6:DelayedStartRepeatCycle | | | | | 0:OnDelay | |
| 336 | Timer 4 Output | -200.00% | 200.00% | | RO | 0.00% | | |
| 344 | Timer 4 Status | 0:False | 1:True | | RO | 0:False | | |
| 340 | Timer 4 Value | 0.0Secs | 300.0Secs | | RO | 0.0Secs | | |
| 312 | Timer 4 Value A | -200.00% | 200.00% | | | 1.00% | | |
| 316 | Timer 4 Value B | -200.00% | 200.00% | | | 0.00% | | |
| 533 | Torque Select | 0 | 3 | | RO | 0 | | |
| 518 | Torque Sum | -100.00% | 100.00% | | | 0.00% | | |
| 517 | Total Torque | 0.00% | 100.00% | | RO | 0.00% | | |
| 0 | Trash | -32768 | 32767 | | | 0 | | |
| 469 | Turret Diameter Reset | 0:False | 1:True | | RO | 0:False | | |
| 377 | Turret PID Reset | 0:False | 1:True | | RO | 0:False | | |
| 375 | Turret Roll 1 Delayed Tension Enable | 0:False | 1:True | | RO | 0:False | | |
| 373 | Turret Roll 1 Hold Speed | 0:False | 1:True | | RO | 0:False | | |

| Tag | Parameter Name | Min | Max | ICR | RO | Preset | User |
|-----|--------------------------------------|---------|---------|-----|----|---------|------|
| 465 | Turret Roll 1 Run | 0:False | 1:True | | | 0:False | |
| 467 | Turret Roll 1 Speed Match | 0:False | 1:True | | RO | 0:False | |
| 371 | Turret Roll 1 Tension Enable | 0:False | 1:True | | | 0:False | |
| 376 | Turret Roll 2 Delayed Tension Enable | 0:False | 1:True | | RO | 0:False | |
| 374 | Turret Roll 2 Hold Speed | 0:False | 1:True | | RO | 0:False | |
| 466 | Turret Roll 2 Run | 0:False | 1:True | | | 0:False | |
| 468 | Turret Roll 2 Speed Match | 0:False | 1:True | | RO | 0:False | |
| 530 | Zero Speed Threshold | 0.00% | 100.00% | | | 5.00% | |

6.1 LT Builder

The purpose of the LT Builder (or Builder, for short) is to allow configuration of the Cortex LT by answering a series of questions and making choices based on these answers. This will allow the first-time user to set up the LT for sophisticated applications. The unit can then be used as it is or fine-tuned further for better performance.

Some of the applications the Builder can handle are:

- Basic PID Control
- Center Winder, both Velocity and Torque modes
- Center Unwinder, both Driven and Brake modes
- Velocity controlled Surface Drive
- Level Control
- Turret Winder in Velocity mode

On some screens, the Builder will allow you to step back to change a previous selection. If the “Back” button is enabled, then this is the case. If the Back button is disabled, and you realize you have made a selection on a previous screen incorrectly, you must cancel the Builder and start over.

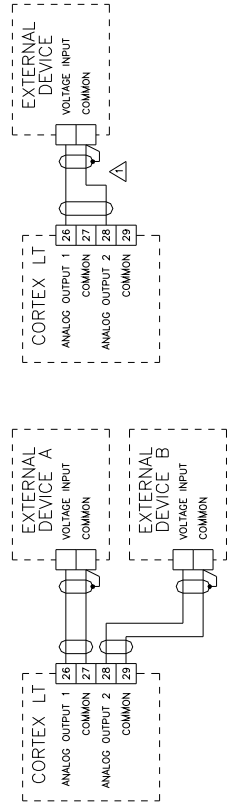
The settings and choices you make as you go through the Builder are held until you complete the Builder and click “Finish”. If you are online, this is when the settings are transferred to the Cortex LT. If you are offline, the parameter file may be saved just as you would any other parameter file, then downloaded to an LT later.

6.2 LT Calibrators

For certain applications, the Builder cannot do everything that needs to be done to configure the Cortex LT. For these applications, there are three Calibrators, one each for the Brake Letoff, the CTCW, and the Turret Winder applications. Each Calibrator is geared to help you calibrate the Cortex LT to do the very best in the application for which it has been configured. Each Calibrator consists of a set of steps to guide you through setting up the LT so that you can range inputs and outputs properly, set up encoders, dancers and loadcells, and even make adjustments to better performance while the equipment is running.

The Calibrators are designed to be used while the LT is online during the first time startup of the application equipment or to adjust certain parameters while watching the equipment and monitoring other parameters. The changes you make in the Calibrators take effect immediately in the Cortex LT, so it is designed to be used online. You can open the Calibrator screens while offline, but some of the features will be disabled. However, this is a very good means to become familiar with the setup process and with what the Calibrators actually do.

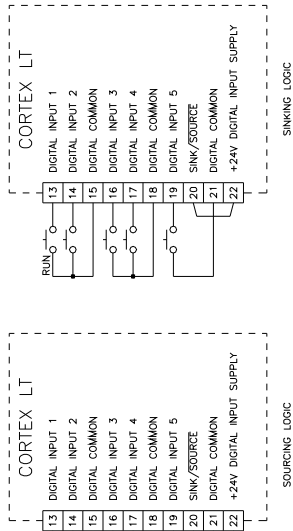
ANALOG OUTPUTS



SINGLE BIPOLEAR OUTPUT

DUAL UNIPOLAR OUTPUT

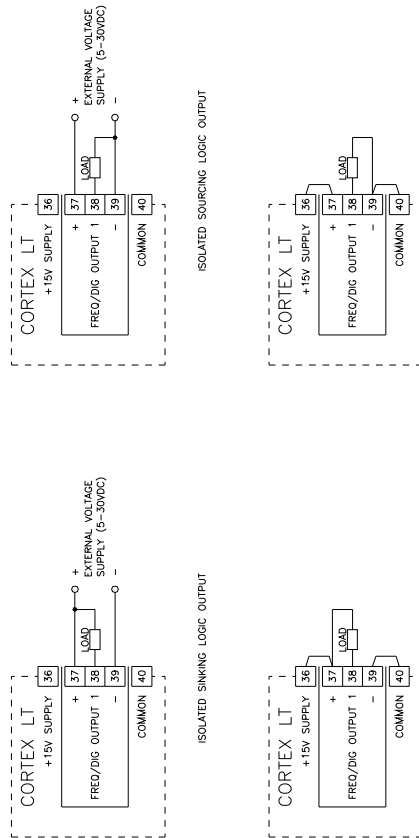
DIGITAL INPUTS



SINKING LOGIC

SOURCING LOGIC

FREQUENCY/DIGITAL OUTPUTS



ISOLATED SINKING LOGIC OUTPUT

ISOLATED SOURCING LOGIC OUTPUT

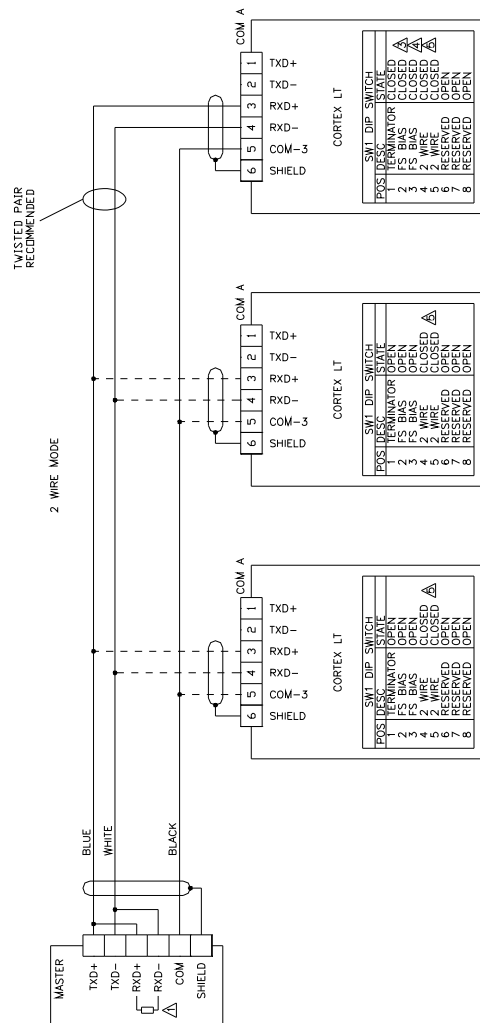
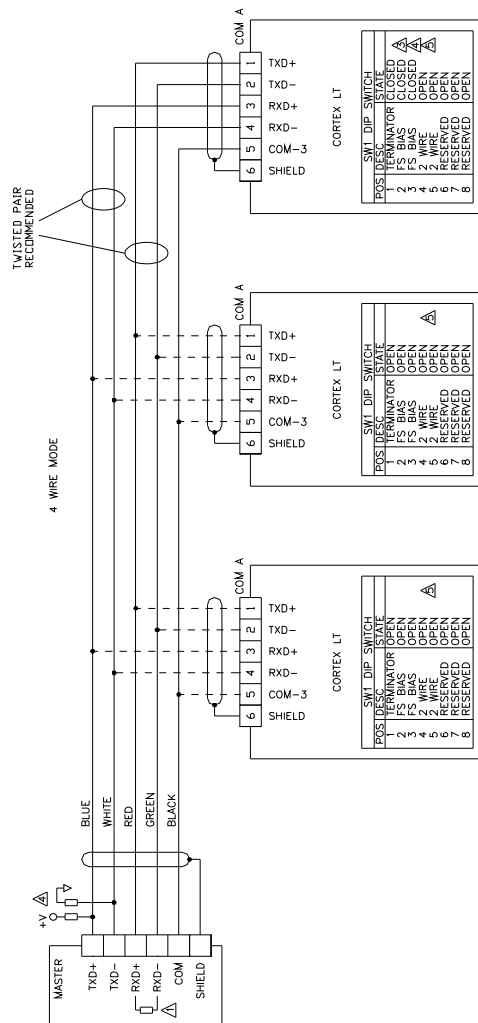
UNISOLATED +15V SINKING LOGIC OUTPUT

UNISOLATED +15V SOURCING LOGIC OUTPUT

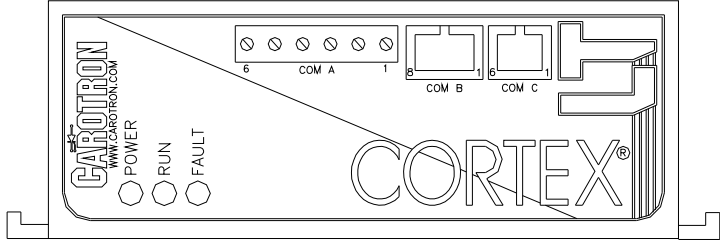
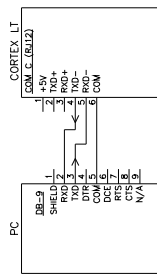
NOTES:
 △ WHEN BIG CAP ANALOG OUTPUT CONNECTION SCHEME IS USED, NO OTHER DISCRETE COMPONENTS CAN BE MADE BETWEEN THE CORTEX LT AND THE EXTERNAL DEVICE.

| | |
|--|--------|
| REV. B 9/13/02 REVISED E/D OUTPUT EXAMPLES | |
| DATE | REV. B |
| ISSUED BY | DATE |
| DESIGNED BY | DATE |
| TESTED BY | DATE |
| APPROVED BY | DATE |
| CARDTRON Precision by Design™ | |
| CORTEX LT EXAMPLE CONNECTIONS | |
| REV. B SH. 1 OF 1 | |

D12626



PC TO COM C CONNECTIONS



- NOTES:
- △ SINCE MASTER IS AT ONE END OF DAISY CHAINED BUS IN THIS EXAMPLE, ITS TERMINATING RESISTOR SHOULD BE A 120 OHM RESISTOR. THE OTHER END OF THE BUS SHOULD NOT BE PROVIDED WITH A TERMINATING RESISTOR INTERNALLY. ONE MAY NEED TO BE PROVIDED EXTERNALLY. (RECOMMENDED VALUE: 120 OHMS). REFER TO MASTER DOCUMENTATION FOR FURTHER DETAILS.
 - 2. MAXIMUM TOTAL NETWORK LENGTH: 4000 FEET.
 - △ DEVICE AT END OF NETWORK SHOULD HAVE ITS TERMINATING RESISTOR SWITCHED IN.
 - △ IN 4 WIRE MODE, FAIL-SAFE BASING MAY BE REQUIRED ON EACH PAIR OF COMMUNICATION LINES. WHEN CLOSED, POSITIONS 2 & 3 ON THE CORTEX LT DIP SWITCH SHOULD BE CLOSED. IN 2 WIRE MODE, EXTERNAL BASING ON THE OTHER PAIR MAY BE REQUIRED. REFER TO MASTER DOCUMENTATION FOR MORE INFORMATION.
 - △ IN 2 WIRE MODE, FAIL-SAFE BASING MUST BE PROVIDED BY AT LEAST ONE DEVICE ON THE NETWORK. IF MASTER DOES NOT PROVIDE BASING, POSITIONS 2 & 3 ON DIP SWITCH 1 ON ONLY ONE CORTEX LT UNIT SHOULD BE CLOSED.
 - △ POSITIONS 4 & 5 OF DIP SWITCH 1 SHOULD BE OPEN WHEN USING 4 WIRE MODE AND CLOSED WHEN USING 2 WIRE MODE.

REV. D, 01-15-10, REVISE COM C CONNECTIONS
 REV. C, 01-15-10, REVISE COM C CONNECTIONS
 REV. B, 11-21-03, ADDED 2 WIRE CONNECTIONS

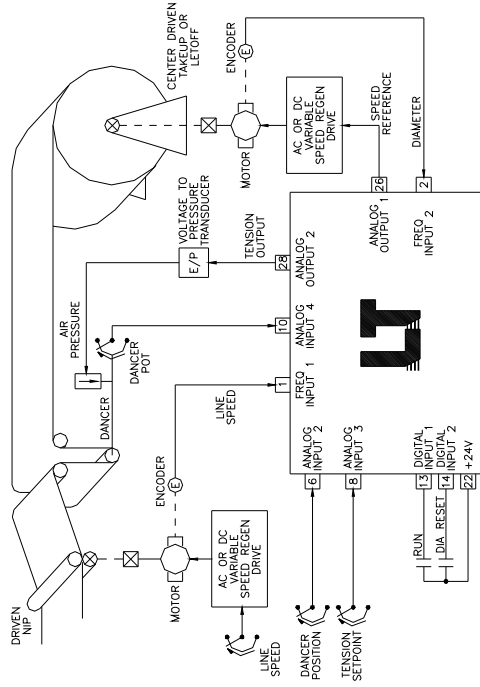
BKP *air/ox* **CAROTRON**
 Precision by Excellence

DESIGNED BY: BKP
 DRAWN BY: BKP
 CHECKED BY: BKP
 DATE: 01-15-10

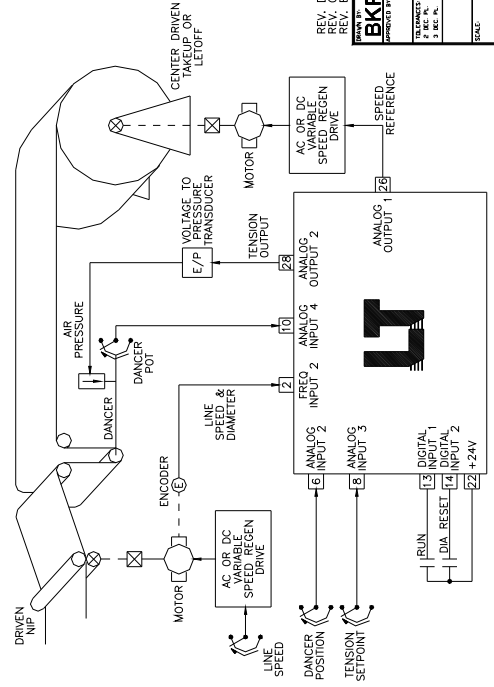
TITLE: CORTEX MODELS NETWORK CONNECTIONS

PART NUMBER: **D12647** REV. **D** SH. **1** OF **1**

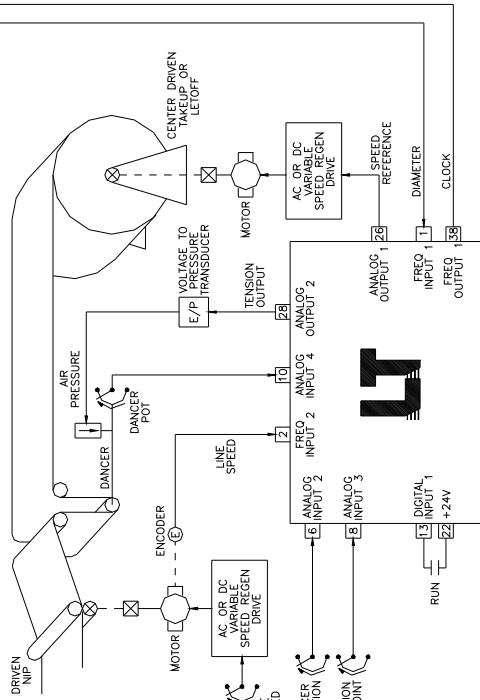
AIR LOADED DANCER CONTROL
ROLL PULSE COUNT DIAMETER CALCULATION



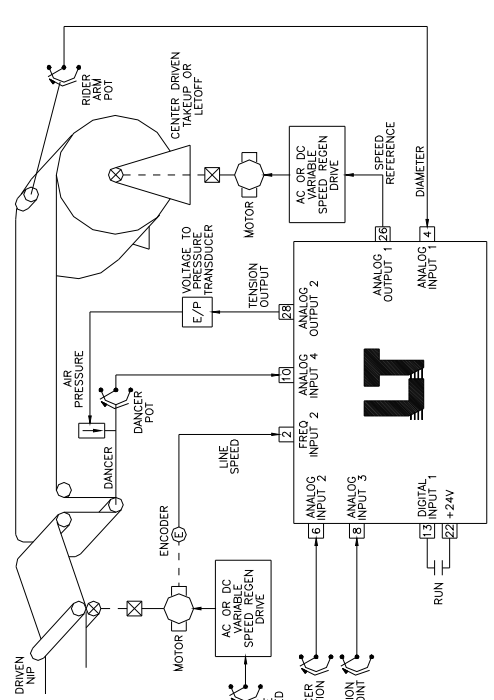
AIR LOADED DANCER CONTROL
LINE PULSE COUNT DIAMETER CALCULATION



AIR LOADED DANCER CONTROL
SONIC DIAMETER MEASUREMENT



AIR LOADED DANCER CONTROL
RIDER ARM DIAMETER MEASUREMENT



REV. D, 02-25-05, ADDED SURFACE TAKEUP/LETOFF
REV. C, 10-14-03, ADDED UNWIND TO WIND PG 6
REV. B, 01-12-03, ADDED UNWIND TO WIND, PG 5
REV. A, 01-12-03, ADDED UNWIND TO WIND, PG 5

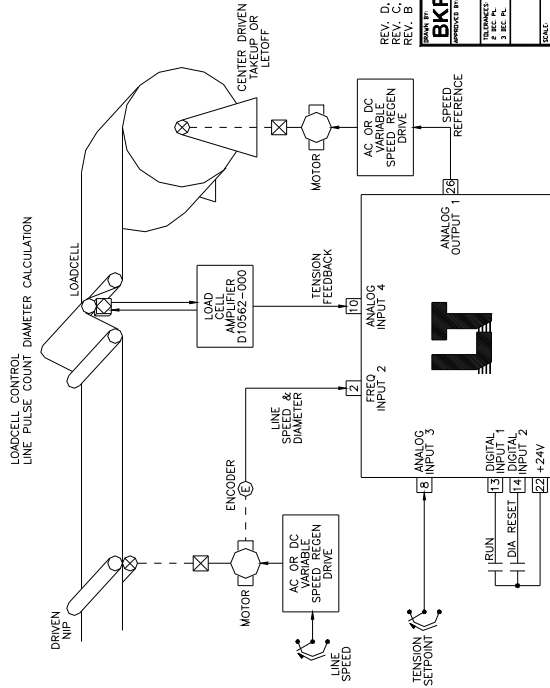
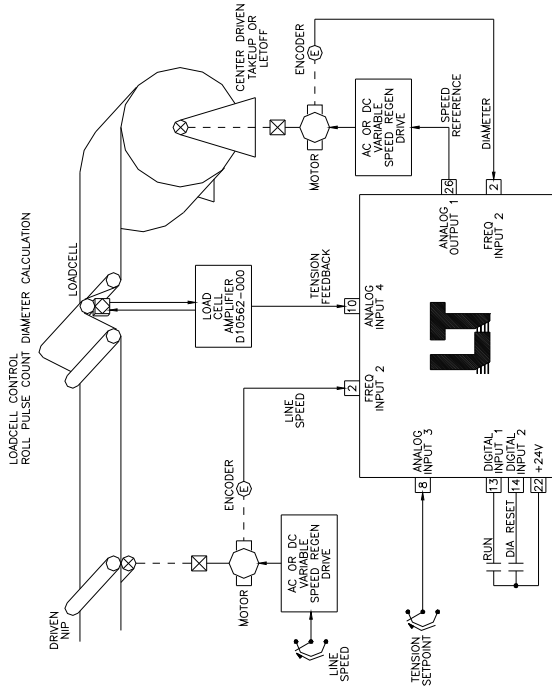
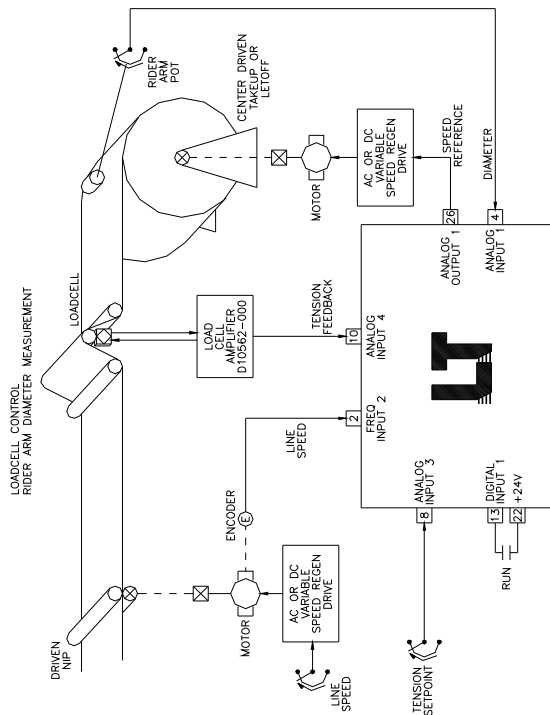
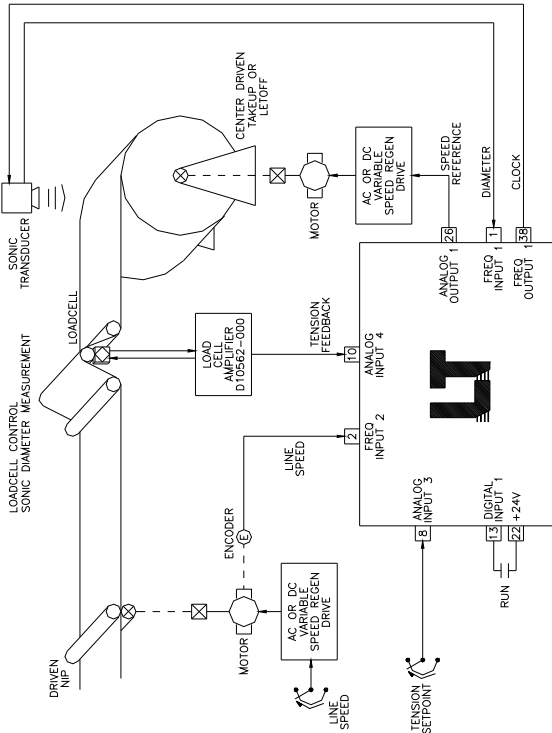
BKP 10/8/02
DATE: 10/8/02
APPROVED BY: [Signature]

TELEPHONE: 1 800 368 8823
FAX: 800 368 8823
1 800 368 8823
5 SEC. PA. 2 800 368 8823

FILE: [Blank]
CORTEX LT
APPLICATION EXAMPLES

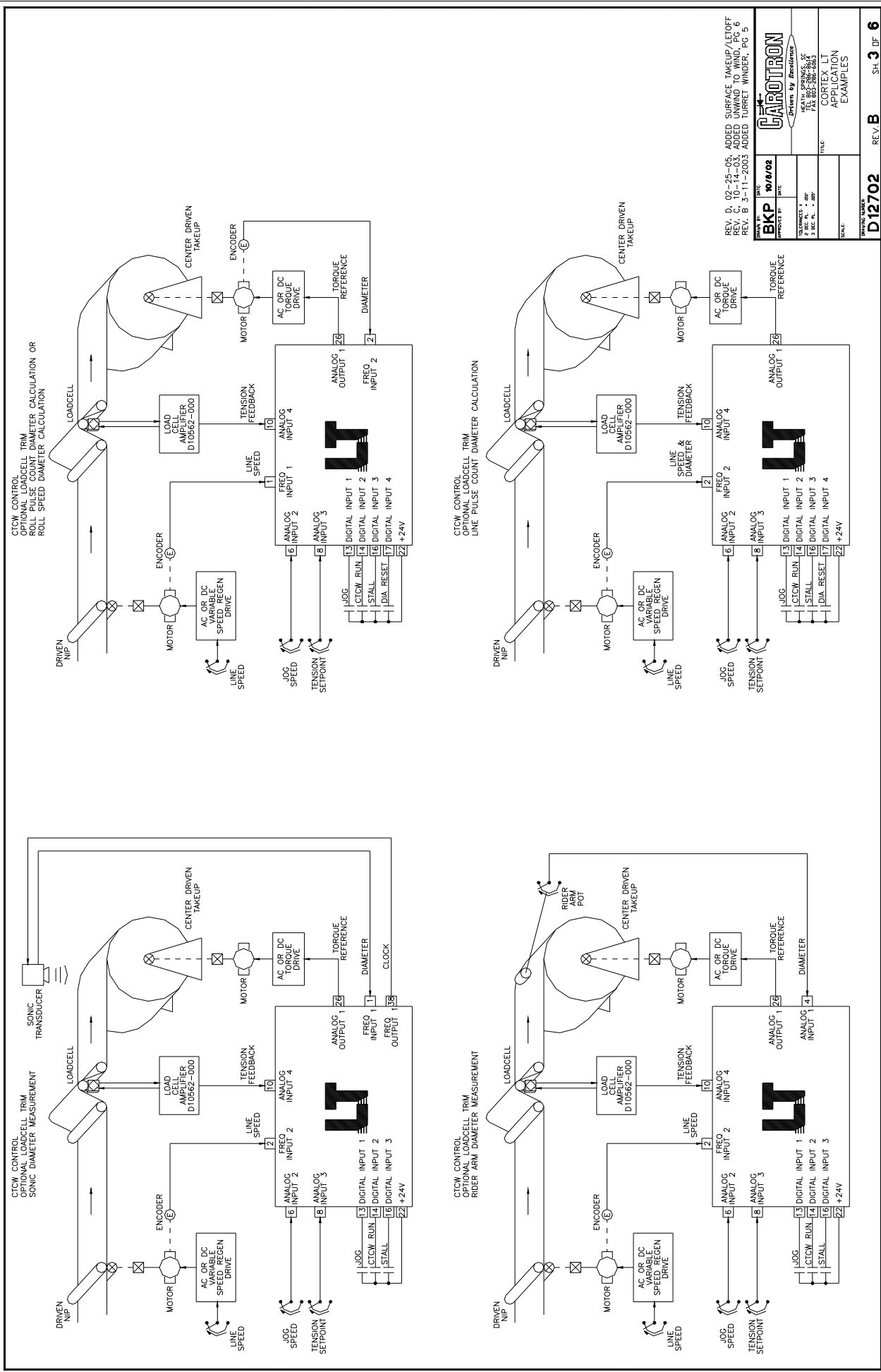
SCALE: [Blank]

PROJECT NUMBER: **D12702** REV. D SH. 1 OF 6



REV. D: 02-25-05, ADDED SURFACE TAKEUP/LETOFF
 REV. C: 02-25-05, ADDED UNWIND TO WIND/FC, 6
 REV. B: 3-11-2003, ADDED TURRET WINDER, PG. 5

| | |
|----------------------|--------------------------------|
| DATE | 10/8/02 |
| APPROVED BY | BKP |
| DESIGNED BY | |
| 3.00 P. N. 000 | |
| HEATH SPRINGS, SC | |
| 114 800-288-2885 | |
| DRIVEN BY Excellence | |
| TITLE | CORTEX LT APPLICATION EXAMPLES |
| REV. B | |
| REV. B | |
| D12702 | |
| SH. 2 OF 6 | |



REV. D, 02-25-05, ADDED SURFACE TAKEUP/LETOFF
 REV. C, 01-28-03, ADDED TURRET WINDER, PG. 6
 REV. B, 3-11-2003, ADDED TURRET WINDER, PG. 5
 REV. A, 01-28-03, ADDED TURRET WINDER, PG. 5

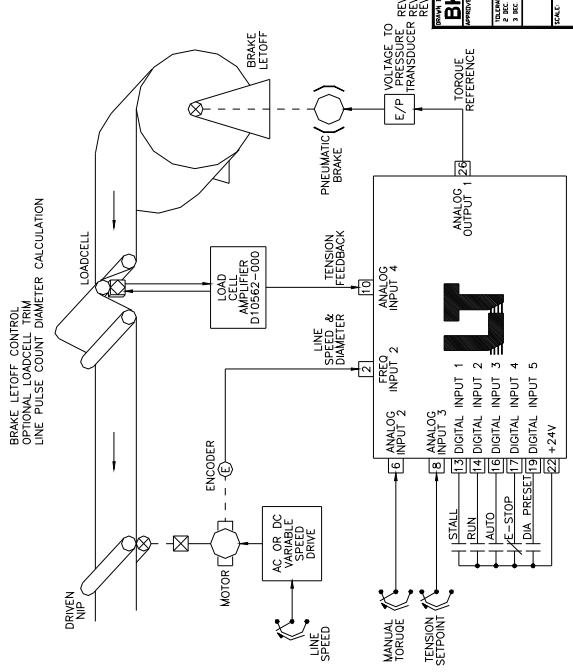
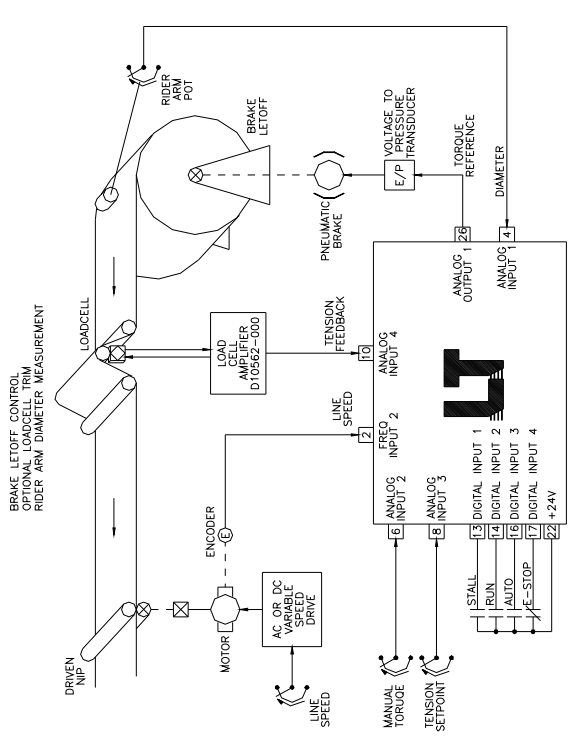
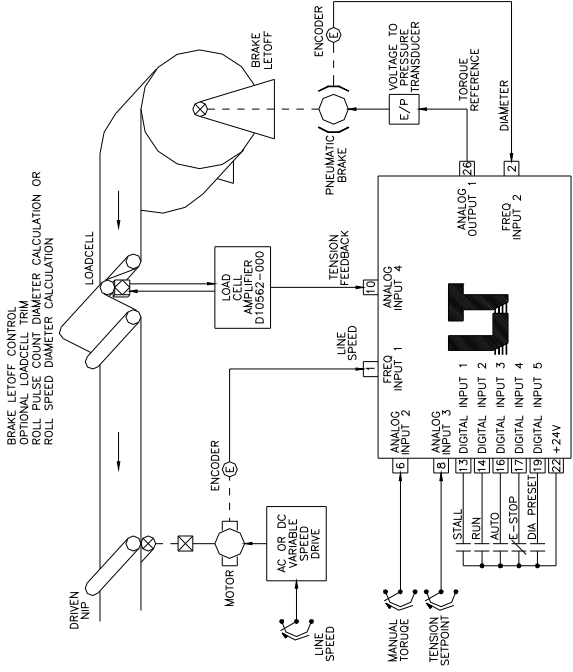
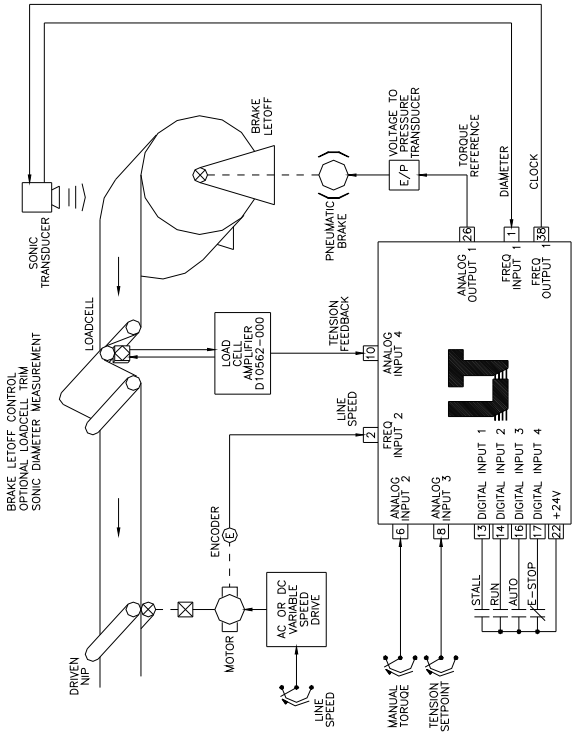
BKP 10/16/02
 PROJECT NO. 10100
 DATE

TELEPHONE: 7
 FAX: 888-288-6666
 3 303.541.7000
 EMAIL

GAROTRON
 Precision by Resilience

CORTEX LIT
 APPLICATION
 EXAMPLES

PRINTED NUMBER: **D12702** REV. **B** SH. **3** OF **6**

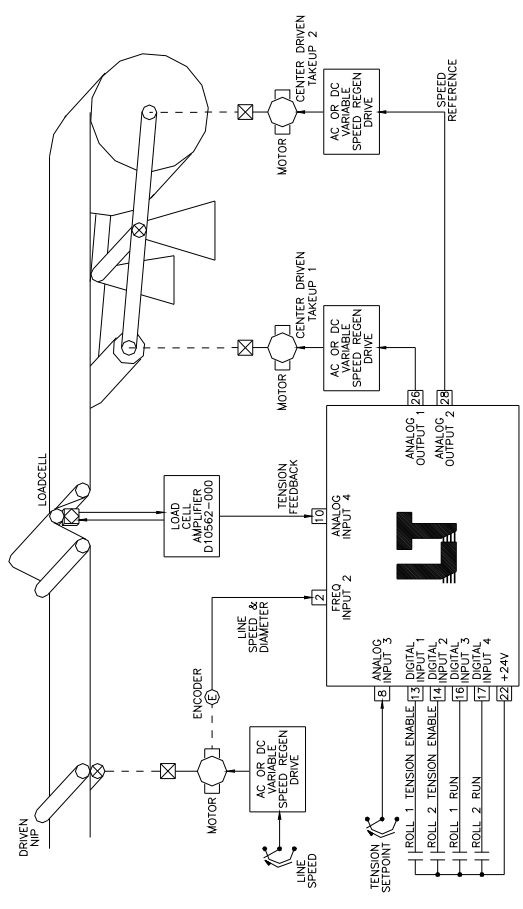
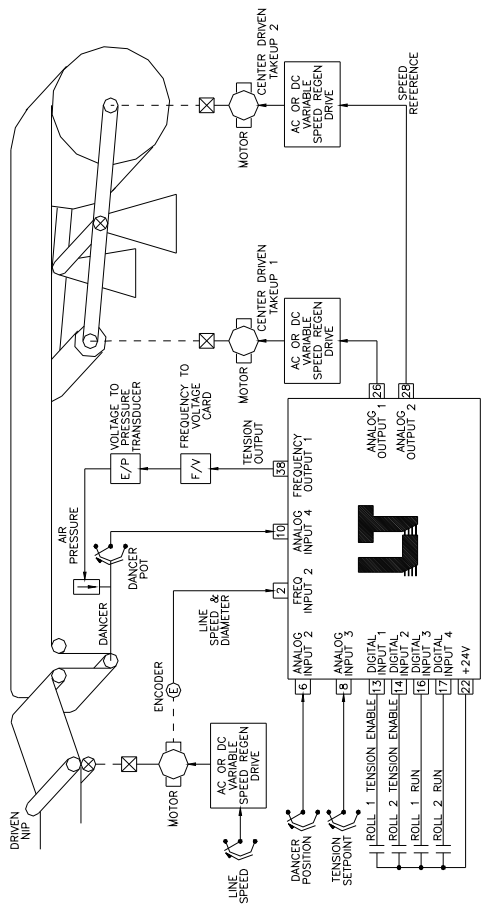


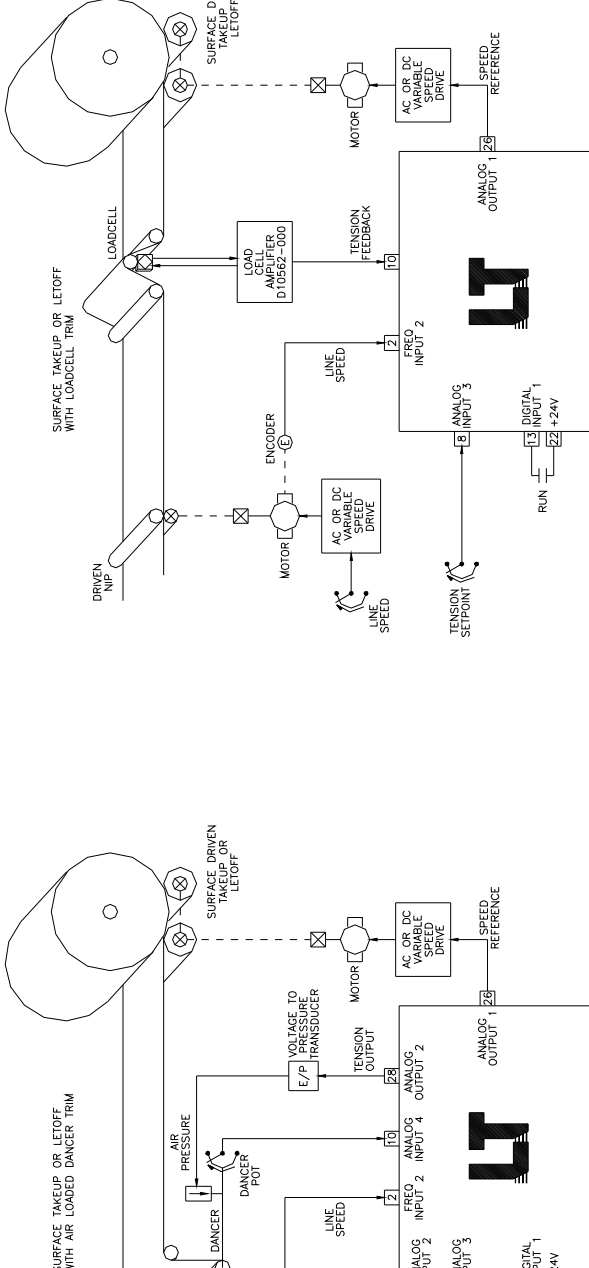
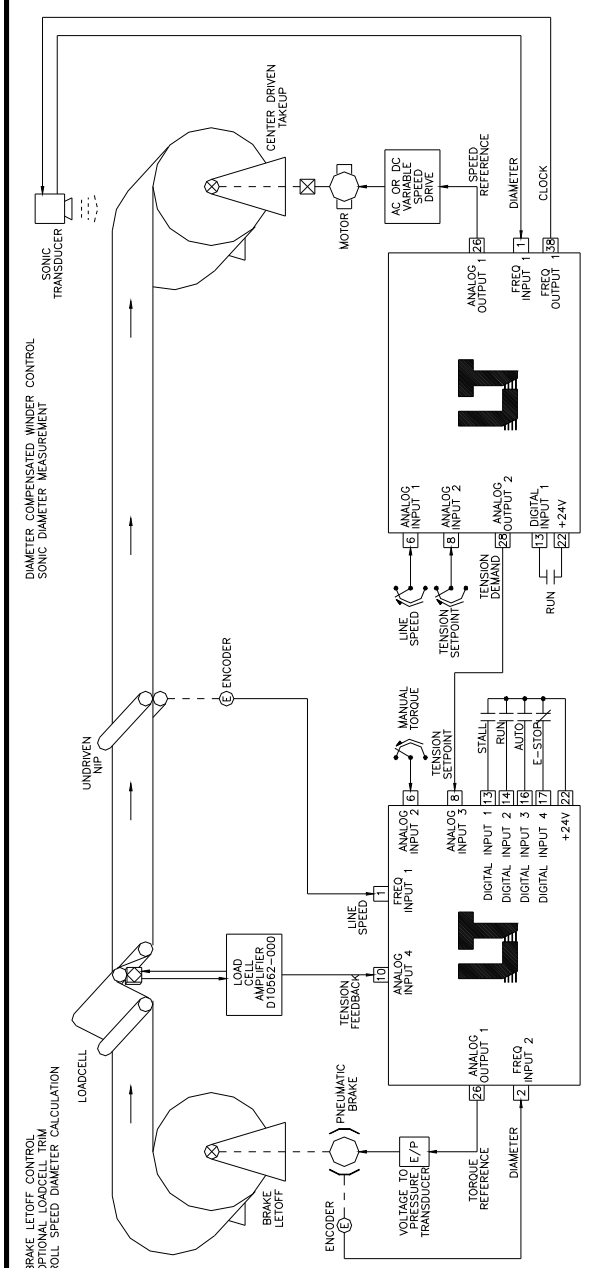
| | | | |
|----------------|--------------------------------------|-----------|------------------------------|
| DATE | REV. D | 02-25-05 | ADDED SURFACE TAKEUP /LETOFF |
| REVISIONS | REV. C | 10-14-03 | ADDED UNWIND TO WINN /FC 6 |
| | REV. B | 3-11-2003 | ADDED TURRET WINDER, PG 5 |
| DESIGNED BY | L. B. BROWN, JR. | | |
| DRAWN BY | M. J. HARRIS | | |
| CHECKED BY | M. J. HARRIS | | |
| APPROVED BY | M. J. HARRIS | | |
| TITLE | CORTEX L1 CALCULATION EXAMPLES | | |
| DRAWING NUMBER | D12702 | | |
| REV. | REV. B | | SH. 4 DF 6 |

REV. D, 02-25-05, ADDED SURFACE TAKEUP/AETOFF
 REV. C, 10-14-03, ADDED UNWIND TO WIND, PG 6
 REV. B, 3-11-2003, ADDED TURRET WINDER, PG 5

| | |
|-------------|--------------------------------|
| DATE | 10/8/02 |
| BY | BKP |
| APPROVED BY | |
| SCALE | |
| TITLE | CORTEX LT APPLICATION EXAMPLES |
| REV. A | 08/01/02 |
| REV. B | 03/11/03 |
| REV. C | 10/14/03 |
| REV. D | 02/25/05 |

DRIVING NUMBER
D12702 REV. B SH. 5 OF 6



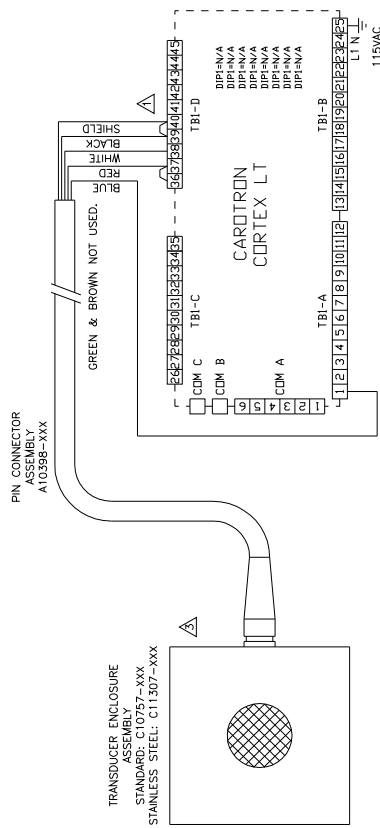


REV. D, 03-25-05, ADDED SURFACE TAKEUP/LETOFF
 REV. C, 10-14-03, ADDED UNWIND TO WIND, PG. 6
 REV. B, 03-11-03, ADDED TURRET WINDER, PG. 5

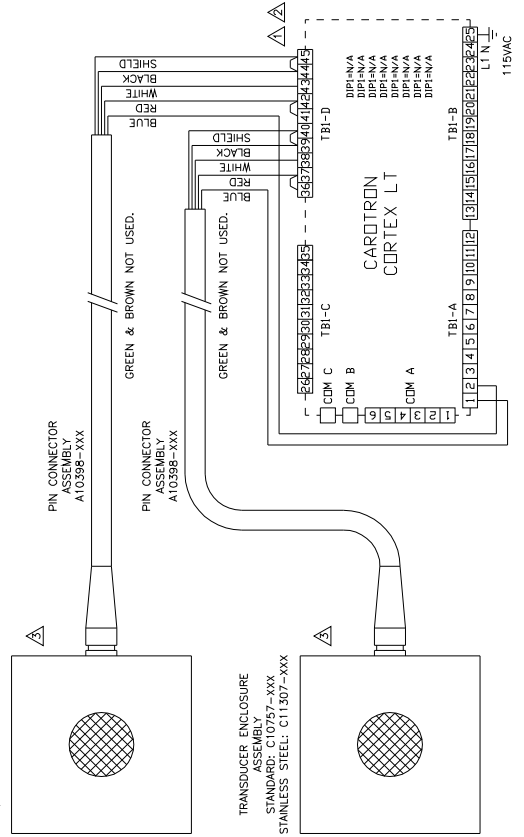
| | |
|--|------|
| BKP 10/1/02 | DATE |
| ISSUED BY | DATE |
| DESIGNED BY | DATE |
| 2-REV. P.A. 1-007 | |
| 3-REV. P.A. 2-007 | |
| SCALE | |
| PARTRON <i>Driven by Knowledge</i> 1511 BRIDGEWAY, S.W. ALBUQUERQUE, NM 87102 TEL: 505-263-3333 FAX: 505-263-3332 WWW.PARTRON.COM APPLICATION EXAMPLES | |

REV. D 12702 REV. D Sh. 6 of 6

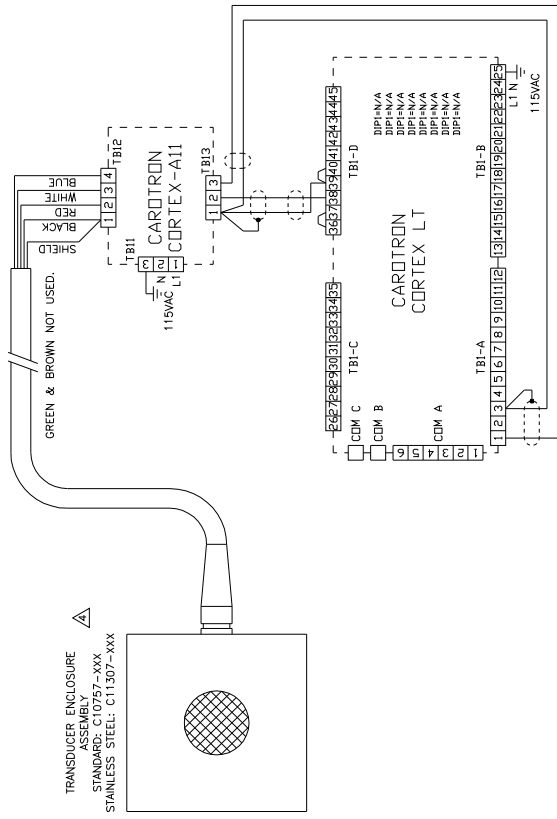
SINGLE SONIC TRANSDUCER CONNECTIONS



DUAL SONIC TRANSDUCER CONNECTIONS



SINGLE SONIC TRANSDUCER CONNECTIONS WITH EXTERNAL POWER SUPPLY

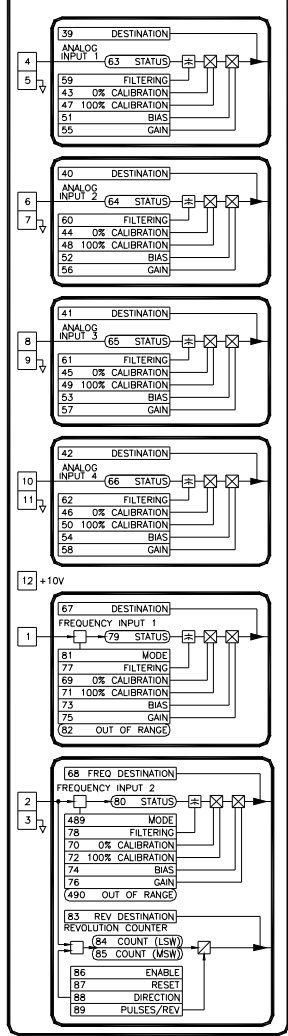
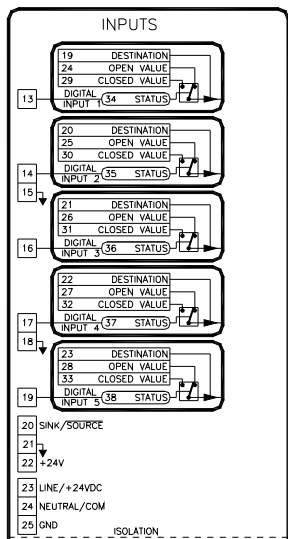


NOTES:

- ⚠ FREQUENCY/DIGITAL OUTPUT 1 MUST BE IN FREQ MODE AND CONFIGURED TO OUTPUT A 7 HZ CLOCK SIGNAL. FREQUENCY INPUT 1 MUST BE IN SONIC MODE.
- ⚠ FREQUENCY/DIGITAL OUTPUT 2 MUST BE IN THE FREQ MODE. FREQUENCY INPUT 2 MUST BE IN SONIC MODE.
- ⚠ JUMPER IN TRANSDUCER MUST BE IN THE 8-15V POSITION.
- ⚠ JUMPER IN TRANSDUCER MUST BE IN THE 5V POSITION.

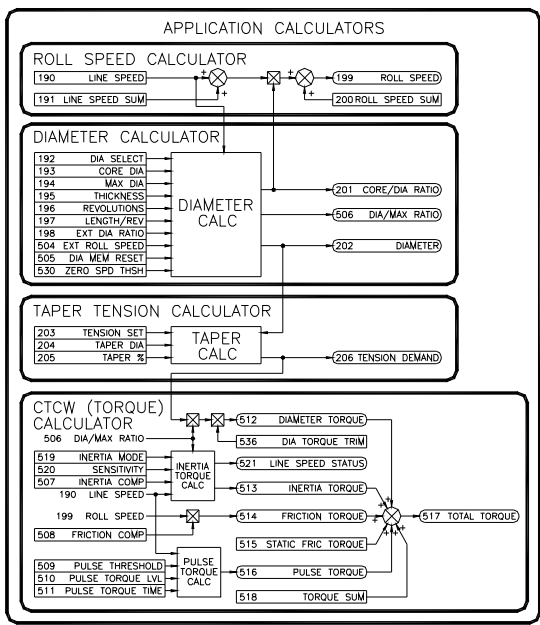
| | | | |
|--|--|---------------------|--|
| DATE: 6/02/02 | | DRAWN BY: BJK | |
| PROJECT BY: DATE: | | CHECKED BY: DATE: | |
| DESIGNED BY: DATE: | | APPROVED BY: DATE: | |
| REV. NO. : 001 | | REV. NO. : 001 | |
| TITLE: CORTEX LT SONIC OPTION CONNECTION DIAGRAM | | PART NUMBER: D12656 | |
| REV. B | | SH. 1 OF 1 | |

CORTEX LT SOFTWARE



INTERNAL LINKS

| | | | |
|-----|-----------|-----|----------------|
| 139 | SOURCE 1 | 140 | DESTINATION 2 |
| 141 | SOURCE 2 | 142 | DESTINATION 2 |
| 143 | SOURCE 3 | 144 | DESTINATION 3 |
| 145 | SOURCE 4 | 146 | DESTINATION 4 |
| 147 | SOURCE 5 | 148 | DESTINATION 5 |
| 149 | SOURCE 6 | 150 | DESTINATION 6 |
| 151 | SOURCE 7 | 152 | DESTINATION 7 |
| 153 | SOURCE 8 | 154 | DESTINATION 8 |
| 155 | SOURCE 9 | 156 | DESTINATION 9 |
| 157 | SOURCE 10 | 158 | DESTINATION 10 |
| 159 | SOURCE 11 | 160 | DESTINATION 11 |
| 161 | SOURCE 12 | 162 | DESTINATION 12 |
| 163 | SOURCE 13 | 164 | DESTINATION 13 |
| 165 | SOURCE 14 | 166 | DESTINATION 14 |
| 167 | SOURCE 15 | 168 | DESTINATION 15 |
| 169 | SOURCE 16 | 170 | DESTINATION 16 |
| 171 | SOURCE 17 | 172 | DESTINATION 17 |
| 173 | SOURCE 18 | 174 | DESTINATION 18 |
| 175 | SOURCE 19 | 176 | DESTINATION 19 |
| 177 | SOURCE 20 | 178 | DESTINATION 20 |



SYSTEM

| | |
|-----|-------------------------|
| 0 | TRASH |
| 1 | ADDR MODE TEST 1 |
| 2 | ADDR MODE TEST 2 |
| 3 | CONFIGURATION CODE |
| 4 | CUSTOMIZATION CODE(LSW) |
| 5 | CUSTOMIZATION CODE(MSW) |
| 6 | FIRMWARE MAJOR |
| 7 | FIRMWARE MINOR |
| 8 | FIRMWARE REVISION |
| 9 | COMMAND ENTRY |
| 10 | COMMAND STATUS |
| 11 | SYSTEM STATUS |
| 12 | BOOT FIRMWARE MAJOR |
| 13 | BOOT FIRMWARE MINOR |
| 14 | BOOT FIRMWARE REVISION |
| 15 | TOTAL PARAMETERS |
| 16 | RESERVED |
| 17 | RESERVED |
| 18 | RESERVED |
| 191 | PARAMETERS CHANGED |

COMMUNICATIONS

| | |
|-----|-----------------|
| 189 | ADDRESSING MODE |
| 458 | NETWORK ADDRESS |

COM PORT A

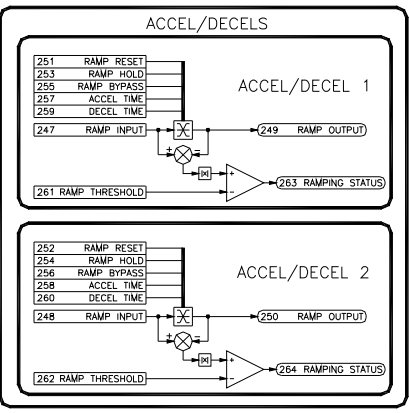
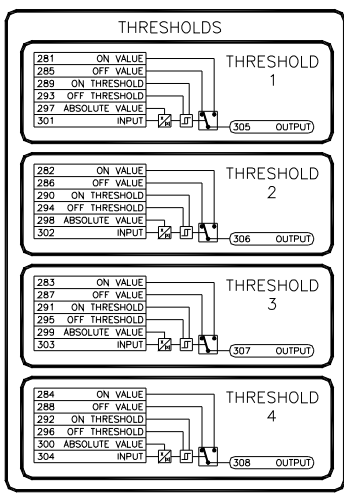
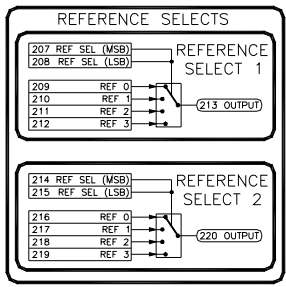
| | |
|-----|----------------------|
| 459 | STATUS |
| 460 | BAUD RATE |
| 461 | FIRMWARE MAJOR |
| 462 | FIRMWARE MINOR |
| 463 | FIRMWARE REVISION |
| 464 | FIRMWARE SUBREVISION |

COM PORT B

| | |
|-----|----------------------|
| 539 | STATUS |
| 540 | BAUD RATE |
| 541 | FIRMWARE MAJOR |
| 542 | FIRMWARE MINOR |
| 543 | FIRMWARE REVISION |
| 544 | FIRMWARE SUBREVISION |

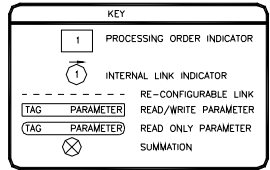
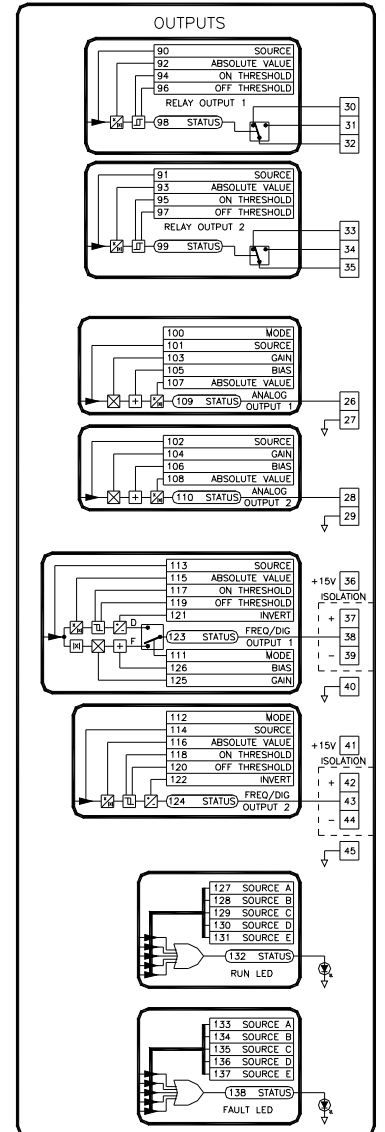
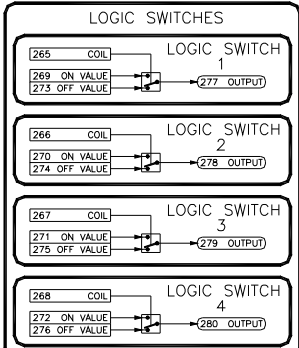
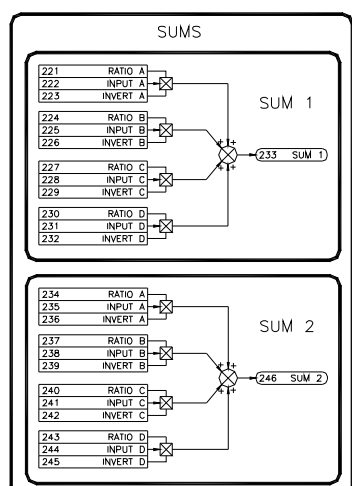
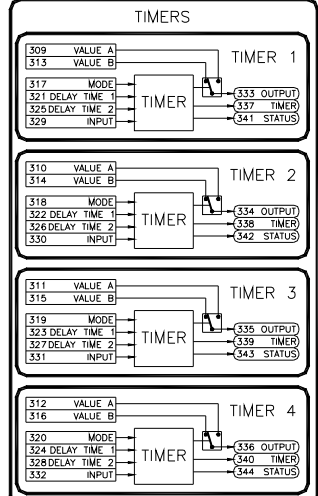
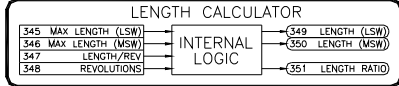
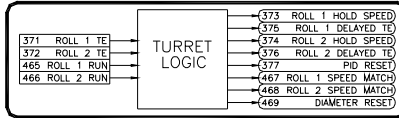
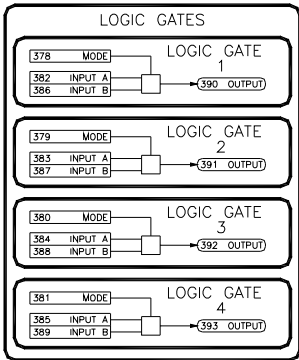
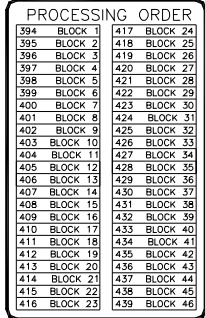
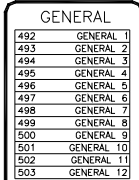
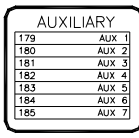
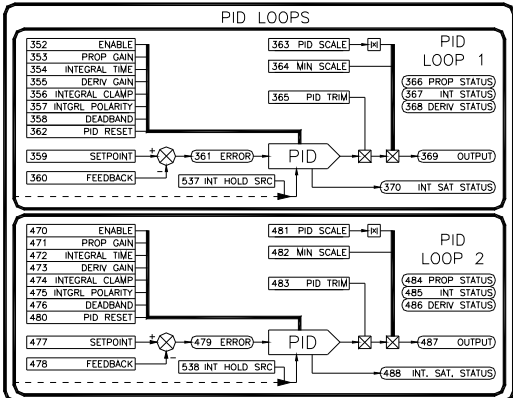
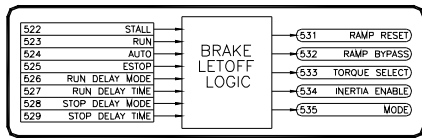
COM PORT C

| | |
|-----|-----------|
| 186 | BAUD RATE |
| 187 | PARITY |
| 188 | STOP BITS |



BLOCK DIAGRAM

REV. K, 1/12/09, REVISED FRICTION TORQUE (APP. CALC)
 REV. J, 1/31/07, REVISED SLIPPING CORE EXAMPLE
 REV. I, 2/25/05, ADDED OTHER EXAMPLES
 REV. H, 5/19/03, COM PORT B
 REV. G, 2/3/03, ADDED LAYERS FOR TURRET WINDER AND BLO
 REV. F, 1/15/03, ADDED LAYERS FOR CTCLW
 REV. E, 11/11/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. D, 10/1/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. C, 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.2
 REV. B, 5/24/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.0



DRWN BY: **BKP** DATE: **2/5/02**

APPROVED BY: _____ DATE: _____

CAROTRON
Driven by Excellence

HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6863

TOLERANCES: ±
2 DEC. PL. ± .010"
3 DEC. PL. ± .005"

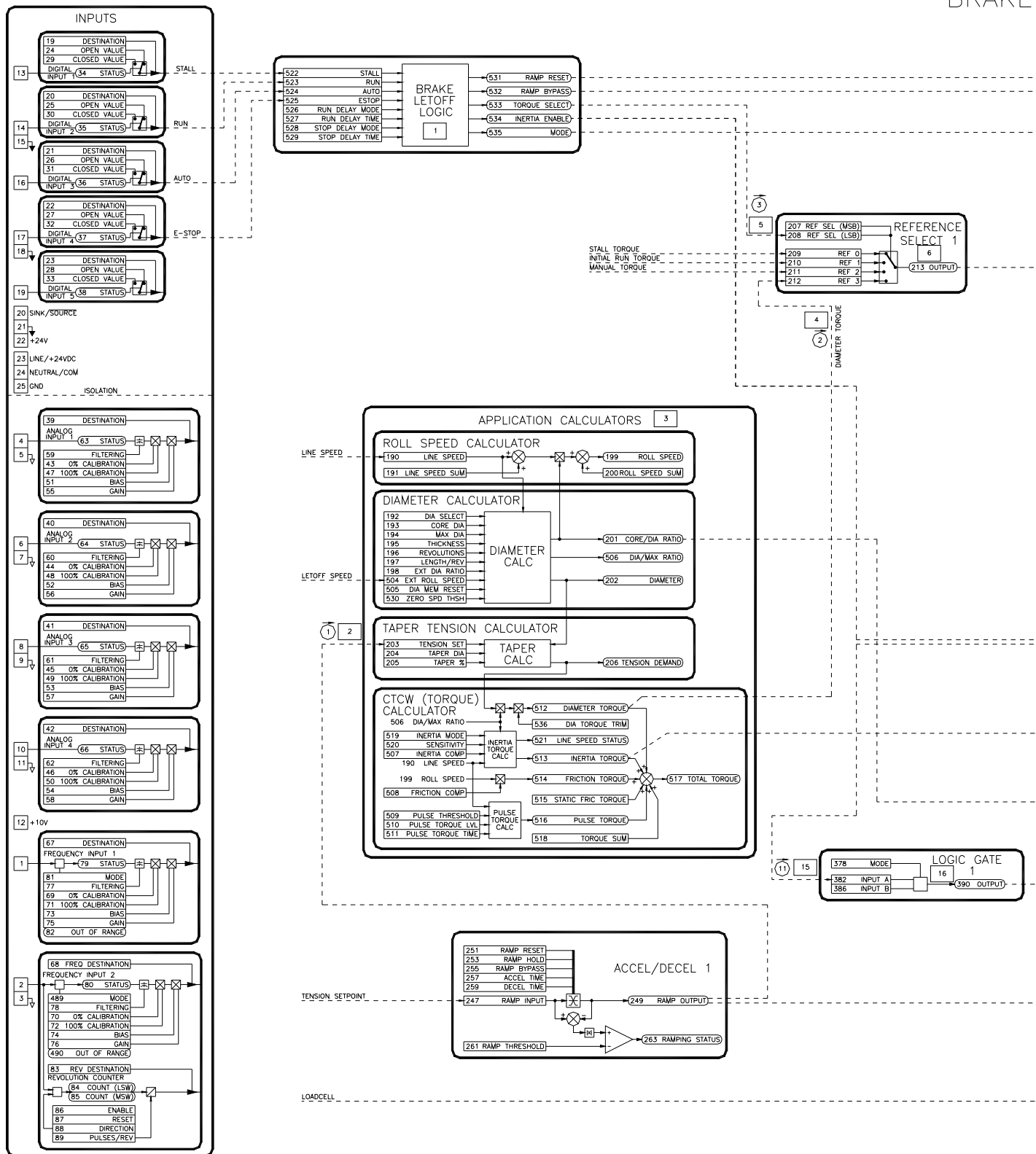
TITLE: **GENERIC CORTEX LT SOFTWARE BLOCK DIAGRAM**

SCALE: _____

DRAWING NUMBER: **D12627** REV. **K** SH. **1** OF **7**

CORTEX LT SOFTWARE

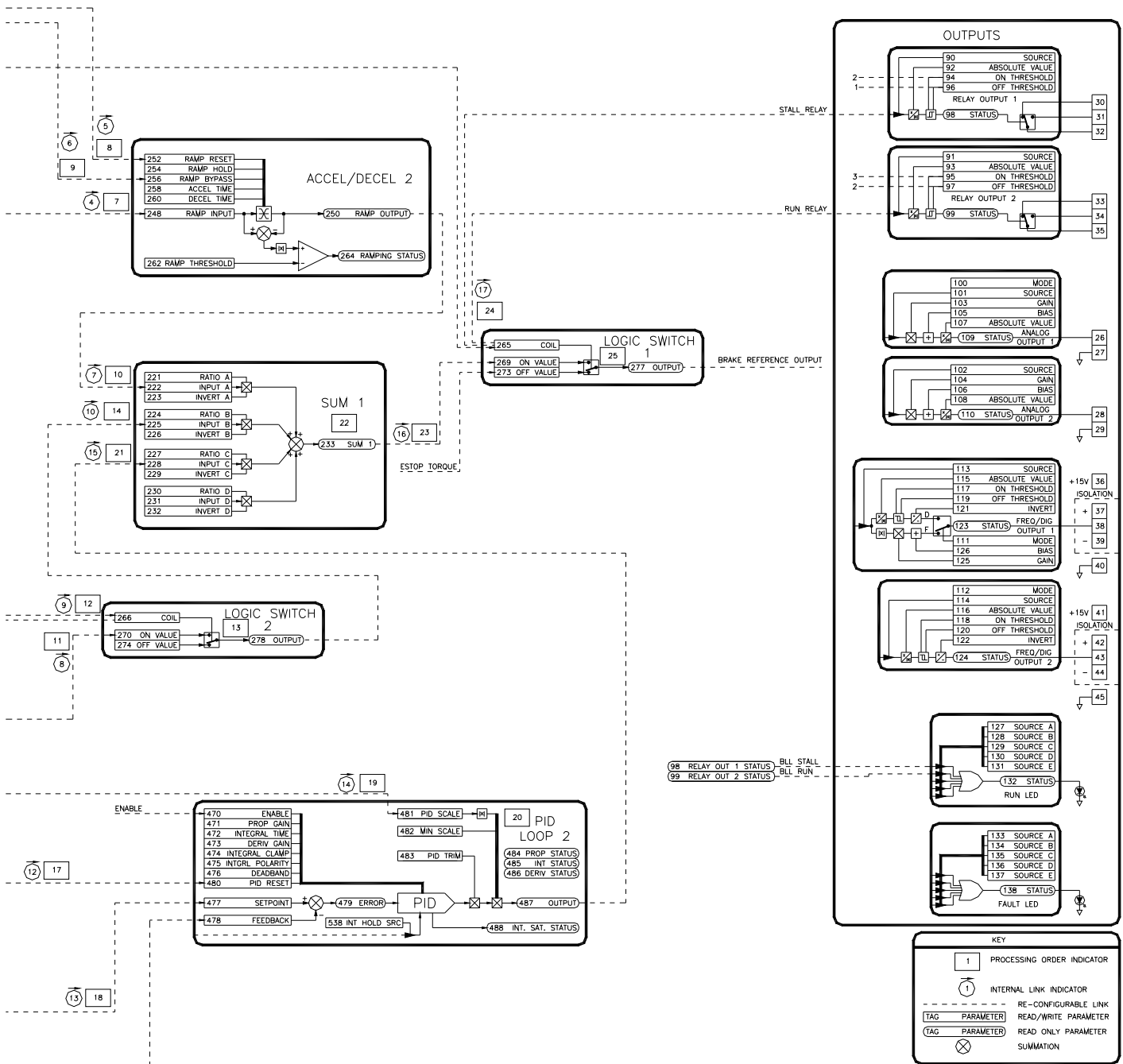
BRAKE



BLOCK DIAGRAM

LETOFF

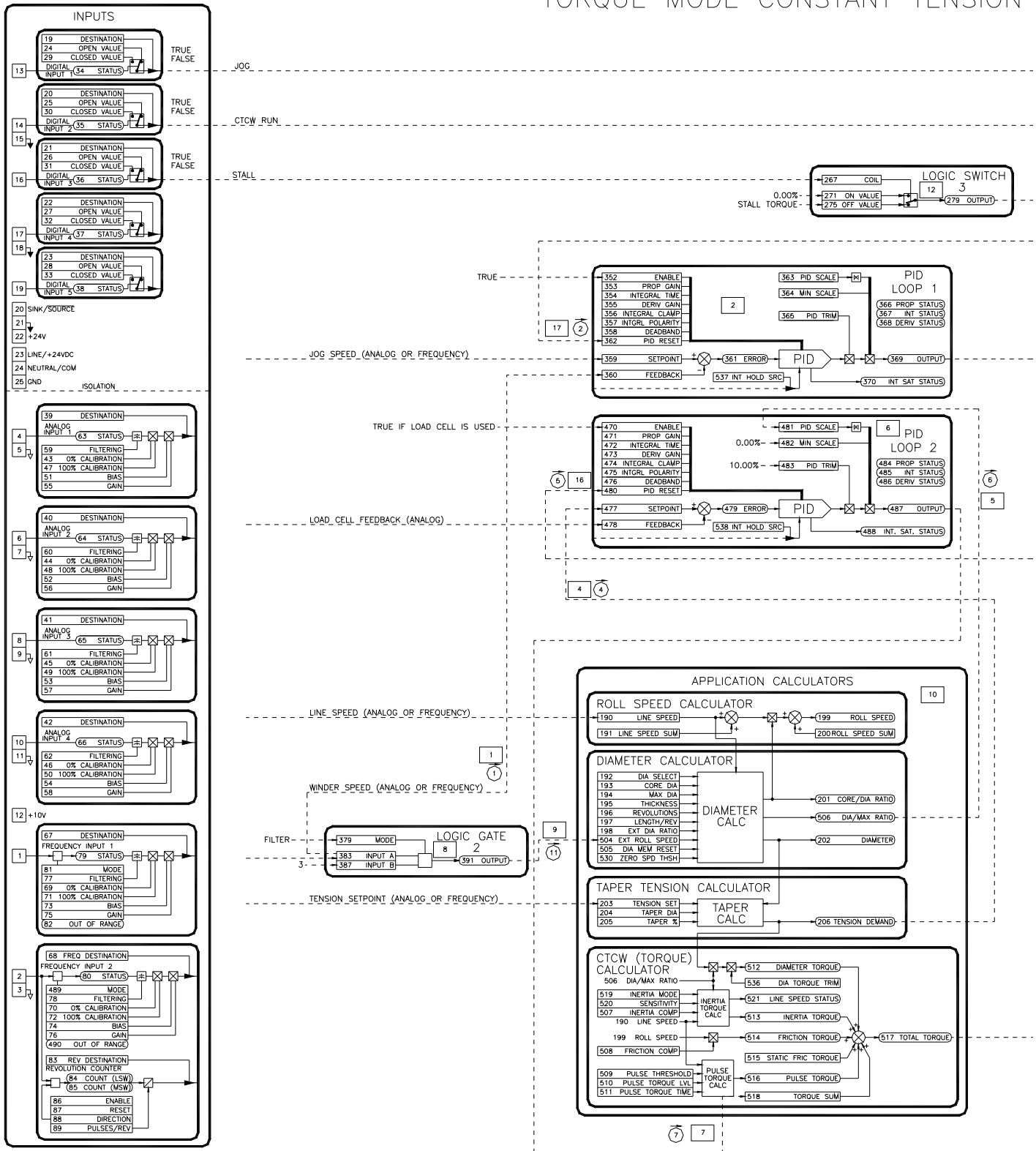
REV. K, 1/12/09, REVISED FRICTION TORQUE (APP. CALC)
 REV. J, 1/31/07, REVISED SLIPPING CORE EXAMPLE
 REV. I, 2/29/06, ADDED OTHER EXAMPLE
 REV. H, 6/19/03, COM PORT B
 REV. G, 2/23/03, ADDED LAYERS FOR TURRET WINDER AND BLO
 REV. F, 1/16/03, ADDED LAYERS FOR CTOW
 REV. E, 11/11/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.2
 REV. D, 10/1/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. C, 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.2
 REV. B, 5/24/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.0



| | | |
|---|--|---|
| DRAWN BY: BKP | DATE: 2/5/02 | <p>Driven by Excellence</p> |
| APPROVED BY: | DATE: | |
| TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005" | | HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063 |
| SCALE: | TITLE: GENERIC CORTEX LT SOFTWARE BLOCK DIAGRAM | |
| DRAWING NUMBER: D12627 | REV. K | SH. 2 OF 7 |

CORTEX LT SOFTWARE

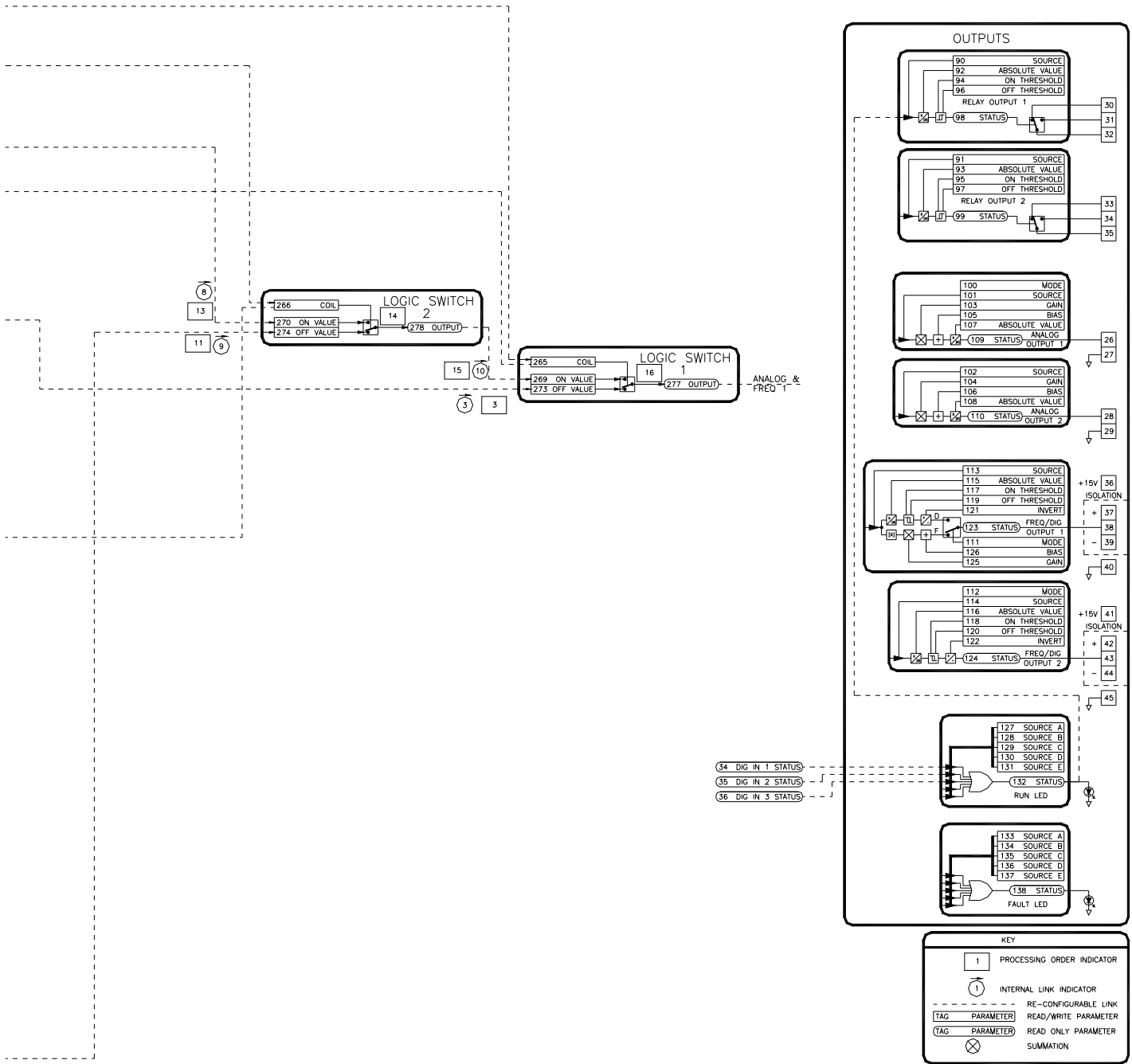
TORQUE MODE CONSTANT TENSION



BLOCK DIAGRAM

CENTER WIND (CTCW)

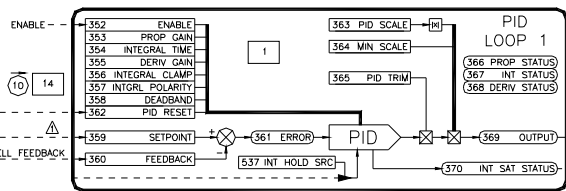
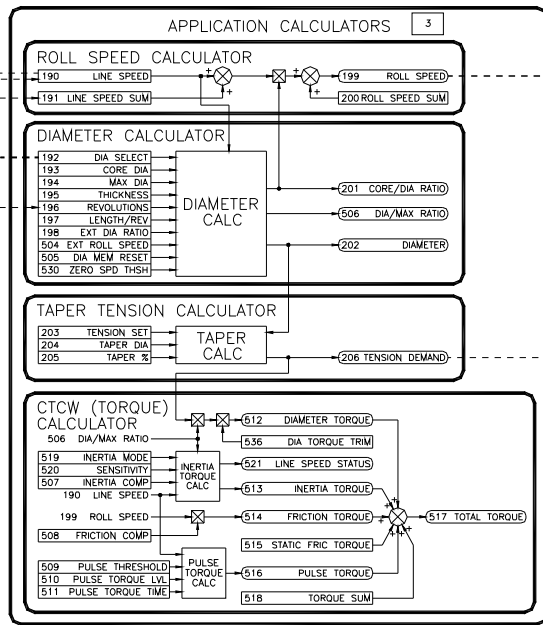
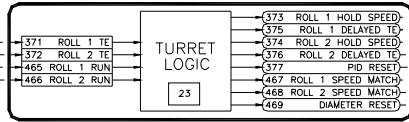
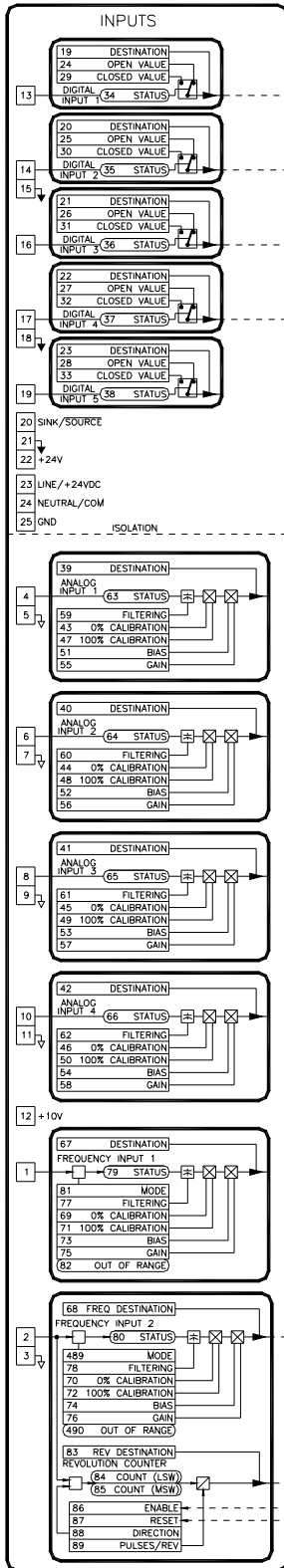
REV. K, 1/12/09, REVISED FRICTION TORQUE (APP. CALC)
 REV. J, 1/31/07, REVISED SLIPPING CORE EXAMPLE
 REV. I, 2/25/05, ADDED OTHER EXAMPLES
 REV. H, 6/19/03, COM PORT B
 REV. G, 2/3/03, ADDED LAYERS FOR TURRET WINDER AND BLO
 REV. F, 1/16/03, ADDED LAYERS FOR CTCW
 REV. E, 11/11/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.2
 REV. D, 10/1/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. C, 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.2
 REV. B, 5/24/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.0



| | | |
|--|---|---|
| DRAWN BY: BKP APPROVED BY: DATE: 2/5/02 | DATE: DATE: TOLERANCES: 2 DEC. PL. = .010 3 DEC. PL. = .005 | <p>Driven by Excellence</p> HEATH SPRINGS, SC TEL 803-286-9614 FAX 803-286-6063 |
| SCALE: | | TITLE: GENERIC CORTEX LT SOFTWARE BLOCK DIAGRAM |
| DRAWING NUMBER: D12627 | | REV. K SH. 3 OF 7 |

CORTEX LT SOFTWARE

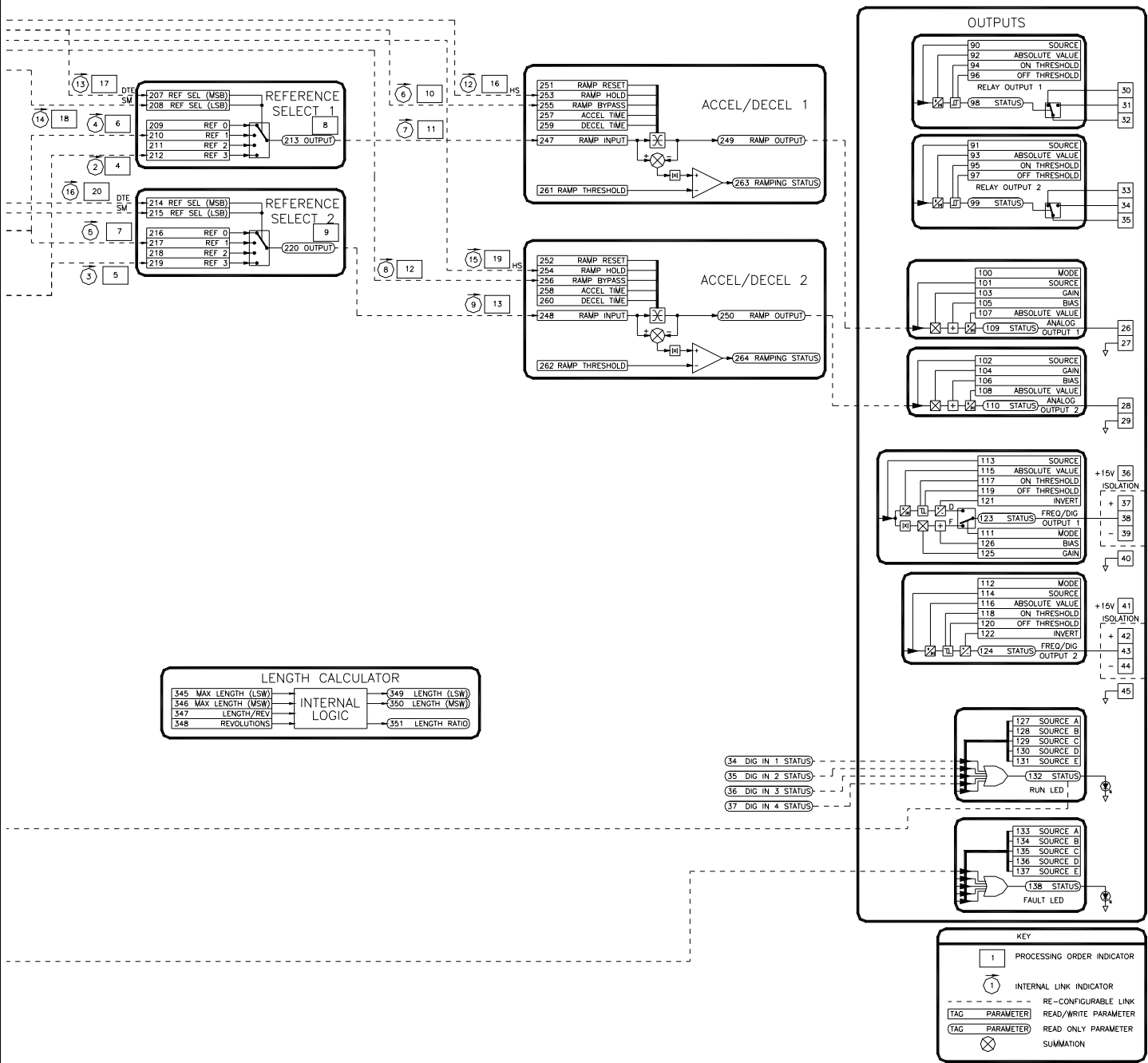
VELOCITY MODE



BLOCK DIAGRAM

TURRET WINDER

REV. K, 1/12/09, REVISED FRICTION TORQUE (APP. CALC)
 REV. J, 1/31/07, REVISED SLIPPING CORE EXAMPLE
 REV. I, 2/25/06, ADDED OTHER EXAMPLES
 REV. H, 6/19/03, COM PORT B
 REV. G, 2/15/03, ADDED LAYERS FOR TURRET WINDER AND BLO
 REV. F, 11/11/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.2
 REV. E, 10/11/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. D, 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.2
 REV. C, 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.0
 REV. B, 5/24/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.0

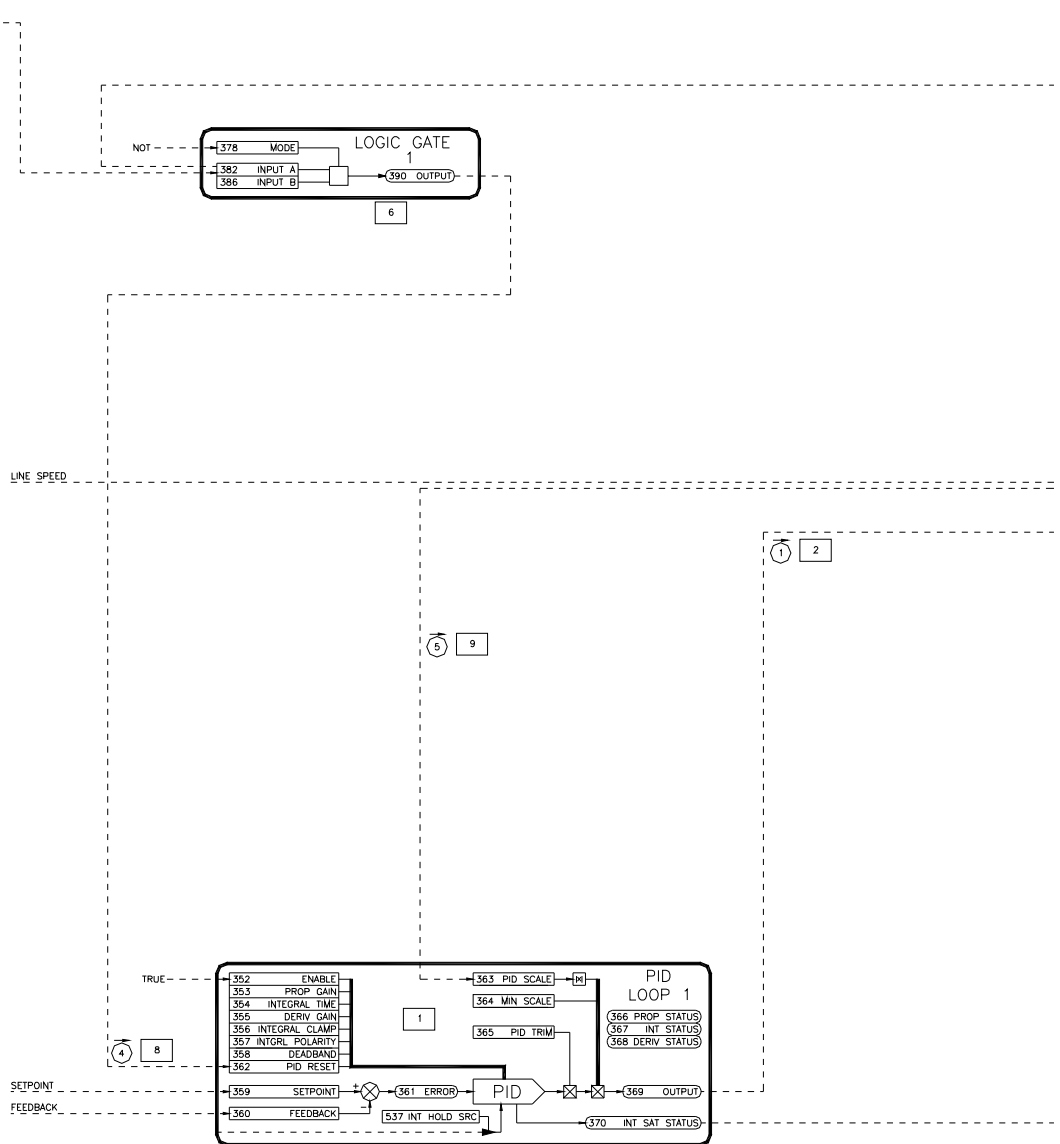
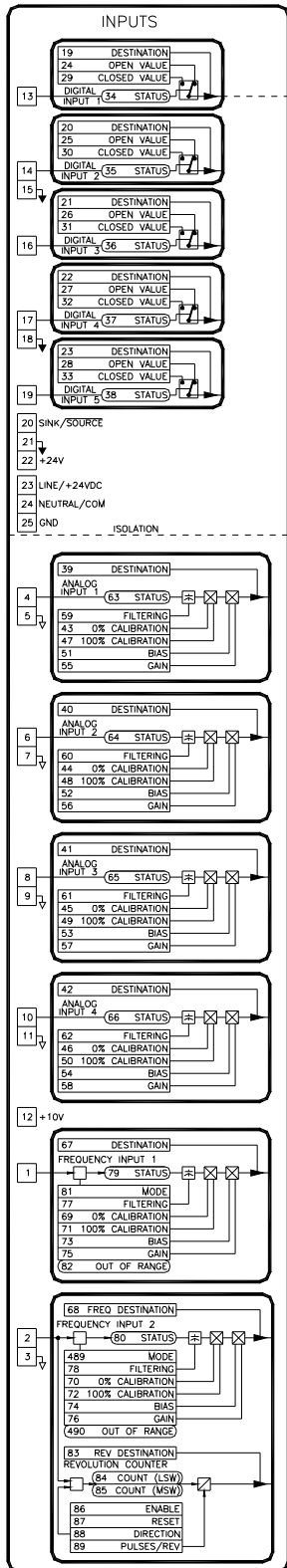


NOTES:
 ▲ LOADCELL CONNECTIONS ARE SHOWN, WHEN USING A DANCER, INTERNAL LINK 19 FROM (206) TENSION DEMAND TO (359) PID1 SETPOINT IS NOT USED, (359) PID1 SETPOINT WILL BE THE DANCER SETPOINT AND (360) PID1 FEEDBACK WILL BE DANCER FEEDBACK.

| | | |
|--|--|---|
| DRAWN BY: BKP | DATE: 2/5/02 | CAROTRON <i>Driven by Excellence</i> |
| APPROVED BY: | DATE: | |
| TOLERANCES: 1 2 DEC. PL. = .01" 3 DEC. PL. = .005" | TITLE: GENERIC CORTEX LT SOFTWARE BLOCK DIAGRAM | HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-8063 |
| SCALE: | DRAWING NUMBER: D12627 | REV. K SH. 4 OF 7 |

CORTEX LT SOFTWARE

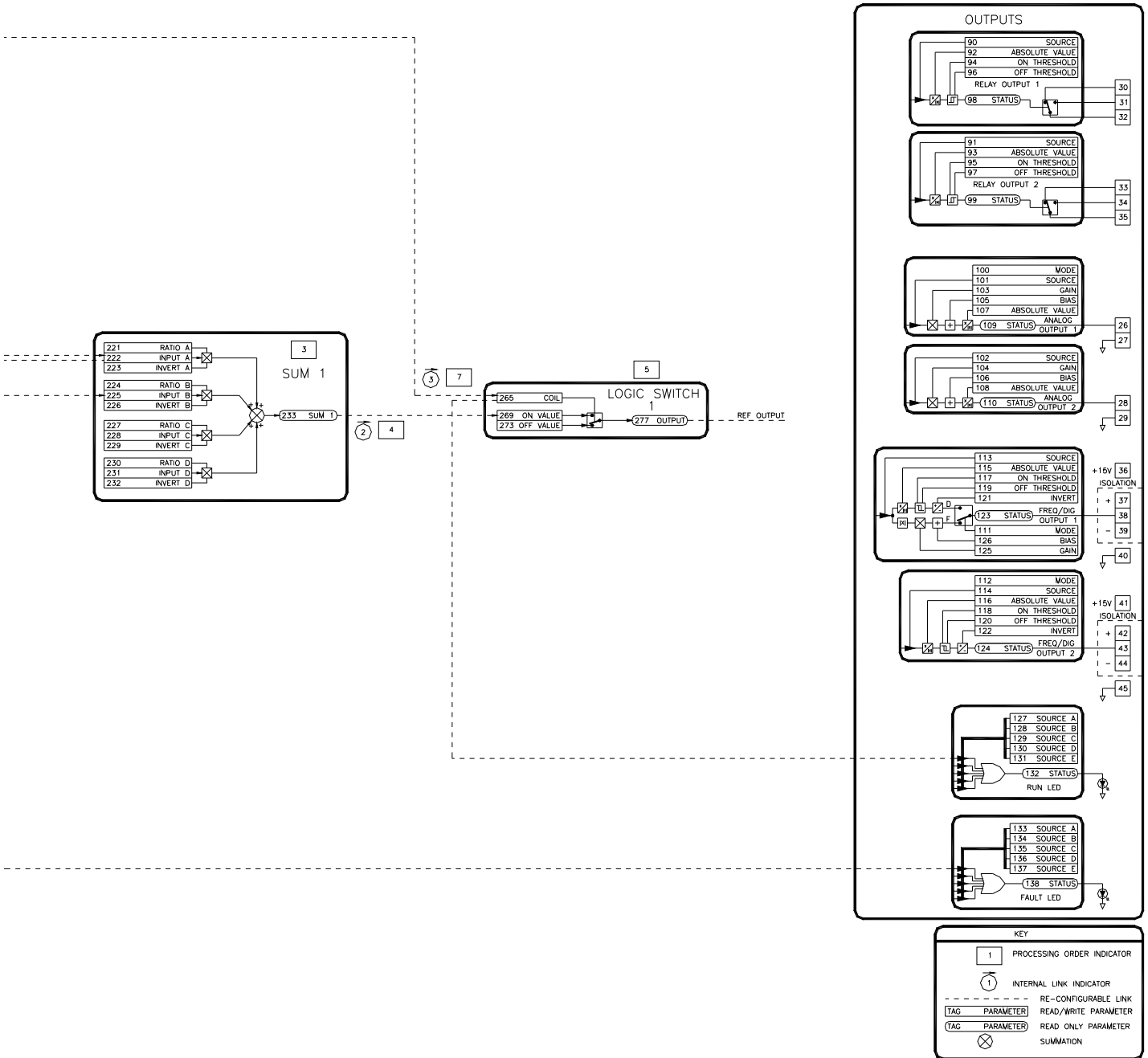
VELOCITY MODE



BLOCK DIAGRAM

WITH PID TRIM

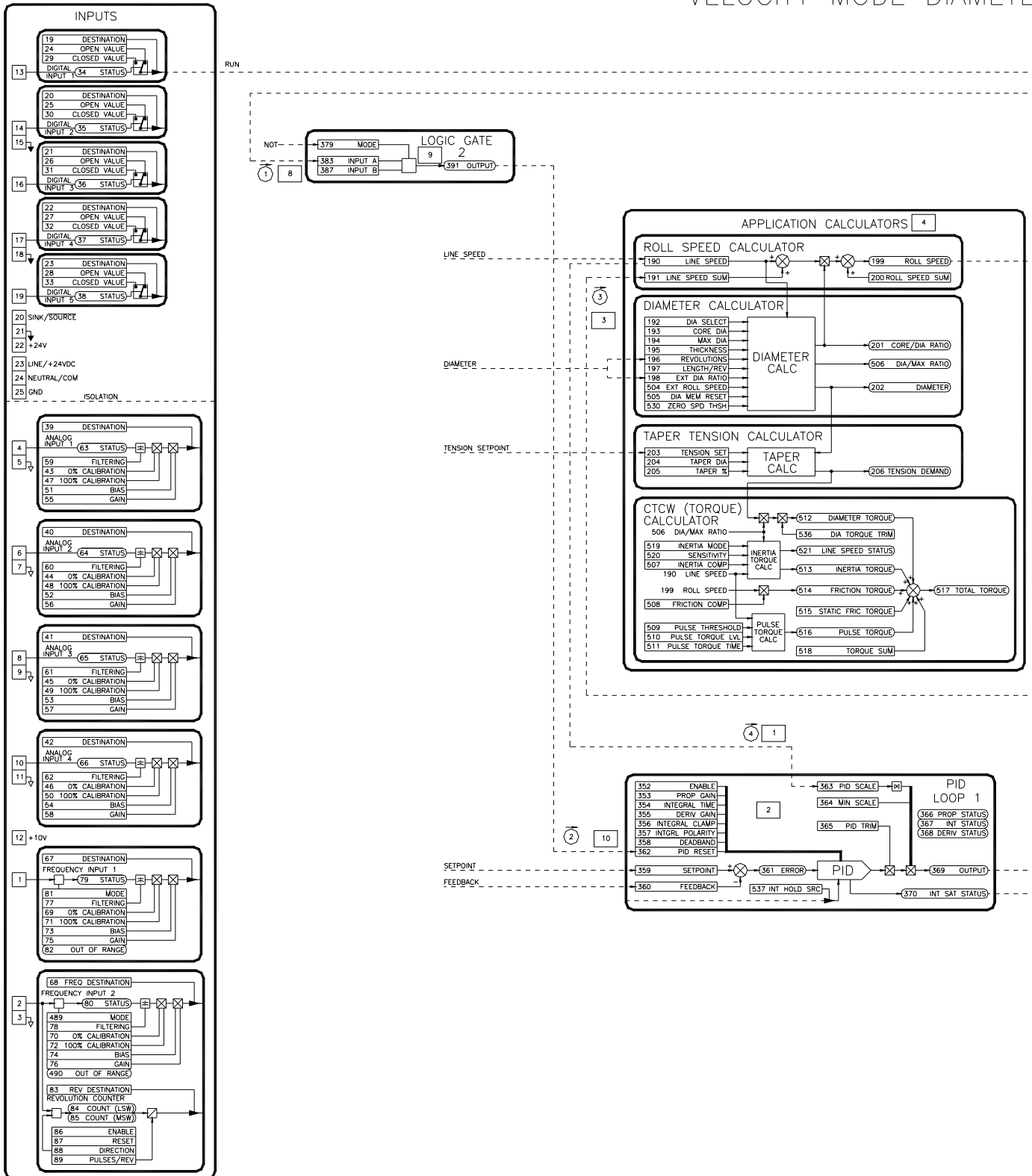
REV. K, 1/12/09, REVISED FRICTION TORQUE (APP. CALC)
 REV. J, 1/31/07, REVISED SLIPPING CORE EXAMPLE
 REV. I, 2/25/05, ADDED OTHER EXAMPLES
 REV. H, 6/19/03, COM. PORT B
 REV. G, 2/3/03, ADDED LAYERS FOR TURRET WINDER AND BLO
 REV. F, 1/16/03, ADDED LAYERS FOR CTW
 REV. E, 11/11/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.2
 REV. D, 10/1/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. C, 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.2
 REV. B, 5/24/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.0



| | | |
|---|------------------------|---|
| DRAWN BY: BKP | DATE: 2/5/02 | <p>Driven by Excellence</p> HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063 |
| APPROVED BY: | DATE: | |
| TOLERANCES: + 2 DEC. PL. + .010" 3 DEC. PL. + .005" | | TITLE: GENERIC CORTEX LT SOFTWARE BLOCK DIAGRAM |
| DRAWING NUMBER: D12627 | | REV. K SH. 5 OF 7 |

CORTEX LT SOFTWARE

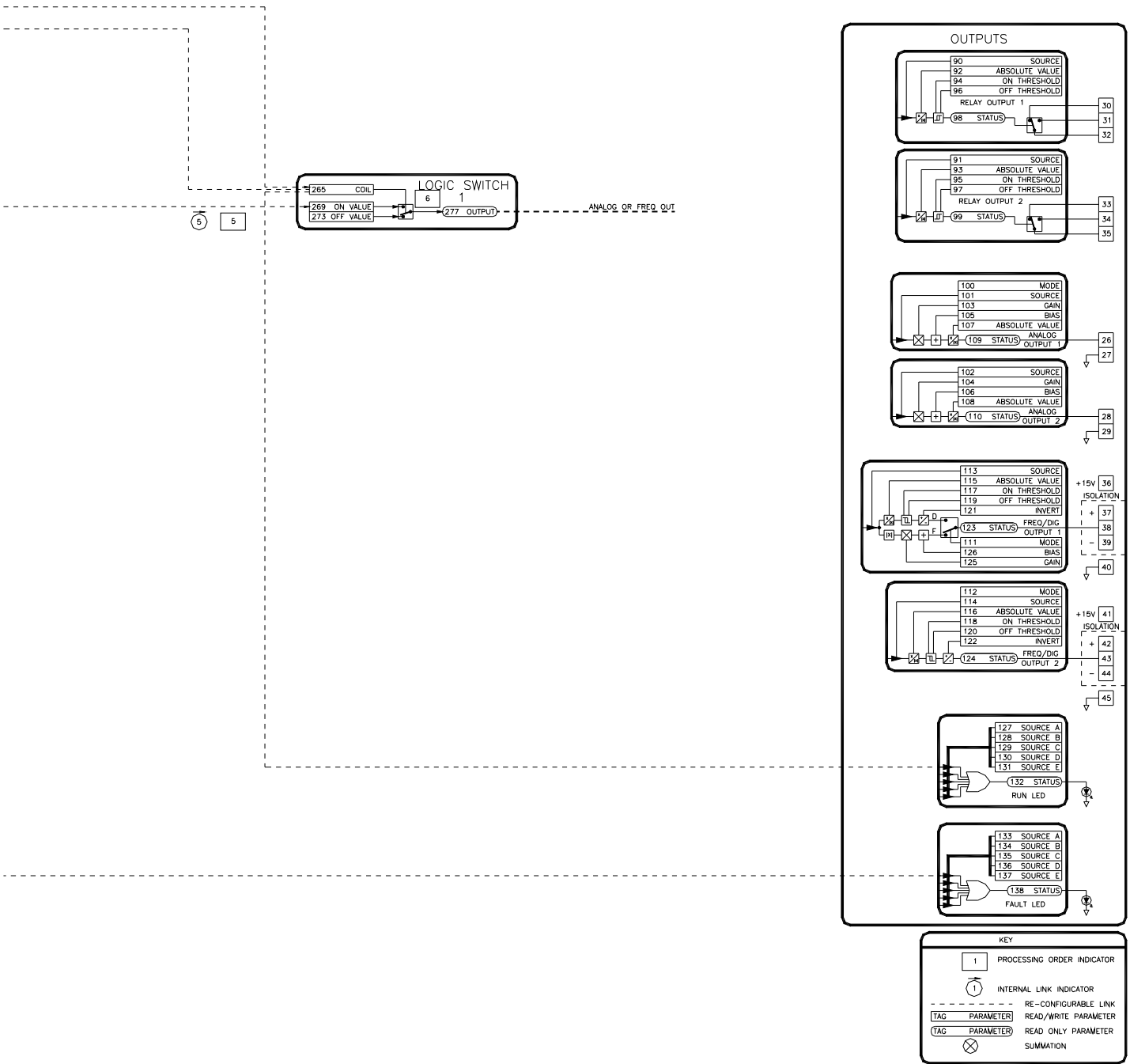
VELOCITY MODE DIAMETER



BLOCK DIAGRAM

COMPENSATION WITH PID TRIM

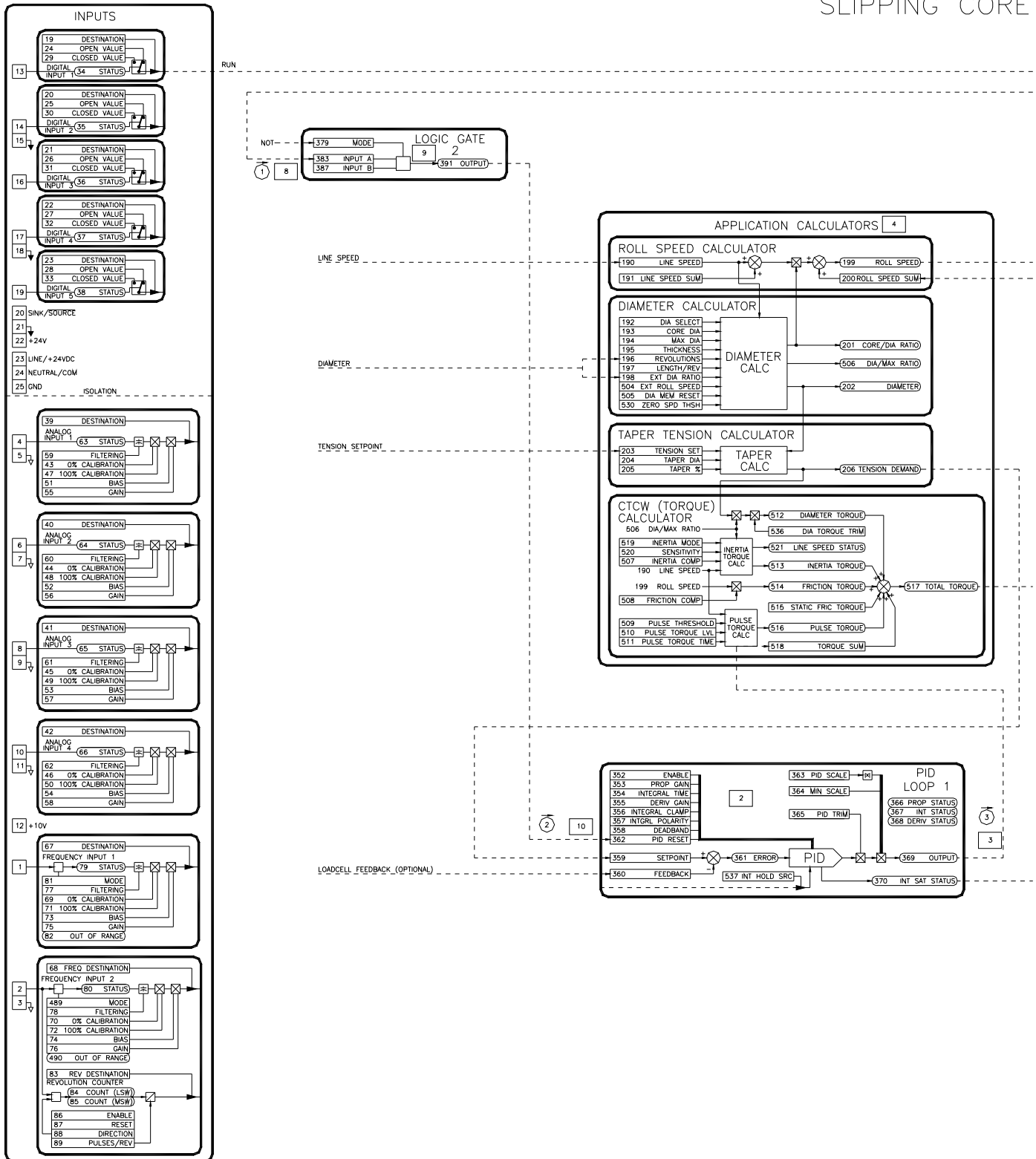
REV. K: 1/12/09, REVISED FRICTION TORQUE (APP CALC)
 REV. J: 1/31/07, REVISED SLIPPING CORE EXAMPLE
 REV. I: 2/25/06, ADDED OTHER EXAMPLES
 REV. H: 8/19/03, COM PORT B
 REV. G: 7/16/03, ADDED LAYERS FOR TURRET WINDER AND BLO
 REV. F: 7/16/03, ADDED LAYERS FOR CTW
 REV. E: 11/11/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. D: 10/1/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. C: 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.2
 REV. B: 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.0



| | | |
|---|--|---|
| DRAWN BY: BKP | DATE: 2/5/02 | <p>Driven by Excellence</p> HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063 |
| APPROVED BY: | DATE: | |
| TOLERANCES: 2 DEC. PL. + .010" 3 DEC. PL. + .005" | TITLE: GENERIC CORTEX LT SOFTWARE BLOCK DIAGRAM | |
| SCALE: | DRAWING NUMBER: D12627 | REV. K SH. 6 OF 7 |

CORTEX LT SOFTWARE

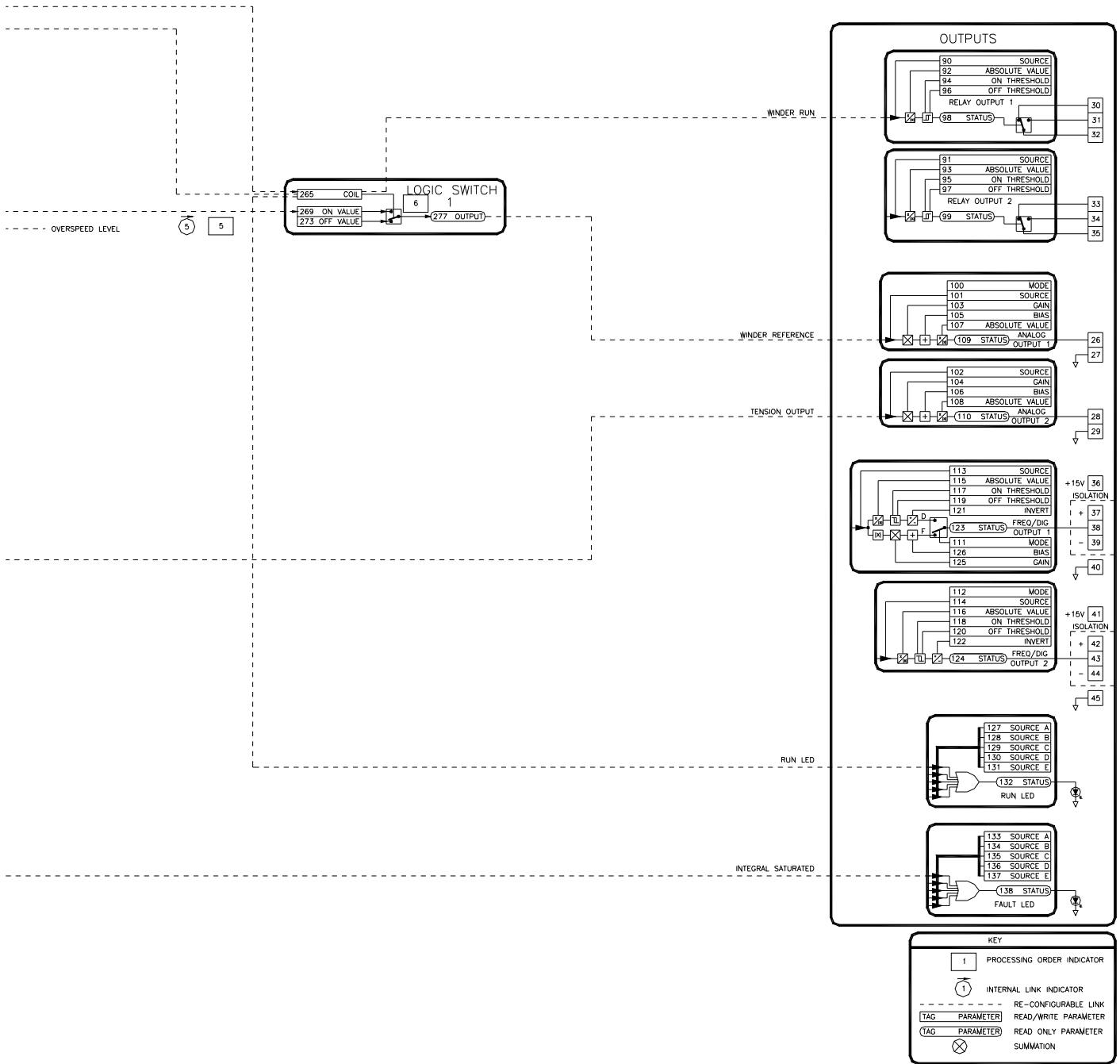
SLIPPING CORE



BLOCK DIAGRAM

WINDER

REV. K, 1/12/09, REVISED FRICTION TORQUE (APP CALC)
 REV. J, 1/31/07, REVISED SLIPPING CORE EXAMPLE
 REV. I, 2/25/05, ADDED OTHER EXAMPLES
 REV. H, 6/19/03, COM PORT B
 REV. G, 2/3/03, ADDED LAYERS FOR TURRET WINDER AND BLO
 REV. F, 1/16/03, ADDED LAYERS FOR CTW
 REV. E, 1/11/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.2
 REV. D, 10/1/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.2.0
 REV. C, 8/22/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.2
 REV. B, 6/24/02, ADDED NEW PARAMETERS FOR FIRMWARE V1.1.0



| | |
|--|---|
| DRAWN BY: BKP DATE: 2/5/02 APPROVED BY: _____ DATE: _____ | <p>Driven by Excellence</p> HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6065 |
| TOLERANCES: 2 DEC. PL. + .010 3 DEC. PL. + .005 | TITLE: GENERIC CORTEX LT SOFTWARE BLOCK DIAGRAM |
| SCALE: _____ | DRAWING NUMBER: D12627 |
| REV. K | SH. 7 OF 7 |

8.1 Modbus® Protocol

The Cortex LT supports a subset of the Modbus® RTU communications protocol. This section describes the Cortex LT's implementation of the protocol. For a complete detailed specification of the entire Modbus® protocol, please refer to <http://www.modbus.org>.

In the Cortex LT, functions 1,2,3,4,5,6,8,15, & 16 are supported. The message format or frame varies depending upon which function code is used. Each frame is started by the slave address and ends with a CRC-16 error checking code. If the slave addresses do not match or the CRC-16 code is invalid, the slave ignores the message and no response is returned. The Cortex LT acts as a slave (server) to a single master (client). Bus contentions are avoided since the Modbus master initiates all communications. Slave devices only place data on the bus in response to a master's request. Each slave device on the bus must have a unique network address.

Frames consist of 8 bit data bytes. Parity can set for None, Odd, or Even. Frames are separated on the bus by a silent period in which no data transmissions occur. This silent period thus signals devices on the bus when a frame has ended and can now begin to examine the frame data. Bytes within a frame must therefore be sent in a continuous stream to avoid silent periods.

The Modbus® protocol uses two general types of data: bits and registers. Registers are composed of 16 bits. Some slave devices further divide each of these data types depending upon its method of access (read-write or read-only). The Cortex LT makes no distinction between read-write and read-only with respect to the command. For example, any register can be read by using Function Code 3 or 4, and any bit can be read using Function Codes 1 or 2. Attempts to write a value to a read-only parameter are ignored.

Since all of the Cortex LT's parameters are implemented internally as 16 bit registers, each parameter can be accessed by using a bit or a register command. Thus, a register can be read or written to by a bit command. In these cases, any non-zero value is interpreted as True (1) and zero is interpreted as False (0).

In the following, hexadecimal number are represented with an 'h' suffix and binary numbers with a 'b' suffix. Decimal data is shown with no suffix.

| Code | Function | Data Type | Access | Data Type Code |
|----------|--------------------------|-----------------|--------------|----------------|
| 1 (01h) | Read Bits | bit | (read-write) | 0x |
| 2 (02h) | Read Bits | bit | (read-only) | 1x |
| 3 (03h) | Read Multiple Registers | 16 bit register | (read-write) | 4x |
| 4 (04h) | Read Multiple Registers | 16 bit register | (read-only) | 3x |
| 5 (05h) | Write Single Bit | bit | (read-write) | 0x |
| 6 (06h) | Write Single Register | 16 bit register | (read-write) | 4x |
| 8 (08h) | Diagnostics (Loopback) | - | - | - |
| 15 (0Fh) | Write Multiple Bits | bit | (read-write) | 0x |
| 16 (10h) | Write Multiple Registers | 16 bit register | (read-write) | 4x |

Table 12: Supported Modbus® Functions

8.2 Modbus® Functions

Function Code 1 (01h) Read Bits

In this example, Function Code 1 is used to read the status of the 5 digital inputs (i.e. parameters 34-38). Digital Inputs 1, 2, & 4 are on.

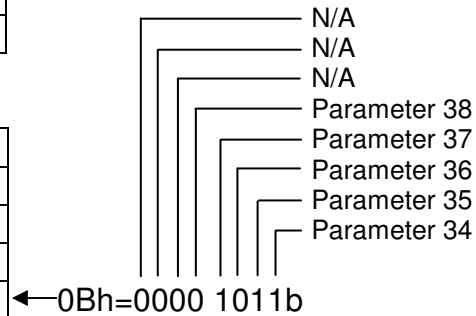
Master Command

| Description | | Data |
|------------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 01h |
| Starting Address | Upper | 00h |
| | Lower | 21h |
| Quantity | Upper | 00h |
| | Lower | 05h |
| CRC-16 | Lower | ACh |
| | Upper | 03h |

} 34-1=0021h*

Normal Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 01h |
| Byte Count | | 01h |
| Data | | 0Bh |
| CRC-16 | Lower | 10h |
| | Upper | 4Fh |



Error Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 81h |
| Error Code | | 02h |
| CRC-16 | Lower | C1h |
| | Upper | 91h |

*This assumes the Cortex LT Addressing Mode (parameter 189) is set to 1 (default). If Addressing Mode is set to 0, then the Address does not need to be decremented by one. In this mode a value of 0022h would be used.

Function Code 2 (02h) Read Bits

In this example, Function Code 2 is used to read the status of the 5 digital inputs (i.e. parameters 34-38). Digital Inputs 2, 3, & 5 are on.

Master Command

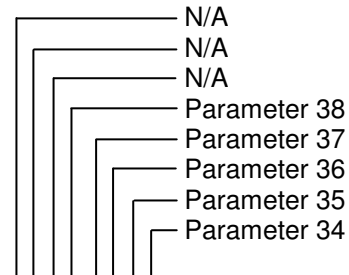
| Description | | Data |
|------------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 02h |
| Starting Address | Upper | 00h |
| | Lower | 21h |
| Quantity | Upper | 00h |
| | Lower | 05h |
| CRC-16 | Lower | E8h |
| | Upper | 03h |

} 34-1=0021h*

Normal Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 02h |
| Byte Count | | 01h |
| Data | | 16h |
| CRC-16 | Lower | 20h |
| | Upper | 46h |

← 16h=0001 0110b



Error Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 82h |
| Error Code | | 03h |
| CRC-16 | Lower | 00h |
| | Upper | A1h |

*This assumes the Cortex LT Addressing Mode (parameter 189) is set to 1 (default). If Addressing Mode is set to 0, then the Address does not need to be decremented by one. In this mode a value of 0022h would be used.

Function Code 3 (03h) Read Multiple Registers

In this example, Function Code 3 is used to read the status of the Analog Inputs 1 & 2 (i.e. parameters 63-64).

Master Command

| Description | | Data |
|------------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 03h |
| Starting Address | Upper | 00h |
| | Lower | 3Eh |
| Quantity | Upper | 00h |
| | Lower | 02h |
| CRC-16 | Lower | A5h |
| | Upper | C7h |

} 63-1=003Eh*

Normal Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 03h |
| Byte Count | | 04h |
| Register Data | Upper | 04h |
| | Lower | 14h |
| Register Data | Upper | 08h |
| | Lower | A1h |
| CRC-16 | Lower | 7Dh |
| | Upper | 7Fh |

} 0414h=1044
} 08A1h=2209

Error Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 83h |
| Error Code | | 02h |
| CRC-16 | Lower | C0h |
| | Upper | F1h |

*This assumes the Cortex LT Addressing Mode (parameter 189) is set to 1 (default). If Addressing Mode is set to 0, then the Address does not need to be decremented by one. In this mode a value of 003Fh would be used.

Function Code 4 (04h) Read Multiple Registers

In this example, Function Code 4 is used to read the value of Line Speed (i.e. parameter 190). When read, the value of Line Speed was 56.47%.

Master Command

| Description | | Data |
|------------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 04h |
| Starting Address | Upper | 00h |
| | Lower | BDh |
| Quantity | Upper | 00h |
| | Lower | 01h |
| CRC-16 | Lower | A1h |
| | Upper | Eh |

} 190-1=00BDh*

Normal Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 04h |
| Byte Count | | 02h |
| Register Data | Upper | 16h |
| | Lower | 0Fh |
| CRC-16 | Lower | F7h |
| | Upper | 54h |

} 160Fh=5647

Error Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 84h |
| Error Code | | 03h |
| CRC-16 | Lower | 03h |
| | Upper | 01h |

*This assumes the Cortex LT Addressing Mode (parameter 189) is set to 1 (default). If Addressing Mode is set to 0, then the Address does not need to be decremented by one. In this mode a value of 00BFh would be used.

Function Code 5 (05h) Write Single Bit

In this example, Function Code 5 is used to write a value of 1 to PID Loop 1 Enable (i.e. parameter 352).

Master Command

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 05h |
| Address | Upper | 01h |
| | Lower | 5Fh |
| Data | Upper | FFh |
| | Lower | 00h |
| CRC-16 | Lower | BDh |
| | Upper | D4h |

} 352-1=015Fh*

} FF00h is used to turn bit on. 0000h would be used to turn bit off.

Normal Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 05h |
| Address | Upper | 01h |
| | Lower | 5Fh |
| Register Data | Upper | FFh |
| | Lower | 00h |
| CRC-16 | Lower | BDh |
| | Upper | D4h |

Error Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 85h |
| Error Code | | 02h |
| CRC-16 | Lower | C3h |
| | Upper | 51h |

*This assumes the Cortex LT Addressing Mode (parameter 189) is set to 1 (default). If Addressing Mode is set to 0, then the Address does not need to be decremented by one. In this mode a value of 0160h would be used.

Function Code 6 (06h) Write Single Register

In this example, Function Code 6 is used to write a value of 34.56% to Tension Setpoint (i.e. parameter 203).

Master Command

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 06h |
| Address | Upper | 00h |
| | Lower | CAh |
| Data | Upper | 0Dh |
| | Lower | 80h |
| CRC-16 | Lower | ACh |
| | Upper | C4h |

} 203-1=00CAh*

} 3456=0D80h

Normal Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 06h |
| Address | Upper | 00h |
| | Lower | CAh |
| Register Data | Upper | 0Dh |
| | Lower | 80h |
| CRC-16 | Lower | ACh |
| | Upper | C4h |

Error Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 86h |
| Error Code | | 02h |
| CRC-16 | Lower | C3h |
| | Upper | A1h |

*This assumes the Cortex LT Addressing Mode (parameter 189) is set to 1 (default). If Addressing Mode is set to 0, then the Address does not need to be decremented by one. In this mode a value of 00CBh would be used.

Function Code 8 (08h) Diagnostics, Echo Data

In this example, Function Code 8 (Diagnostics) with Sub Code 0 (Echo Data) is used to test communications with a slave device. The slave should echo back the received data.

Master Command

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 08h |
| Sub Code | Upper | 00h |
| | Lower | 00h |
| Data | Upper | AAh |
| | Lower | 55h |
| CRC-16 | Lower | 5Dh |
| | Upper | 94h |

Normal Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 08h |
| Sub Code | Upper | 00h |
| | Lower | 00h |
| Data | Upper | AAh |
| | Lower | 55h |
| CRC-16 | Lower | 5Eh |
| | Upper | 94h |

Error Slave Response

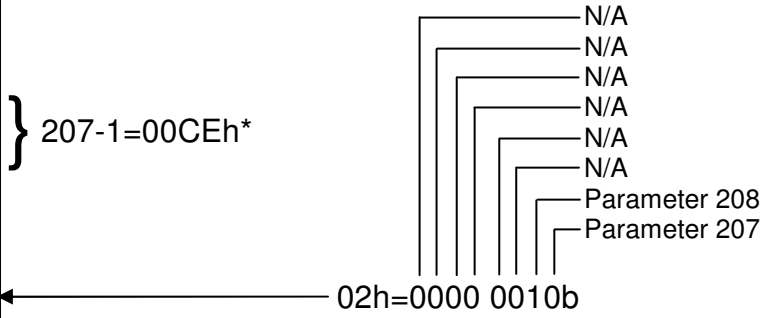
| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 88h |
| Error Code | | 01h |
| CRC-16 | Lower | 87h |
| | Upper | C0h |

Function Code 15 (0Fh) Write Multiple Bits

In this example, Function Code 15 is used to write a value of 1 to Ref Select 1 MSB and a value of 0 to Ref Select 1 LSB (i.e. parameters 207 & 208).

Master Command

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 0Fh |
| Start Address | Upper | 00h |
| | Lower | CEh |
| Num Bits | Upper | 00h |
| | Lower | 02h |
| Byte Count | | 01h |
| Data | | 02h |
| CRC-16 | Lower | 36h |
| | Upper | 86h |



Normal Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 0Fh |
| Start Address | Upper | 00h |
| | Lower | CEh |
| Num Bits | Upper | 00h |
| | Lower | 02h |
| CRC-16 | Lower | B5h |
| | Upper | F5h |

Error Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 8Fh |
| Error Code | | 02h |
| CRC-16 | Lower | C5h |
| | Upper | F1h |

*This assumes the Cortex LT Addressing Mode (parameter 189) is set to 1 (default). If Addressing Mode is set to 0, then the Address does not need to be decremented by one. In this mode a value of 00CFh would be used.

Function Code 16 (10h) Write Multiple Registers

In this example, Function Code 16 is used to write the values 10.5s and 20.6s to the Decel Times (i.e. parameters 259 & 260) of Accel/Decel Block 1 and 2.

Master Command

| Description | | Data | |
|----------------|-------|------|----------------|
| Slave Address | | 01h | |
| Function Code | | 10h | |
| Start Address | Upper | 01h | } 259-1=0102h* |
| | Lower | 02h | |
| Register Count | Upper | 00h | } |
| | Lower | 02h | |
| Byte Count | | 04h | |
| Register Data | Upper | 00h | } 105=0069h |
| | Lower | 69h | |
| Register Data | Upper | 00h | } 206=00CEh |
| | Lower | CEh | |
| CRC-16 | Lower | 2Eh | |
| | Upper | 6Eh | |

Normal Slave Response

| Description | | Data |
|----------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 10h |
| Start Address | Upper | 01h |
| | Lower | 02h |
| Register Count | Upper | 00h |
| | Lower | 02h |
| CRC-16 | Lower | E1h |
| | Upper | F4h |

Error Slave Response

| Description | | Data |
|---------------|-------|------|
| Slave Address | | 01h |
| Function Code | | 90h |
| Error Code | | 02h |
| CRC-16 | Lower | CDh |
| | Upper | C1h |

*This assumes the Cortex LT Addressing Mode (parameter 189) is set to 1 (default). If Addressing Mode is set to 0, then the Address does not need to be decremented by one. In this mode a value of 0103h would be used.

8.2 CRC-16 Calculations

CRC stands for Cyclical Redundancy Check and is a 16 bit value appended to all Modbus® frames. When a device (either master or slave) places data on the bus, the CRC value is appended to the message. The receiving device also calculates a CRC value as it receives the message. The receiver compares its calculated value to the one received. A transmission error has occurred if the values do not match.

Please note that when the CRC value is appended to a message, the low byte is appended first followed by the upper byte. This is different from all other Modbus® data fields where the upper byte is sent first followed by the lower byte.

Below is some example C code to generate a CRC-16 value. The method used below provides for fast generation of the CRC value by using lookup tables that contain precalculated CRC values. Please refer to the Modbus® specification (available at <http://www.modbus.org>) for more details.

```
// The function returns the CRC value. Note that this function internally swaps the high and low CRC bytes.
// Thus, the resulting value can be appended directly to the Modbus message. Msg is a pointer to the
// message that CRC is to be calculated from. DataLen is the quantity of bytes in the message
unsigned int CRC16 (unsigned char *Msg, unsigned char DataLen)
{
    unsigned char CRCHi = 0xFF;           // Initialize high byte of CRC
    unsigned char CRCLo = 0xFF;          // Initialize low byte of CRC
    unsigned char Index;                  // index into CRC lookup table
    while (DataLen--)                     // pass through message buffer
    {
        Index = CRCLo ^ *Msg++;           //calculate the CRC
        CRCLo = CRCHi ^ CRCHi[Index] ;
        CRCHi = CRCLo[Index] ;
    }
    return (CRCHi << 8 | CRCLo) ;
}
```

High-Order Byte Table

// Table of CRC values for high-order byte

```
static unsigned char CRCHi[] = {
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
    0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
    0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40
};
```

Low-Order Byte Table

// Table of CRC values for low-order byte

```
static char CRCLo[] = {
    0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7, 0x05, 0xC5, 0xC4, 0x04,
    0xCC, 0x0C, 0x0D, 0xCD, 0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B, 0xC9, 0x09, 0x08, 0xC8,
    0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB, 0xDA, 0x1A, 0x1E, 0xDE, 0xDF, 0x1F, 0xDD, 0x1D, 0x1C, 0xDC,
    0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13, 0xD3, 0x11, 0xD1, 0xD0, 0x10,
    0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32, 0x36, 0xF6, 0xF7, 0x37, 0xF5, 0x35, 0x34, 0xF4,
    0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A, 0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38,
    0x28, 0xE8, 0xE9, 0x29, 0xEB, 0x2B, 0x2A, 0xEA, 0xEE, 0x2E, 0x2F, 0xEF, 0x2D, 0xED, 0xEC, 0x2C,
    0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26, 0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0,
    0xA0, 0x60, 0x61, 0xA1, 0x63, 0xA3, 0xA2, 0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64, 0xA4,
};
```



```
0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F, 0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68,  
0x78, 0xB8, 0xB9, 0x79, 0xBB, 0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C,  
0xB4, 0x74, 0x75, 0xB5, 0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71, 0x70, 0xB0,  
0x50, 0x90, 0x91, 0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94, 0x54,  
0x9C, 0x5C, 0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B, 0x99, 0x59, 0x58, 0x98,  
0x88, 0x48, 0x49, 0x89, 0x4B, 0x8B, 0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D, 0x4C, 0x8C,  
0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83, 0x41, 0x81, 0x80, 0x40  
};
```


9

Standard Terms & Conditions of Sale

1. General

The Standard Terms and Conditions of Sale of Carotron, Inc. (hereinafter called "Company") are set forth as follows in order to give the Company and the Purchaser a clear understanding thereof. No additional or different terms and conditions of sale by the Company shall be binding upon the Company unless they are expressly consented to by the Company in writing. The acceptance by the Company of any order of the Purchaser is expressly conditioned upon the Purchaser's agreement to said Standard Terms and Conditions. The acceptance or acknowledgement, written, oral, by conduct or otherwise, by the Company of the Purchaser's order shall not constitute written consent by the Company to addition to or change in said Standard Terms and Conditions.

2. Prices

Prices, discounts, allowances, services and commissions are subject to change without notice. Prices shown on any Company published price list and other published literature issued by the Company are not offers to sell and are subject to express confirmation by written quotation and acknowledgement. All orders of the Purchaser are subject to acceptance, which shall not be effective unless made in writing by an authorized Company representative at its office in Heath Springs, S.C. The Company may refuse to accept any order for any reason whatsoever without incurring any liability to the Purchaser. The Company reserves the right to correct clerical and stenographic errors at any time.

3. Shipping dates

Quotation of a shipping date by the Company is based on conditions at the date upon which the quotation is made. Any such shipping date is subject to change occasioned by agreements entered into previous to the Company's acceptance of the Purchaser's order, governmental priorities, strikes, riots, fires, the elements, explosion, war, embargoes, epidemics, quarantines, acts of God, labor troubles, delays of vendors or of transportation, inability to obtain raw materials, containers or transportation or manufacturing facilities or any other cause beyond the reasonable control of the Company. In no event shall the Company be liable for consequential damages for failure to meet any shipping date resulting from any of the above causes or any other cause.

In the event of any delay in the Purchaser's accepting shipment of products or parts in accordance with scheduled shipping dates, which delay has been requested by the Purchaser, or any such delay which has been caused by lack of shipping instructions, the Company shall store all products and parts involved at the Purchaser's risk and expense and shall invoice the Purchaser for the full contract price of such products and parts on the date scheduled for shipment or on the date on which the same is ready for delivery, whichever occurs later.

4. Warranty

The Company warrants to the Purchaser that products manufactured or parts repaired by the Company, will be free, under normal use and maintenance, from defects in material and workmanship for a period of one (1) year after the shipment date from the Company's factory to the Purchaser. The Company makes no warranty concerning products manufactured by other parties.

As the Purchaser's sole and exclusive remedy under said warranty in regard to such products and parts, including but not limited to remedy for consequential damages, the Company will at its option, repair or replace without charge any product manufactured or part repaired by it, which is found to the Company's satisfaction to be so defective; provided, however, that (a) the product or part involved is returned to the Company at the location designated by the Company, transportation charges prepaid by the Purchaser; or (b) at the Company's option the product or part will be repaired or replaced in the Purchaser's plant; and also provided that (c) the Company is notified of the defect within one (1) year after the shipment date from the Company's factory of the product or part so involved.

The Company warrants to the Purchaser that any system engineered by it and started up under the supervision of an authorized Company representative will, if properly installed, operated and maintained, perform in compliance with such system's written specifications for a period of one (1) year from the date of shipment of such system.

As the Purchaser's sole and exclusive remedy under said warranty in regard to such systems, including but not limited to remedy for consequential damages, the Company will, at its option, cause, without charges any such system to so perform, which system is found to the Company's satisfaction to have failed to so perform, or refund to the Purchaser the purchase price paid by the Purchaser to the Company in regard thereto; provided, however, that (a) Company and its representatives are permitted to inspect and work upon the system involved during

reasonable hours, and (b) the Company is notified of the failure within one (1) year after date of shipment of the system so involved.

The warranties hereunder of the Company specifically exclude and do not apply to the following:

a. Products and parts damaged or abused in shipment without fault of the Company.

b. Defects and failures due to operation, either intentional or otherwise, (1) above or beyond rated capacities, (2) in connection with equipment not recommended by the Company, or (3) in an otherwise improper manner.

c. Defects and failures due to misapplication, abuse, improper installation or abnormal conditions of temperature, humidity, abrasives, dirt or corrosive matter.

d. Products, parts and systems which have been in any way tampered with or altered by any party other than an authorized Company representative.

e. Products, parts and systems designed by the Purchaser.

f. Any party other than the Purchaser.

The Company makes no other warranties or representation, expressed or implied, of merchantability and of fitness for a particular purpose, in regard to products manufactured, parts repaired and systems engineered by it.

5. Terms of payment

Standard terms of payment are net thirty (30) days from date of the Company invoice. For invoice purposed, delivery shall be deemed to be complete at the time the products, parts and systems are shipped from the Company and shall not be conditioned upon the start up thereof. Amounts past due are subject to a service charge of 1.5% per month or fraction thereof.

6. Order cancellation

Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either party, the Purchaser shall pay to the Company the reasonable costs, expenses, damages and loss of profit of the Company incurred there by, including but not limited to engineering expenses and expenses caused by commitments to the suppliers of the Company's subcontractors, as determined by the Company.

7. Changes

The Purchaser may, from time to time, but only with the written consent of an authorized Company representative, make a change in specifications to products, parts or systems covered by a purchase order accepted by the company. In the event of any such changes, the Company shall be entitled to revise its price and delivery schedule under such order.

8. Returned material

If the Purchaser desires to return any product or part, written authorization thereof must first be obtained from the Company which will advise the Purchaser of the credit to be allowed and restocking charges to be paid in regard to such return. No product or part shall be returned to the Company without a "RETURN TAG" attached thereon which has been issued by the Company.

9. Packing

Published prices and quotations include the Company's standard packing for domestic shipment. Additional expenses for special packing or overseas shipments shall be paid by the Purchaser. If the Purchaser does not specify packing or accepts parts unpacked, no allowance will be made to the Purchaser in lieu of packing.

10. Standard transportation policy

Unless expressly provided in writing to the contrary, products, parts and systems are sold f.o.b. first point of shipment. Partial shipments shall be permitted, and the Company may invoice each shipment separately. Claims for non-delivery of products, parts and systems, and for damages thereto must be filed with the carrier by the Purchaser. The Company's responsibility therefor shall cease when the carrier signs for and accepts the shipment.



CAROTRON

Driven by Excellence

D.C. DRIVES, A.C. INVERTERS,
SOLID STATE STARTERS, SYSTEM INTERFACE
CIRCUITS AND ENGINEERED SYSTEMS

3204 Rocky River Road
Heath Springs, SC 29058
Phone: (803) 286-8614
Fax: (803) 286-6063
Email: saleserv@carotron.com
Web: www.carotron.com
MAN1043-00 (Rev H)
Issued 4-16-2012