MicroManager

Velocity Mode
PID Dancer/Loadcell
Control

Instruction Manual
MM3000-PID

CAROTRON
Driven by Excellence
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SOLID STATE STARTERS, SYSTEM INTERFACE
CIRCUITS AND ENGINEERED SYSTEMS

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1 General Description

The MicroManager 3000 series is a microprocessor based industrial system controller designed to handle a wide range of industrial applications. The simple user interface allows high level microprocessor control of an application but without the need of a computer for configuration.

Model MM3000-PID (Proportional-Integral-Derivative) is designed for velocity mode applications that use dancers or loadcells. In addition, the unit can also be used as a generic PID controller.

In winding/unwinding applications, the MM3000-PID also uses internal algorithms to determine the required center driven speed based on roll diameter.

2 Specifications

2.1 Electrical

A.C. Input Voltage Range - Single Phase
- 115 VAC ± 10%, 50/60 Hz ± 2 Hz
- Fused internally

Power Supply Output
- +12V regulated supply: 70mA max.

Digital Inputs (4 Total)
- Sinking or Sourcing Logic (selectable)
- Vil=+10.5 VDC min to +12.0 VDC max
- Vih=0.0 VDC min to +8.5 VDC max

Analog Inputs (2 Total)
- 10 bit resolution (over-sampled to achieve 12 bit)
- Voltage Range: 0 to +12 VDC
- Input Impedance: 240kΩ

Frequency Inputs (1 Total)
- Sinking or Sourcing Logic (selectable)
- Frequency: 42kHz max, square wave
- Voltage: +12 VDC max
  Vil=0.0 VDC min to +1.5 VDC max
  Vih=+2.5 VDC min to +12.0 VDC max

Digital Outputs (2 Total)
- Open collector (sinking output)
- 100ma max, 30VDC max

Analog Outputs (3 Total)
- Outputs 1 & 2:
  12 bits, voltage 0 to +10 VDC max,
  or current 0 to +20 mADC max
- Output 3:
  10 bits, voltage only 0 to +5 VDC max

Communications
- Modbus® RTU
- RS485 Multidrop (2 or 4 wire)

Temperature Range
- Chassis: 0-55°C

2.2 Physical

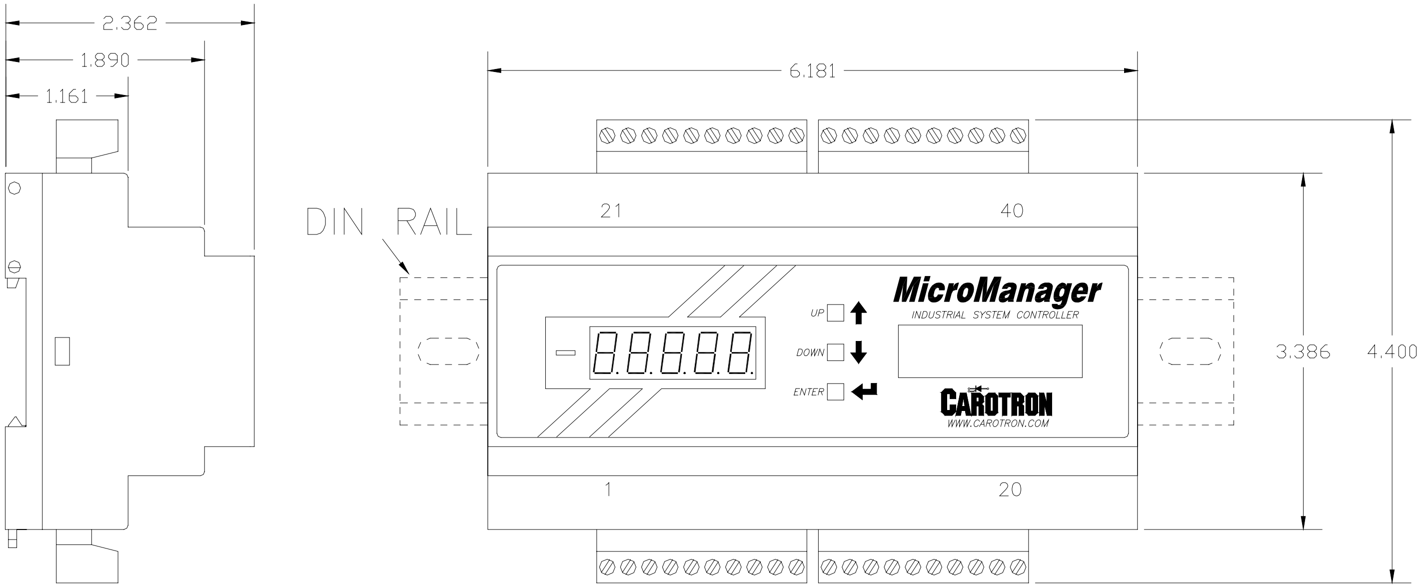

Figure 1: Physical Dimensions

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 at the designated terminal strip location.

Use fully insulated and shielded cable for all signal wiring. The shield should be connected to circuit common at one end only. 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 relay, contactor, starter, solenoid or other electro-mechanical device located in close proximity to or on the same line supply as the MicroManager 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 be connected as close to the coil as possible.

4 Terminal Connections

4.1 Signal Connections

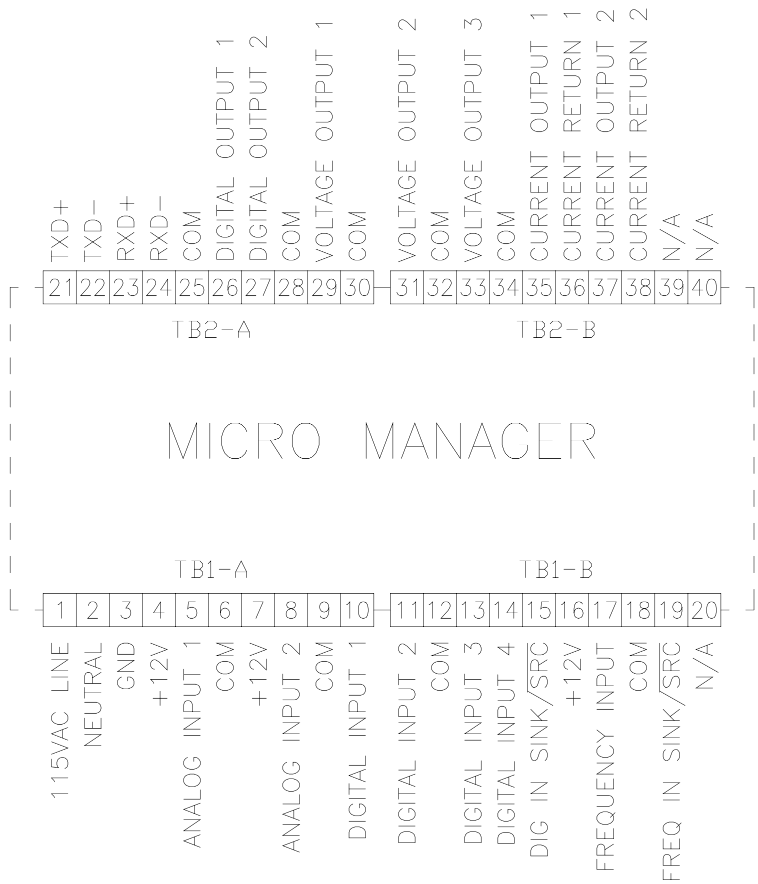

Figure 2: General Connections

5 User Interface

Programming and adjustment of the MicroManager is accomplished via a three button interface and 5 seven segment LED displays. When power is first applied, all of the LED segments (including the negative sign) are momentarily lit. The display is then cleared and **CArotron** scrolls across the display. Next, the firmware revision is displayed as **r x.xx**. Lastly, **P1** is displayed indicating parameter 1.

Editing parameters is performed by using the Up and Down buttons to select the desired parameter. When the Enter button is pressed, the value of the selected parameter will be displayed. If the parameter type is Read/Write, the Up and Down buttons can be used to edit the value. If either the Up or Down button is pressed and held, the rate that the parameter value changes will continually increase, allowing large changes to be made quickly. Once the desired value has been displayed, press the Enter button to enter the new value. To escape the editing mode without applying changes, press both the Up and Down buttons simultaneously.

The value of Read Only parameters can be viewed as above, but the Up and Down buttons cannot be used to edit the value. If either button is pressed while a Read Only parameter is displayed, the display will flash **rEAd Only** to remind the user that this parameter cannot be edited.

There are some parameters whose values cannot be changed while the unit is in the Run mode. These parameters are listed as ICR, **I**nhibit **C**hange while **R**unning. Similar to above, if these parameter values are attempted to be edited while running, the display will flash **icr Loc'd** (icr locked) to inform the user that this parameter is an ICR type and that it cannot be edited, since the unit is currently in the Run mode.

In a typical setup, there will be a few Read/Write parameters whose values will be controlled by inputs, or by other parameters. The connections between these inputs or parameters is called a link. Thus, when a parameter value is being set or controlled by an input link or an internal link, the parameter cannot be edited manually. Similar to above, if an attempt is made to edit one of these parameters, the display will flash **Linc Loc'd Pxxx** (where xxx will be a number indicating the source of the link) to inform the user that a link has been made to this parameter.

Whenever parameter changes are made, they must be saved by setting P1 to 1. Otherwise, changes will be lost when power is cycled on the unit.

On power up, if an internal memory errors while loading the parameter values, the LED's will continually flash **EE Error**. Press and hold either the Up or Down button until the unit resets. If the EE Error persists, the internal memory has likely been corrupted. Press both the Up and Down buttons to force the unit to re-initialize using the factory defaults. This can be verified as the display will momentarily display **dFLTS USEd** (defaults used). At this time, any parameter value changes must be re-entered.

6 Quick Start Procedure

The MM3000-PID has 11 predefined quick start configurations that can be loaded by setting P3 to the value listed in the table below. There a five dancer configurations and five loadcell configurations. Also available is a generic PID configuration. Determine the configuration that best matches your application. Then proceed to the adjustment procedure (located later in this section) for the configuration that you have chosen.

Diameter Method	Dancer	Loadcell	Generic
None	1,2	8,9	15
External	3	10	-
Roll Revs	4	11	-
Line Revs	5	12	-

Table 1: Pre-defined Configurations

If using on a winder or unwinder application, determine the method of roll diameter calculation that will be used. The MicroManager provides three methods for obtaining the roll diameter. Each method is described in detail below.

In dancer applications, the weight of the dancer controls the amount of material tension. Thus, tension is changed by adding or removing weights to the dancer. In more advanced systems, air pressure is used to adjust the force of the dancer. On winder controls with air loaded dancers, the MicroManager can provide a taper tension output signal. This signal can be used with an E/P (Voltage to Pressure) transducer to allow the material tension to be tapered (decreased) as the diameter builds.

6.1 Description of Diameter Calculation Methods

No Diameter
When no diameter compensation is needed, the MM3000-PID can be used to regulate the surface speeds of nips, s-wraps, bedrolls, etc…

External Diameter
The simplest example of an external diameter signal is a rider arm and a potentiometer. In this method, one end of a rider arm lies on the roll. A pivot point at the other end is attached to a potentiometer. As the diameter changes, a proportional voltage signal is produced. Other examples are sonic and laser sensors that output a voltage signal proportional to diameter.

Count Roll Revolutions
The diameter can be calculated by counting the roll revolutions. For every one revolution of the roll, two material thicknesses are added (for winders) or subtracted (for unwinders) to the diameter. Roll revolutions may be obtained from an encoder mounted on the roll drive or simply from a proximity sensor and a bolt on the roll shaft.

Line Revolutions
The diameter can also be calculated by counting the revolutions of a line roller in contact with the material. This basically measures the length of material wound onto or taken off of the roll. With this length, along with the material thickness, the diameter can be calculated. An encoder or proximity switch is typically used in conjunction with a roller wheel placed on the material to obtain the revolutions.

6.2 Description of Signals

Below is a brief description of the signal functions that are used on many of the pre-defined MicroManager configurations. Note that **not** all functions are used/available on every configuration.

Dancer Position Setpoint
This signal defines the desired operating position of the dancer. Typically, this signal level is provided as an internal setting since its value rarely, if ever, changes.

Dancer Position Feedback
This signal provides the MicroManager with the actual position of the dancer. Typically, this signal is from a potentiometer and wired to Analog Input 2.

Diameter
In configurations 3 & 10, an external sensor provides the MicroManager with a signal that is proportional to the actual winder/unwinder diameter. The external sensor is typically configured to provide 0 Volts at core and 10V at max diameter. This sensor can be as simple as a rider arm attached to a potentiometer or as complex as a sonic or laser that measures distance.

Diameter Reset
In configurations where the diameter is calculated by counting pulses, this digital input is used to reset the count, returning the diameter to core for winders and max for unwinders.

Line Speed
This signal is proportional to the speed of the line. Depending upon the configuration selected, this signal can be provided as an analog or a frequency.

Run
This is a digital input that enables the MicroManager speed reference output. Often, this signal is provided by a 'Run' contact on the line drive. This contact should be closed anytime the line drive is running (including ramping down to stop).

Tension Setpoint
This signal provides the MicroManager with desired tension level of the material. In dancer systems, this signal is only used when a voltage to pressure transducer is used to control dancer loading.

Thickness Select
In configurations where a material thickness is required to calculate diameter, these two

digital inputs are used to select between 4 programmable thicknesses. Refer to the table below.

Digital Input 3	Digital Input 4	Thickness Used
Open	Open	P239: Thickness 0
Open	Closed	P240: Thickness 1
Closed	Open	P241: Thickness 2
Closed	Closed	P242: Thickness 3

Table 2: Thickness Select

Drive Enable
This digital output is on (sinking) when the Run input is active and off when the Run input is off. This output is typically used to start/stop the dancer/loadcell controlled drive.

Speed Reference
This output signal is used as a reference to the dancer/loadcell controlled drive.

Tension Output
In dancer winder applications that require tapering tension, this output is used in conjunction with a voltage to pressure transducer to provide for dancer loading.

6.3 Config 1: Dancer with No Diameter Compensation

This dancer configuration is typically used to regulate the surface speeds of nips, s-wraps, bedrolls, etc… This setup is similar to Configuration 2 except here, Line Speed is provided as a frequency signal.

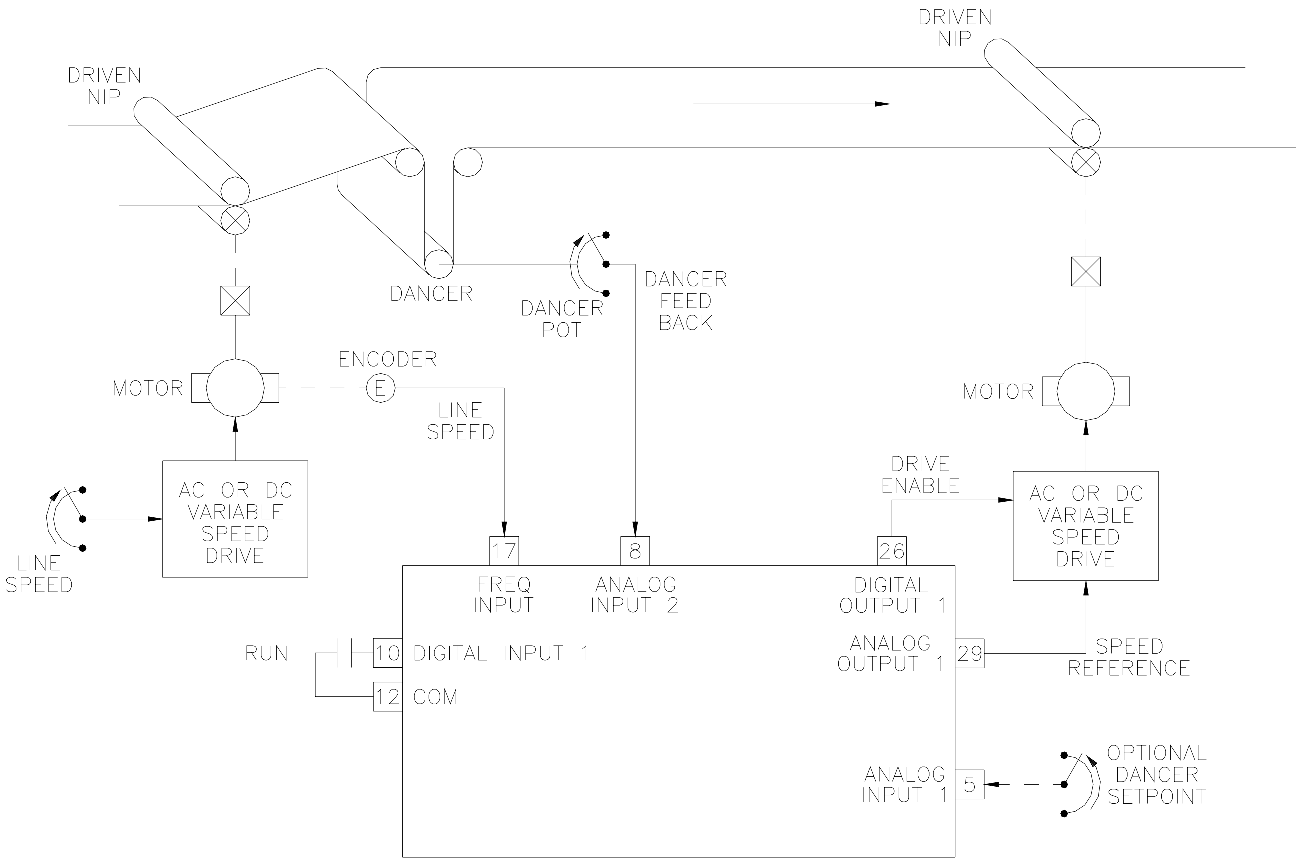

Figure 3: Dancer with No Diameter Comp (Configuration 1)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 88. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 1.

Step 2 Dancer Position Feedback Calibration

1. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Manually position the dancer to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Manually position the dancer to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 100.00% as the dancer moves from one extreme to the other.

Step 3 Dancer Position Setpoint Calibration

1. By default, the dancer position setpoint is set internally via P205 (PID Setpoint). Set P205 (PID Loop Setpoint) to the desired operating point of the dancer. Typically, this would be set to 50.00% for operation in mid-position. If an external dancer position setpoint potentiometer is required, follow the steps below to calibrate an external potentiometer.
2. Set P15 to 205. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Adjust the potentiometer fully counter clockwise to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Adjust the potentiometer fully clockwise to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
3. The input can be verified by monitoring the value of P205 (PID Loop Setpoint). It should range from 0.00% to 100.00% as the potentiometer is moved from min to max.

Step 4 Line Speed Calibration

1. Set P68 to 1 to initiate Frequency Input 1 calibration. The display will momentarily show LoCAL, and then display the actual frequency level in Hertz. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the actual frequency value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed. Once complete stop the line.

Step 5 Speed Matching Calibration

1. Adjust the dancer controlled drive's Accel/Decel ramp rates to minimum.
2. Temporarily set P208 (PID Trim) to 0.00%.
3. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
4. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
5. Adjust P114 (Analog Output 1 Gain) or the dancer controlled drive's speed scaling until the surface speed of the nip or s-wrap matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the dancer controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.
6. Reduce the line speed and verify that the dancer controlled drive's speed tracks the line speed. Once complete, stop the line.

Step 6 Final Tuning

1. Set P208 (PID Trim) initially to 10.00%. If an external dancer position potentiometer is used, set for mid-position. Otherwise, set P205 to 50.00%. Run the line at approx 50% speed.
2. Check that the dancer logic is correct by manually moving the dancer in the direction that should cause the dancer controlled drive to slow down. Verify that it does slow down.

Move the dancer to the other extreme and ensure that the dancer controlled drive speeds up. If the logic is inverted, set P208 to -10.00% and repeat test.

3. Stop the machine and load material. Re-start the machine at 25% speed and observe the dancer. Adjust P196 (Proportional Gain) and P197 (Integral Time) until dancer is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.4 Config 2: Dancer with No Diameter Compensation

This dancer configuration is typically used to regulate the surface speeds of nips, s-wraps, bedrolls, etc… This setup is similar to Configuration 1 except here, Line Speed is provided as an analog voltage signal.

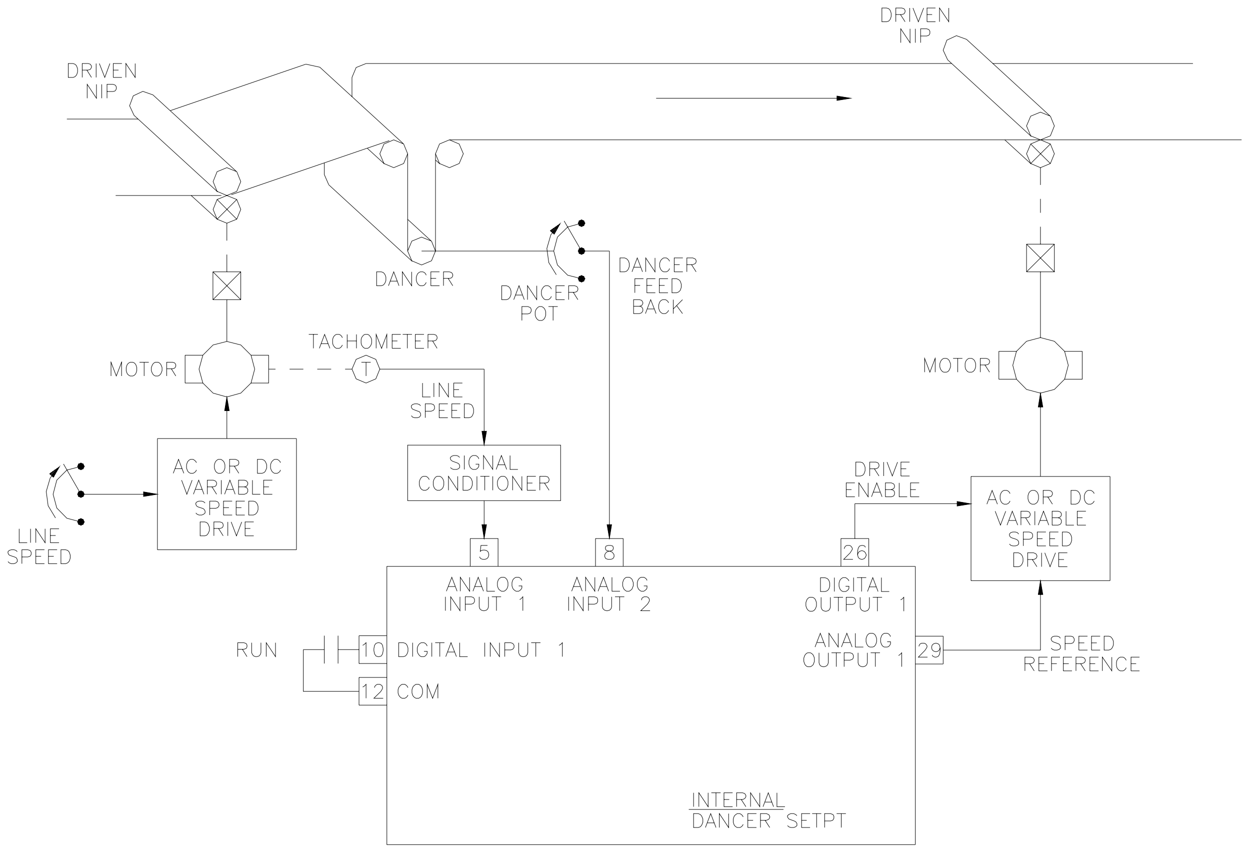

Figure 4: Dancer with No Diameter Comp (Configuration 2)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 88. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 2.

Step 2 Dancer Position Feedback Calibration

1. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Manually position the dancer to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Manually position the dancer to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 100.00% as the dancer moves from one extreme to the other.

Step 3 Dancer Position Setpoint Calibration

1. Set P205 (PID Loop Setpoint) to the desired operating point of the dancer. Typically, this would be set to 50.00% for operation in mid-position.

Step 4 Line Speed Calibration

1. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated. Once complete stop the line.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed.

Step 5 Speed Matching Calibration

1. Adjust the dancer controlled drive's Accel/Decel ramp rates to minimum.
2. Temporarily set P208 (PID Trim) to 0.00%.
3. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
4. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
5. Adjust P114 (Analog Output 1 Gain) or the dancer controlled drive's speed scaling until the surface speed of the nip or s-wrap matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the dancer controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.
6. Reduce the line speed and verify that the dancer controlled drive's speed tracks the line speed. Once complete, stop the line.

Step 6 Final Tuning

1. Set P208 (PID Trim) initially to 10.00%. Run the line at approx 50% speed.
2. Check that the dancer logic is correct by manually moving the dancer in the direction that should cause the dancer controlled drive to slow down. Verify that it does slow down. Move the dancer to the other extreme and ensure that the dancer controlled drive speeds up. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Re-start the machine at 25% speed and observe the dancer. Adjust P196 (Proportional Gain) and P197 (Integral Time) until dancer is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.5 Config 3: Dancer with External Diameter Compensation

This dancer configuration is typically used to regulate the center driven takeup or letoff speed of a winder or an unwinder using an external diameter signal.

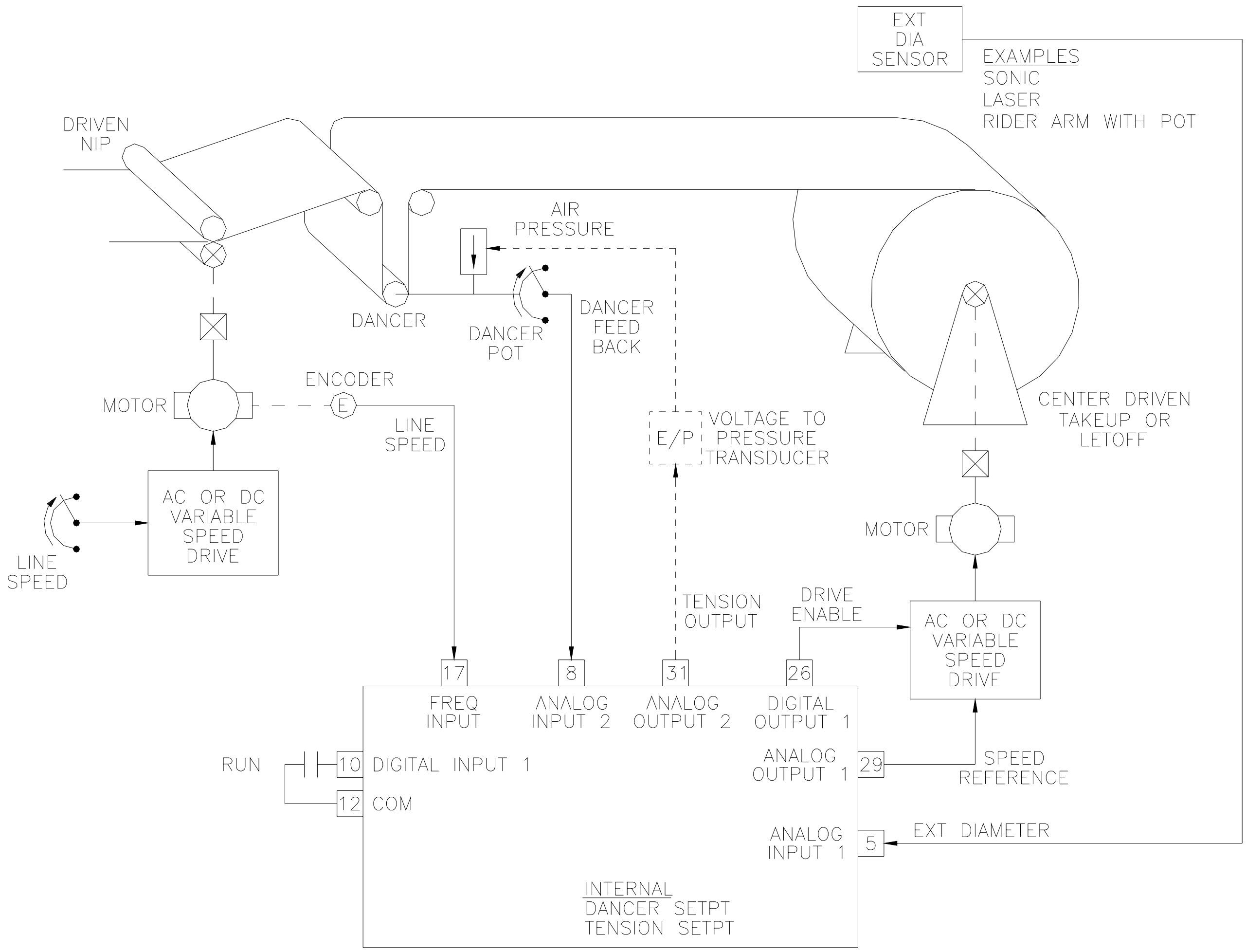

Figure 5: Dancer with External Diameter (Configuration 3)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 88. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 3.
3. Set the following parameters according to your application. If multiple size core and max diameters are to be used, enter the smallest core diameter and the largest max diameter.
   P228 Core Diameter in user units
   P229 Max Diameter in user units

Step 2 Dancer Position Feedback Calibration

1. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Manually position the dancer to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion

value. Manually position the dancer to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 100.00% as the dancer moves from one extreme to the other.

Step 3 Dancer Position Setpoint Calibration

1. Set P205 (PID Loop Setpoint) to the desired operating point of the dancer. Typically, this would be set to 50.00% for operation in mid-position.

Step 4 External Diameter Calibration

1. Load the smallest core that will be used. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Press ENTER to calibrate this minimum input signal level. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Load or simulate a maximum diameter roll to produce the maximum input signal. Press ENTER to calibrate this level. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P232 (External Diameter Ratio). It should read 0.00% with an empty core and 100.00% at max diameter. If reversed, change P29 from 0.00% to 100.00% and P31 from 100.00% to 0.00%.

Step 5 Line Speed Calibration

1. Set P68 to 1 to initiate Frequency Input 1 calibration. The display will momentarily show LoCAL, and then display the actual frequency level in Hertz. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the actual frequency value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed. Once complete stop the line.

Step 6 Speed Matching Calibration

1. Ensure that an empty core is loaded and P245 (Diameter) is equal to P228 (Core Diameter).
2. Adjust the dancer controlled drive's Accel/Decel ramp rates to minimum.
3. Temporarily set P208 (PID Trim) to 0.00%.
4. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
5. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
6. Adjust P114 (Analog Output 1 Gain) or the dancer controlled drive's speed scaling until the surface speed of the empty core matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the dancer controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.

7. Reduce the line speed to approximately 50%, and verify that the dancer controlled drive's speed tracks the line speed.
8. An larger diameter can be faked by raising the rider arm or placing a target in front of a sonic or laser. This should cause a decrease in speed of the winder/unwinder roll. Once complete, stop the line.

Step 7 Final Tuning

1. Set P208 (PID Trim) initially to 10.00%. Run the line at approx 50% speed.
2. Check that the dancer logic is correct by manually moving the dancer in the direction that should cause the dancer controlled drive to slow down. Verify that it does slow down. Move the dancer to the other extreme and ensure that the dancer controlled drive speeds up. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Re-start the machine at 25% speed and observe the dancer. Adjust P196 (Proportional Gain) and P197 (Integral Time) until dancer is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. If taper tension is required, refer to the Taper Tension Adjustment Procedure on 42.
7. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.6 Config 4: Dancer with Roll Revolutions Diameter Compensation

This dancer configuration is typically used to regulate the center driven takeup or letoff speed of a winder or an unwinder using the roll revolutions diameter compensation method.

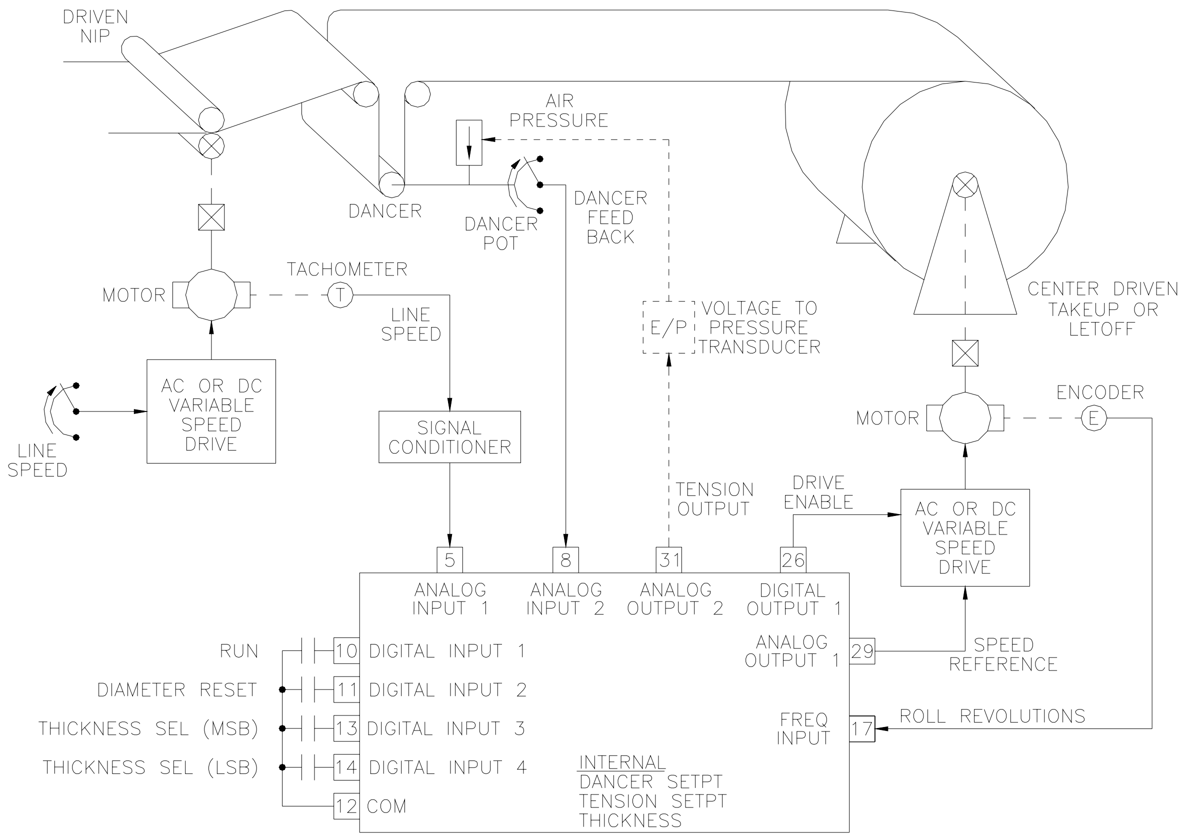

Figure 6: Dancer with Roll Revolutions Diameter (Configuration 4)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 88. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 4.
3. Set the following parameters according to your application. If multiple size core and max diameters are to be used, enter an average value of the core and max diameters that will be used.
   P226: 0=Winder, 1=Unwinder
   P228 Core Diameter in user units
   P229 Max Diameter in user units

Step 2 Dancer Position Feedback Calibration

1. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Manually position the dancer to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Manually position the dancer to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.

2. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 100.00% as the dancer moves from one extreme to the other.

Step 3 Dancer Position Setpoint Calibration

1. Set P205 (PID Loop Setpoint) to the desired operating point of the dancer. Typically, this would be set to 50.00% for operation in mid-position.

Step 4 Roll Revolutions Diameter Calibration

1. Set P76 (Pulses/Revolution) to the number of pulses that will be applied to the Frequency Input in one revolution of the roll (winder/unwinder). This value can be obtained by monitoring P74 (Count). Ensure P74 is zero by momentarily applying the Diameter Reset on Digital Input 2. Close Digital Input 1 to enable the MicroManager. Manually rotate the winder/unwinder roll one revolution. Open Digital Input 1 to disable the MicroManager. Set P76 to the value of P74.
2. Enter the material thickness into P239. If multiple material thicknesses are used, enter additional values into P240-P242.

Step 5 Line Speed Calibration

1. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated. Once complete stop the line.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed.

Step 6 Speed Matching Calibration

1. Ensure that an empty core is loaded and the Diameter Reset (Digital Input 2) is activated.
2. Adjust the dancer controlled drive's Accel/Decel ramp rates to minimum.
3. Temporarily set P208 (PID Trim) to 0.00%.
4. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
5. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
6. Adjust P114 (Analog Output 1 Gain) or the dancer controlled drive's speed scaling until the surface speed of the empty core matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the dancer controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.
7. Reduce the line speed to approximately 50%, and verify that the dancer controlled drive's speed tracks the line speed.
8. Release the Diameter Reset (Digital Input 2). The winder/unwinder roll should begin decreasing in speed. Stop the line.

Step 7 Final Tuning

1. Set P208 (PID Trim) initially to 10.00%. Activate the Diameter Reset (Digital Input 2) and run the line at approx 50% speed.
2. Check that the dancer logic is correct by manually moving the dancer in the direction that should cause the dancer controlled drive to slow down. Verify that it does slow down. Move the dancer to the other extreme and ensure that the dancer controlled drive speeds up. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Select the desired material thickness via Digital Inputs 3 & 4. (Refer to Table 7 on page 58 for additional info.) Release the Diameter Reset (Digital Input 2) and re-start the machine at 25% speed and observe the dancer. Adjust P196 (Proportional Gain) and P197 (Integral Time) until dancer is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. If taper tension is required, refer to the Taper Tension Adjustment Procedure on 42.
7. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.7 Config 5: Dancer with Line Revolutions Diameter Compensation

This dancer configuration is typically used to regulate the center driven takeup or letoff speed of a winder or an unwinder using the line revolutions diameter compensation method.

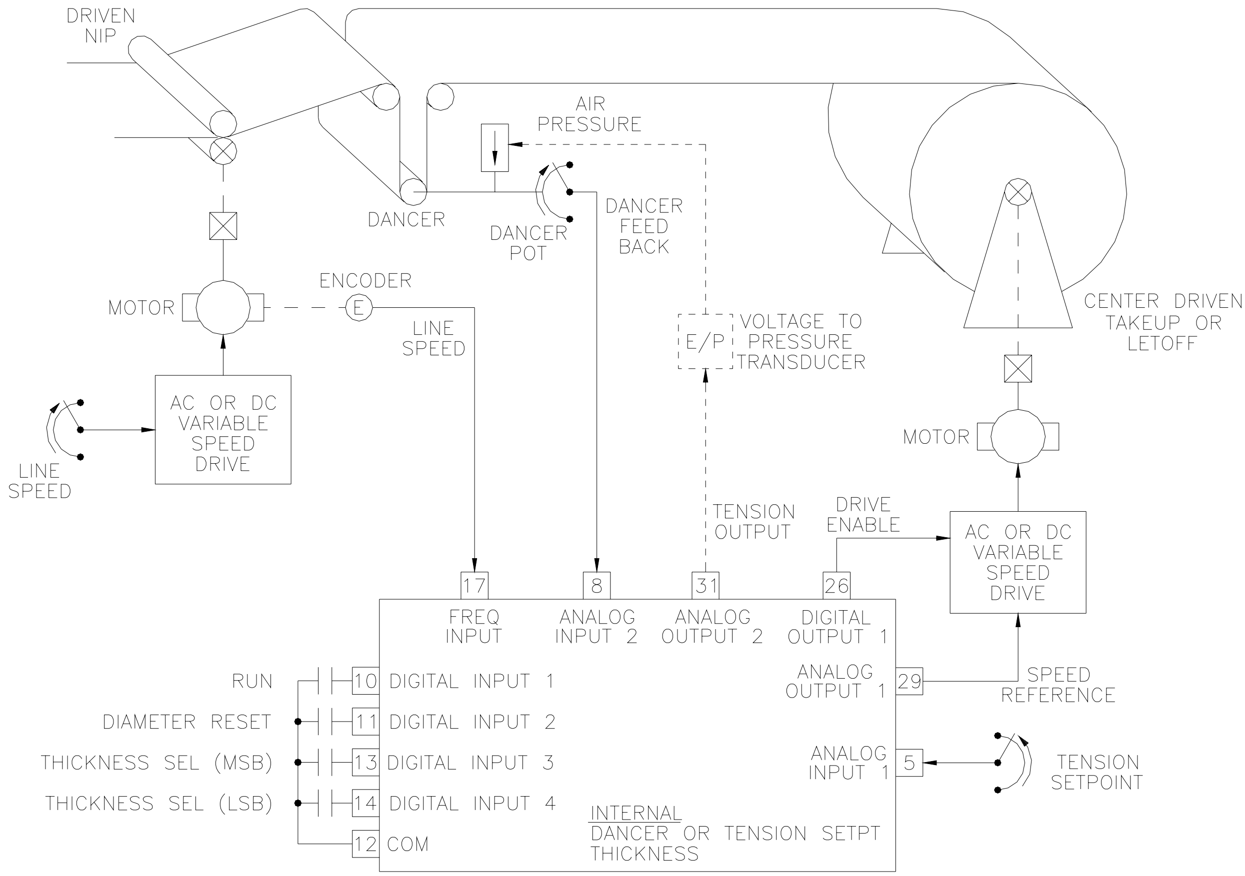

Figure 7: Dancer with Line Revolutions Diameter (Configuration 5)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 88. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 5.
3. Set the following parameters according to your application. If multiple size core and max diameters are to be used, enter an average value of the core and max diameters that will be used.
   P226 0=Winder, 1=Unwinder
   P228 Core Diameter in user units
   P229 Max Diameter in user units

Step 2 Dancer Position Feedback Calibration

1. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Manually position the dancer to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Manually position the dancer to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed

and the calibration must be repeated.
2. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 100.00% as the dancer moves from one extreme to the other.

Step 3 Dancer Position Setpoint Calibration
Set P205 (PID Loop Setpoint) to the desired operating point of the dancer. Typically, this would be set to 50.00% for operation in mid-position.

Step 4 Tension Setpoint Calibration
1. This calibration step is only necessary if an external voltage to pressure transducer is used to control dancer loading.
2. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Adjust the potentiometer fully counter clockwise to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Adjust the potentiometer fully clockwise to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
3. The input can be verified by monitoring the value of P246 (Tension Setpoint). It should range from 0.00% to 100.00% as the potentiometer is moved from min to max.

Step 5 Line Revolutions Diameter Calibration
1. Set P76 (Pulses/Revolution) to the number of pulses that will be applied to the Frequency Input in one revolution of the line roller. This value can be obtained by monitoring P74 (Count). Ensure P74 is zero by momentarily applying the Diameter Reset on Digital Input 2. Close Digital Input 1 to enable the MicroManager. Manually rotate the line roller one revolution. Open Digital Input 1 to disable the MicroManager. Set P76 to the value of P74.
2. Enter the circumference of the line roller into P231 (Length/Revolution).
3. Enter the material thickness into P239. If multiple material thicknesses are used, enter additional values into P240-P242.

Step 6 Line Speed Calibration
1. Set P68 to 1 to initiate Frequency Input 1 calibration. The display will momentarily show LoCAL, and then display the actual frequency level in Hertz. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the actual frequency value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed. Once complete stop the line.

Step 7 Speed Matching Calibration
1. Ensure that an empty core is loaded and the Diameter Reset (Digital Input 2) is activated.
2. Adjust the dancer controlled drive's Accel/Decel ramp rates to minimum.
3. Temporarily set P208 (PID Trim) to 0.00%.
4. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is

approx. 100.00%.

5. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
6. Adjust P114 (Analog Output 1 Gain) or the dancer controlled drive's speed scaling until the surface speed of the empty core matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the dancer controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.
7. Reduce the line speed to approximately 50%, and verify that the dancer controlled drive's speed tracks the line speed.
8. Release the Diameter Reset (Digital Input 2). The winder/unwinder roll should begin decreasing in speed. Once complete, stop the line.

Step 8 Final Tuning

1. Set P208 (PID Trim) initially to 10.00%. Activate the Diameter Reset (Digital Input 2) and run the line at approx 50% speed.
2. Check that the dancer logic is correct by manually moving the dancer in the direction that should cause the dancer controlled drive to slow down. Verify that it does slow down. Move the dancer to the other extreme and ensure that the dancer controlled drive speeds up. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Select the desired material thickness via Digital Inputs 3 & 4. (Refer to Table 7 on page 58 for additional info.) Release the Diameter Reset (Digital Input 2) and re-start the machine at 25% speed and observe the dancer. Adjust P196 (Proportional Gain) and P197 (Integral Time) until dancer is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. If taper tension is required, refer to the Taper Tension Adjustment Procedure on 42.
7. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.8 Config 8: Loadcell with No Diameter Compensation

This loadcell configuration is typically used to regulate the surface speeds of nips, s-wraps, bedrolls, etc… This setup is similar to Configuration 9 except here, Line Speed is provided as a frequency signal.

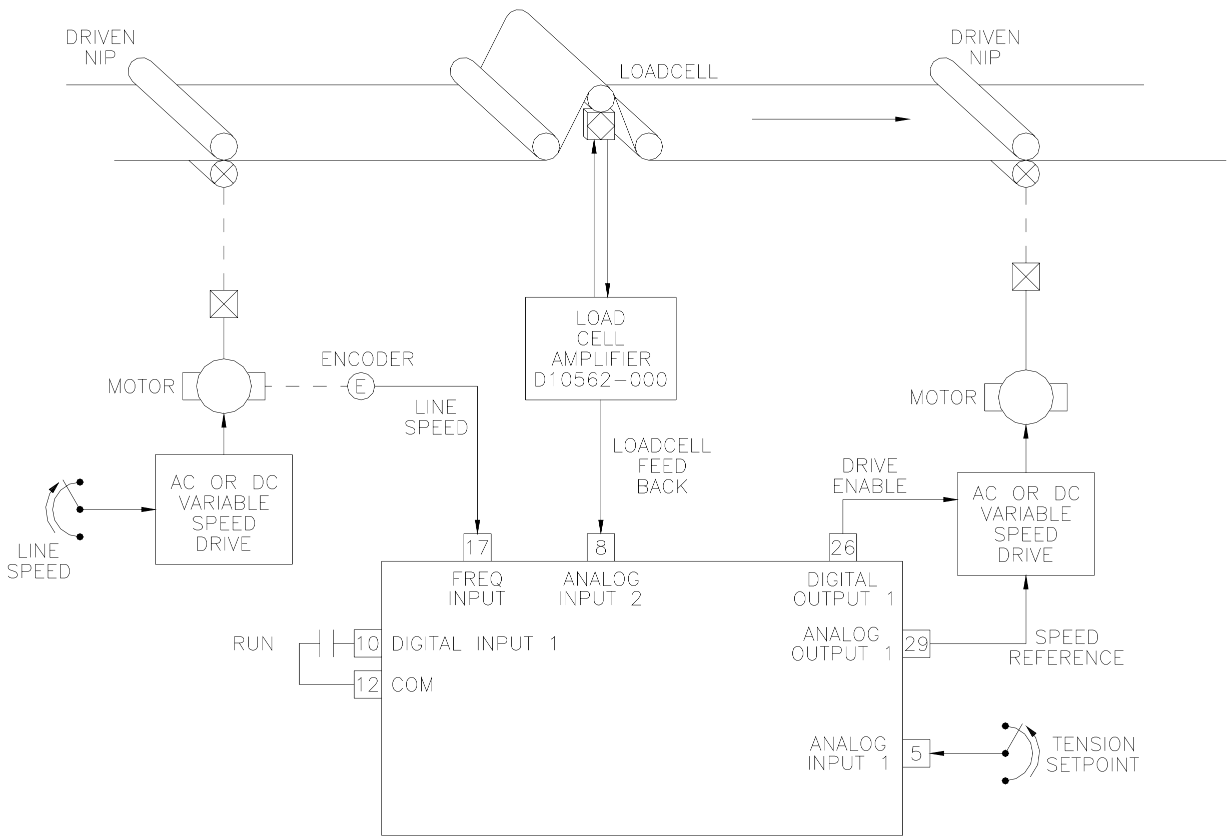

Figure 8: Loadcell with No Diameter Comp (Configuration 8)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 89. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 8.

Step 2 Loadcell Feedback Calibration

1. Calibrate the loadcell amplifier for a unipolar voltage output. Typically, the amplifier is calibrated for provide 0V at no load and 10V at 110% load. Refer to the amplifier's documentation for further information.
2. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Remove all loading from the loadcells to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Apply 110% load to the loadcells to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
3. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 110.00% as the load changes from no load to 110% load.

Step 3 Tension Setpoint Calibration

1. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Adjust the potentiometer fully counter clockwise to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Adjust the potentiometer fully clockwise to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P205 (PID Loop Setpoint). It should range from 0.00% to 100.00% as the potentiometer is moved from min to max.

Step 4 Line Speed Calibration

1. Set P68 to 1 to initiate Frequency Input 1 calibration. The display will momentarily show LoCAL, and then display the actual frequency level in Hertz. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the actual frequency value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed. Once complete stop the line.

Step 5 Speed Matching Calibration

1. Adjust the loadcell controlled drive's Accel/Decel ramp rates to minimum.
2. Temporarily set P208 (PID Trim) to 0.00%.
3. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
4. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
5. Adjust P114 (Analog Output 1 Gain) or the loadcell controlled drive's speed scaling until the surface speed of the nip or s-wrap matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the dancer controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.
6. Reduce the line speed and verify that the loadcell controlled drive's speed tracks the line speed. Once complete, stop the line.

Step 6 Final Tuning

1. Set P208 (PID Trim) initially to 10.00%. Adjust the external tension pot to approx 10% and run the line at approx 50% speed.
2. Check that the loadcell logic is correct. Since there is no force on the loadcells the loadcell controlled drive's speed should be slightly faster than the line speed. Monitor P207 (PID Error). When a force greater than the Tension Setpoint is applied to the loadcells (causing P207 to be negative), the loadcell controlled drive should slow down. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Re-start the machine at 25% speed and observe the filtered loadcell feedback (P267). Adjust P196 (Proportional Gain) and P197 (Integral Time) until loadcell feedback is steady.

4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.8 Config 9: Loadcell with No Diameter Compensation

This loadcell configuration is typically used to regulate the surface speeds of nips, s-wraps, bedrolls, etc… This setup is similar to Configuration 8 except here, Line Speed is provided as an analog signal.

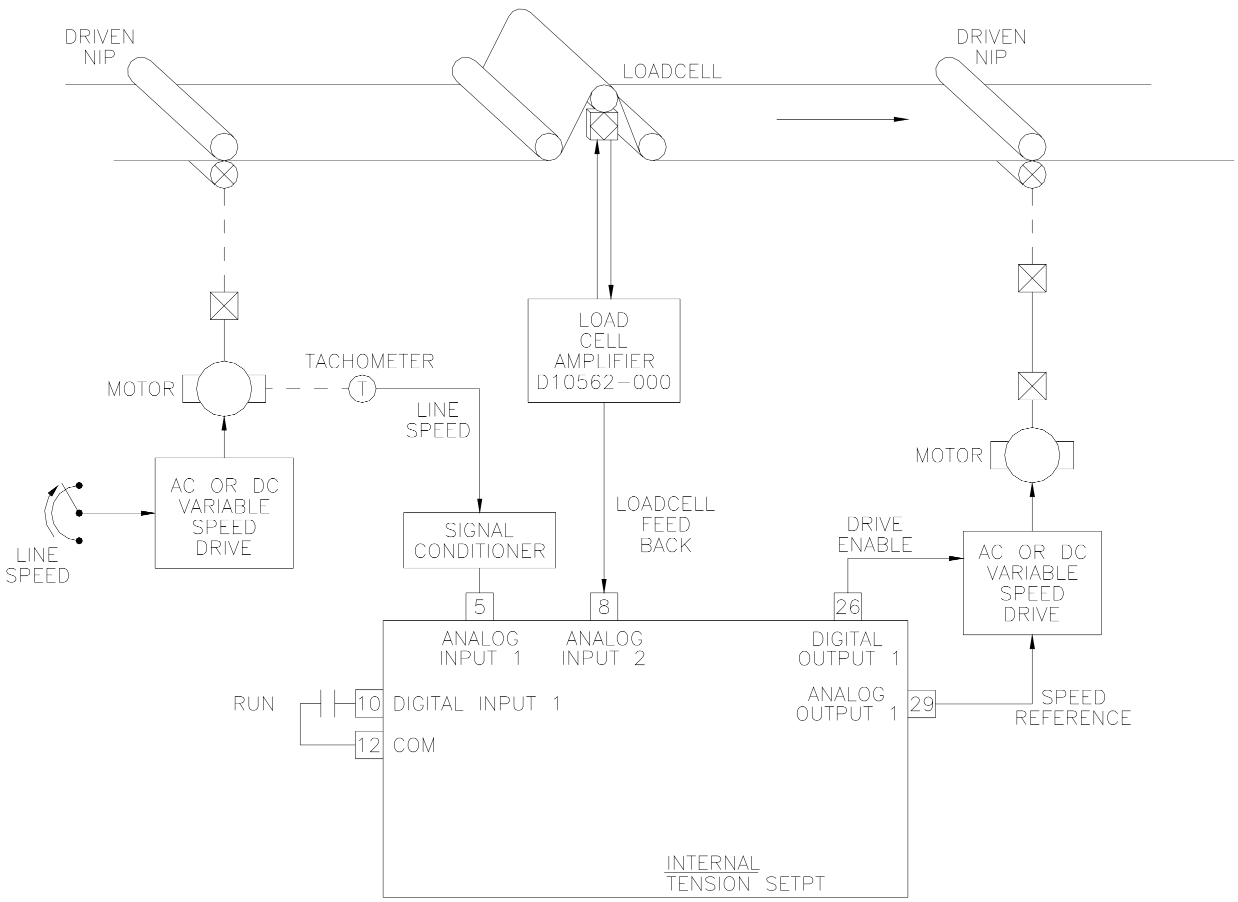

Figure 9: Loadcell with No Diameter Comp (Configuration 9)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 89. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 9.

Step 2 Loadcell Feedback Calibration

1. Calibrate the loadcell amplifier for a unipolar voltage output. Typically, the amplifier is calibrated for provide 0V at no load and 10V at 110% load. Refer to the amplifier's documentation for further information.
2. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Remove all loading from the loadcells to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Apply 110% load to the loadcells to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.

3. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 110.00% as the load changes from no load to 110% load.

Step 3 Line Speed Calibration

1. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated. Once complete stop the line.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed.

Step 4 Speed Matching Calibration

1. Adjust the loadcell controlled drive's Accel/Decel ramp rates to minimum.
2. Temporarily set P208 (PID Trim) to 0.00%.
3. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
4. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
5. Adjust P114 (Analog Output 1 Gain) or the loadcell controlled drive's speed scaling until the surface speed of the nip or s-wrap matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the dancer controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.
6. Reduce the line speed and verify that the loadcell controlled drive's speed tracks the line speed. Once complete, stop the line.

Step 5 Final Tuning

1. Set P208 (PID Trim) initially to 10.00%. Set P246 (Tension Setpoint) to 10% and run the line at approx 50% speed.
2. Check that the loadcell logic is correct. Since there is no force on the loadcells the loadcell controlled drive's speed should be slightly faster than the line speed. Monitor P207 (PID Error). When a force greater than the Tension Setpoint is applied to the loadcells (causing P207 to be negative), the loadcell controlled drive should slow down. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Re-start the machine at 25% speed and observe the filtered loadcell feedback (P267). Adjust P196 (Proportional Gain) and P197 (Integral Time) until loadcell feedback is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.9 Config 10: Loadcell with External Diameter Compensation

This loadcell configuration is typically used to regulate the center driven takeup or letoff speed of a winder or an unwinder using an external diameter signal.

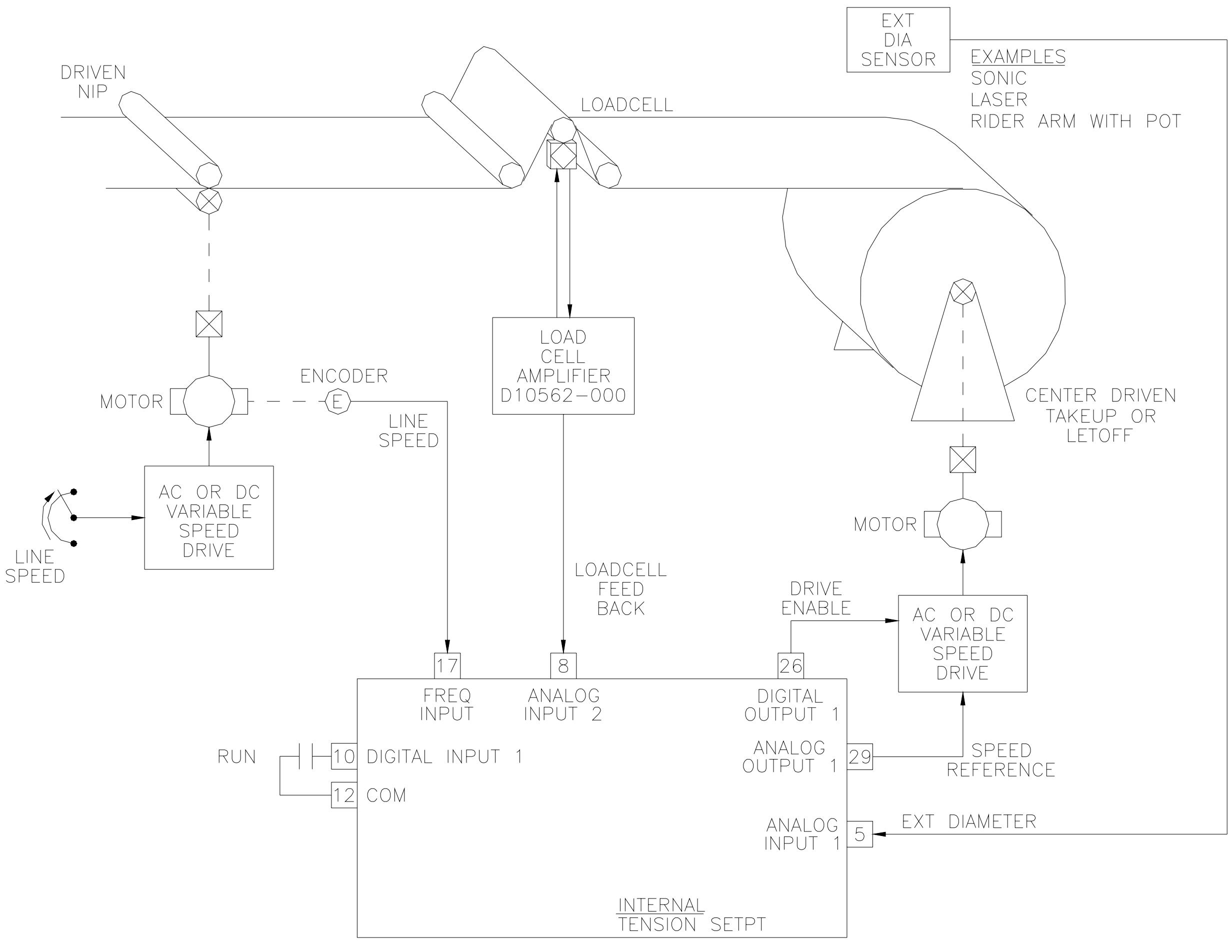

Figure 10: Loadcell with External Diameter Comp (Configuration 10)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 89. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 10.

Step 2 Loadcell Feedback Calibration

1. Calibrate the loadcell amplifier for a unipolar voltage output. Typically, the amplifier is calibrated for provide 0V at no load and 10V at 110% load. Refer to the amplifier's documentation for further information.
2. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Remove all loading from the loadcells to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Apply 110% load to the loadcells to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.

3. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 110.00% as the load changes from no load to 110% load.

Step 3 External Diameter Calibration

1. Load the smallest core that will be used. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Press ENTER to calibrate this minimum input signal level. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Load or simulate a maximum diameter roll to produce the maximum input signal. Press ENTER to calibrate this level. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P232 (External Diameter Ratio). It should read 0.00% with an empty core and 100.00% at max diameter. If reversed, change P29 from 0.00% to 100.00% and P31 from 100.00% to 0.00%.

Step 4 Line Speed Calibration

1. Set P68 to 1 to initiate Frequency Input 1 calibration. The display will momentarily show LoCAL, and then display the actual frequency level in Hertz. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the actual frequency value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed. Once complete stop the line.

Step 5 Speed Matching Calibration

1. Ensure that an empty core is loaded and P245 (Diameter) is equal to P228 (Core Diameter).
2. Adjust the loadcell controlled drive's Accel/Decel ramp rates to minimum.
3. Temporarily set P208 (PID Trim) to 0.00%.
4. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
5. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
6. Adjust P114 (Analog Output 1 Gain) or the loadcell controlled drive's speed scaling until the surface speed of the empty core matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the loadcell controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.
7. Reduce the line speed to approximately 50%, and verify that the loadcell controlled drive's speed tracks the line speed.
8. An larger diameter can be faked by raising the rider arm or placing a target in front of a sonic or laser. This should cause a decrease in speed of the winder/unwinder roll. Once complete, stop the line.

Step 6 Final Tuning

1. Set P208 (PID Trim) initially to 10.00% and P246 (Tension Setpoint) to 10.00%. Run the line at approx 50% speed.
2. Check that the loadcell logic is correct. Since there is no force on the loadcells the loadcell controlled drive's speed should be slightly faster than the line speed. Monitor P207 (PID Error). When a force greater than the Tension Setpoint is applied to the loadcells (causing P207 to be negative), the loadcell controlled drive should slow down. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Re-start the machine at 25% speed and observe the filtered loadcell feedback (P267). Adjust P196 (Proportional Gain) and P197 (Integral Time) until loadcell feedback is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. If taper tension is required, refer to the Taper Tension Adjustment Procedure on 42.
7. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.10 Config 11: Loadcell with Roll Revolutions Diameter Compensation

This loadcell configuration is typically used to regulate the center driven takeup or letoff speed of a winder or an unwinder using the roll revolutions diameter compensation method.

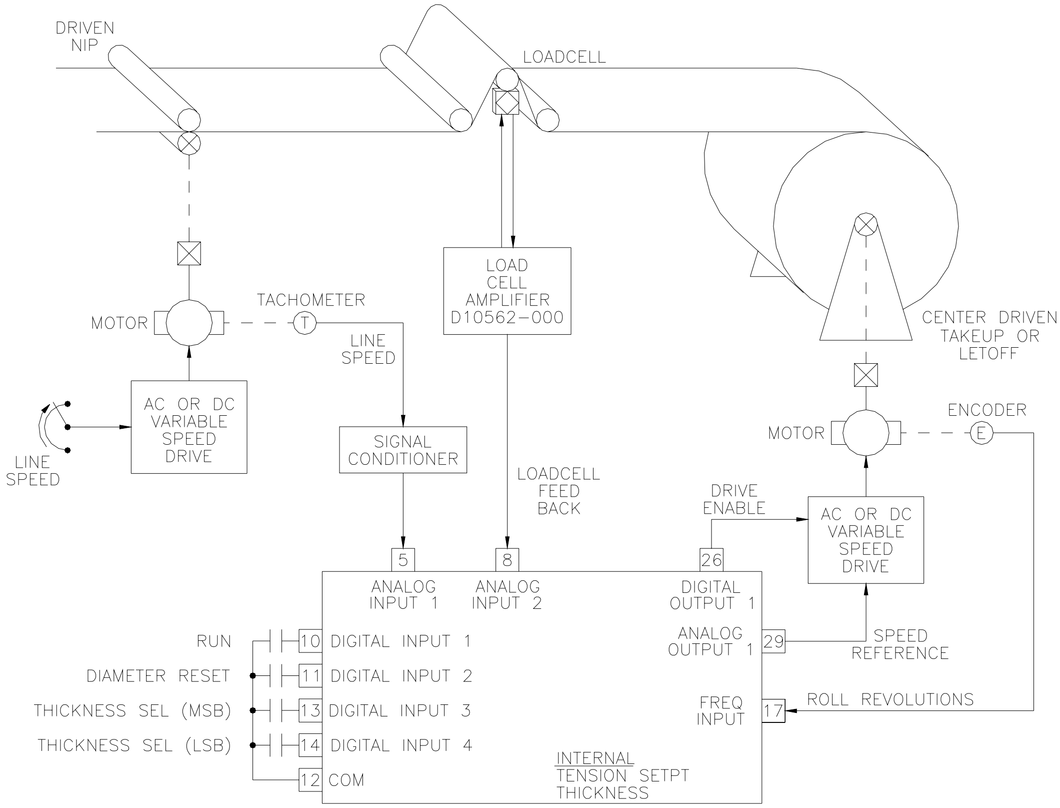

Figure 11: Loadcell with Roll Revolutions Diameter (Configuration 11)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 89. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 11.
3. Set the following parameters according to your application. If multiple size core and max diameters are to be used, enter an average value of the core and max diameters that will be used.
   P226 0=Winder, 1=Unwinder
   P228 Core Diameter in user units
   P229 Max Diameter in user units

Step 2 Loadcell Feedback Calibration

1. Calibrate the loadcell amplifier for a unipolar voltage output. Typically, the amplifier is calibrated for provide 0V at no load and 10V at 110% load. Refer to the amplifier's documentation for further information.
2. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Remove all loading from the loadcells to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Apply 110% load to the loadcells to provide for the maximum input

signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.

3. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 110.00% as the load changes from no load to 110% load.

Step 3 Roll Revolutions Diameter Calibration

1. Set P76 (Pulses/Revolution) to the number of pulses that will be applied to the Frequency Input in one revolution of the roll (winder/unwinder). This value can be obtained by monitoring P74 (Count). Ensure P74 is zero by momentarily applying the Diameter Reset on Digital Input 2. Close Digital Input 1 to enable the MicroManager. Manually rotate the winder/unwinder roll one revolution. Open Digital Input 1 to disable the MicroManager. Set P76 to the value of P74.
2. Enter the material thickness into P239. If multiple material thicknesses are used, enter additional values into P240-P242.

Step 4 Line Speed Calibration

1. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated. Once complete stop the line.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed.

Step 5 Speed Matching Calibration

1. Ensure that an empty core is loaded and the Diameter Reset (Digital Input 2) is activated.
2. Adjust the loadcell controlled drive's Accel/Decel ramp rates to minimum.
3. Temporarily set P208 (PID Trim) to 0.00%.
4. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
5. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
6. Adjust P114 (Analog Output 1 Gain) or the loadcell controlled drive's speed scaling until the surface speed of the empty core matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the loadcell controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.
7. Reduce the line speed to approximately 50%, and verify that the loadcell controlled drive's speed tracks the line speed.
8. Release the Diameter Reset (Digital Input 2). The winder/unwinder roll should begin decreasing in speed. Once complete, stop the line.

Step 6 Final Tuning

1. Set P208 (PID Trim) initially to 10.00% and P246 (Tension Setpoint) to 10.00%. Activate the Diameter Reset (Digital Input 2) and run the line at approx 50% speed.

2. Check that the loadcell logic is correct. Since there is no force on the loadcells the loadcell controlled drive's speed should be slightly faster than the line speed. Monitor P207 (PID Error). When a force greater than the Tension Setpoint is applied to the loadcells (causing P207 to be negative), the loadcell controlled drive should slow down. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Select the desired material thickness via Digital Inputs 3 & 4. (Refer to Table 7 on page 58 for additional info.) Release the Diameter Reset (Digital Input 2) and re-start the machine at 25% speed and observe the filtered loadcell feedback (P267). Adjust P196 (Proportional Gain) and P197 (Integral Time) until loadcell feedback is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. If taper tension is required, refer to the Taper Tension Adjustment Procedure on 42.
7. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.11 Config 12: Loadcell with Line Revolutions Diameter Compensation

This loadcell configuration is typically used to regulate the center driven takeup or letoff speed of a winder or an unwinder using the line revolutions diameter compensation method.

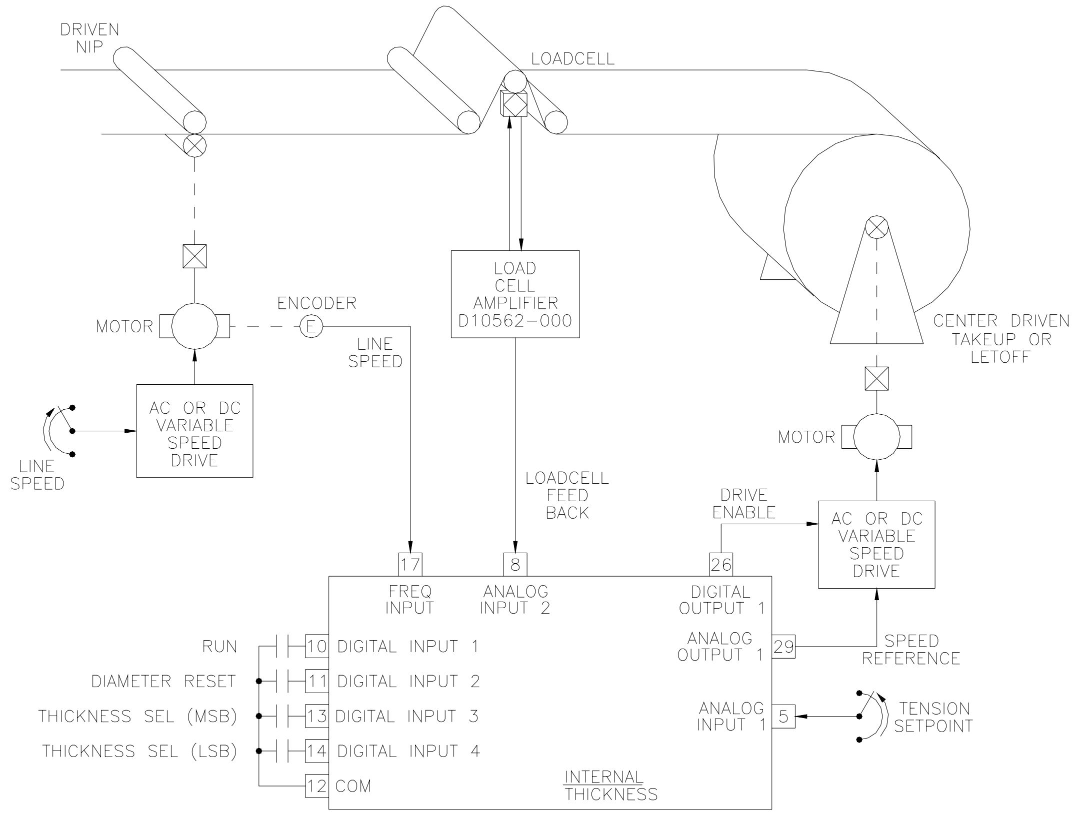

Figure 12: Loadcell with Line Revolutions Diameter (Configuration 12)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 89. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 12.
3. Set the following parameters according to your application. If multiple size core and max diameters are to be used, enter an average value of the core and max diameters that will be used.
   P226 0=Winder, 1=Unwinder
   P228 Core Diameter in user units
   P229 Max Diameter in user units

Step 2 Loadcell Feedback Calibration

1. Calibrate the loadcell amplifier for a unipolar voltage output. Typically, the amplifier is calibrated for provide 0V at no load and 10V at 110% load. Refer to the amplifier's documentation for further information.
2. Set P24 to 1 to initiate the Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Remove all loading from the loadcells to provide for the minimum input signal and then press ENTER. The

display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Apply 110% load to the loadcells to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.

3. The input can be verified by monitoring the value of P206 (PID Loop Feedback). It should range from 0.00% to 110.00% as the load changes from no load to 110% load.

Step 3 Tension Setpoint Calibration

1. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Adjust the potentiometer fully counter clockwise to provide for the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Adjust the potentiometer fully clockwise to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P246 (Tension Setpoint). It should range from 0.00% to 100.00% as the potentiometer is moved from min to max.

Step 4 Line Revolutions Diameter Calibration

1. Set P76 (Pulses/Revolution) to the number of pulses that will be applied to the Frequency Input in one revolution of the line roller. This value can be obtained by monitoring P74 (Count). Ensure P74 is zero by momentarily applying the Diameter Reset on Digital Input 2. Close Digital Input 1 to enable the MicroManager. Manually rotate the line roller one revolution. Open Digital Input 1 to disable the MicroManager. Set P76 to the value of P74.
2. Enter the circumference of the line roller into P231 (Length/Revolution).
3. Enter the material thickness into P239. If multiple material thicknesses are used, enter additional values into P240-P242.

Step 5 Line Speed Calibration

1. Set P68 to 1 to initiate Frequency Input 1 calibration. The display will momentarily show LoCAL, and then display the actual frequency level in Hertz. With the line stopped, press ENTER. The display will momentarily show HiCAL, and again display the actual frequency value. Run the line speed to its maximum desired speed and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
2. The input can be verified by monitoring the value of P222 (Line Speed). It should read 0.00% when the line is stopped and 100.00% at full speed. Once complete stop the line.

Step 6 Speed Matching Calibration

1. Ensure that an empty core is loaded and the Diameter Reset (Digital Input 2) is activated.
2. Adjust the dancer controlled drive's Accel/Decel ramp rates to minimum.
3. Temporarily set P208 (PID Trim) to 0.00%.
4. Start the MicroManager and line drive and run to full speed. Verify the value of P222 is approx. 100.00%.
5. Use a hand tachometer to measure the surface speed of a line roller to obtain the material speed (i.e. Ft/min, m/sec, etc…).
6. Adjust P114 (Analog Output 1 Gain) or the loadcell controlled drive's speed scaling until

the surface speed of the empty core matches the speed from the previous step. Note: when adjusting P114, the new value must entered for it to take affect. The maximum speed can be decreased by lowering P114 (Analog Output 1 Gain) or by decreasing the drive's speed scaling adjustment. If the speed of the loadcell controlled drive needs to be increased, use that drive's max speed adjustment. Increasing P114 beyond 100.00% should not be used for this purpose as the output signal will still be limited to 10V or 20mA.

7. Reduce the line speed to approximately 50%, and verify that the loadcell controlled drive's speed tracks the line speed.
8. Release the Diameter Reset (Digital Input 2). The winder/unwinder roll should begin decreasing in speed. Once complete, stop the line.

Step 7 Final Tuning

1. Set P208 (PID Trim) initially to 10.00% and P246 (Tension Setpoint) to 10.00%. Activate the Diameter Reset (Digital Input 2) and run the line at approx 50% speed.
2. Check that the loadcell logic is correct. Since there is no force on the loadcells the loadcell controlled drive's speed should be slightly faster than the line speed. Monitor P207 (PID Error). When a force greater than the Tension Setpoint is applied to the loadcells (causing P207 to be negative), the loadcell controlled drive should slow down. If the logic is inverted, set P208 to -10.00% and repeat test.
3. Stop the machine and load material. Select the desired material thickness via Digital Inputs 3 & 4. (Refer to Table 7 on page 58 for additional info.) Release the Diameter Reset (Digital Input 2) and re-start the machine at 25% speed and observe the filtered loadcell feedback (P267). Adjust P196 (Proportional Gain) and P197 (Integral Time) until loadcell feedback is steady.
4. Increase the line speed and tweak P196 & P197 if required.
5. Monitor P214 (Integral Status). If this value approaches ±100.00% during operation, the magnitude of P208 may need to be increased (i.e. increase to 15-20% or decrease to negative 15-20%).
6. If taper tension is required, refer to the Taper Tension Adjustment Procedure on 42.
7. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.12 Config 15: Generic PID Setup

This is a generic PID configuration.

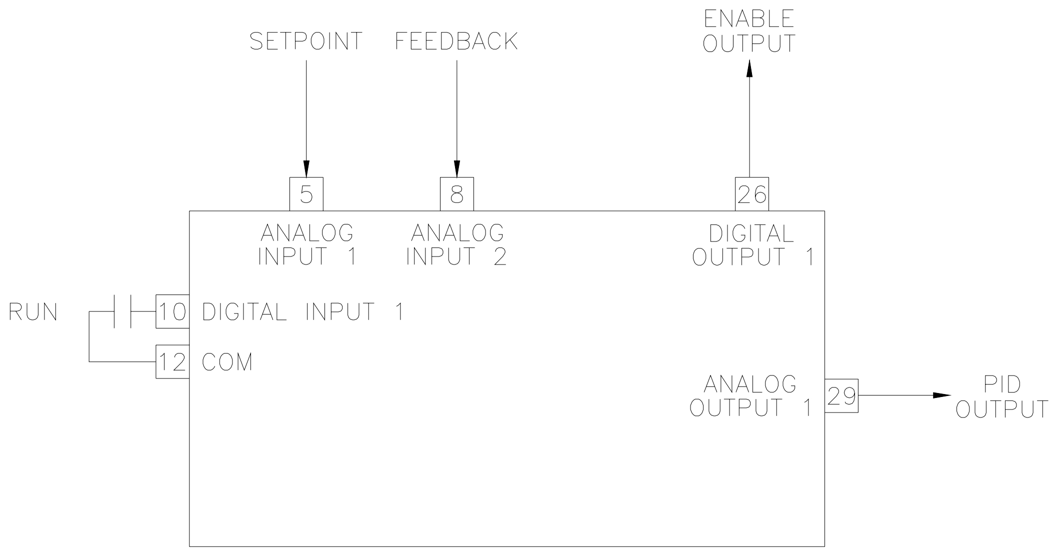

Figure 13: Generic PID (Configuration 15)

Step 1 Wiring & Initialization

1. Make wiring connections using D13429 on page 89. Initially, all material must be **removed** from the machine for setup.
2. Apply power and set P3 (Initialize) to 15.

Step 2 Setpoint Calibration

1. If an internal PID setpoint is desired, set P15 to zero and set P205 to the desired operating point (i.e. 0.00% to 100.00%). Otherwise, follow the steps below to calibrate an external setpoint.
2. Set P23 to 1 to initiate Analog Input 1 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Adjust the external device to provide the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Adjust the external device to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error will be displayed and the calibration must be repeated.
3. The input can be verified by monitoring the value of P205 (PID Setpoint). It should read 0.00% with the minimum input signal and 100.00% with the maximum input signal.

Step 3 Feedback Calibration

1. Set P24 to 1 to initiate Analog Input 2 calibration. The display will momentarily show LoCAL, and then display the raw analog-to-digital conversion value. Adjust the external feedback device to provide the minimum input signal and then press ENTER. The display will momentarily show HiCAL, and again display the raw analog-to-digital conversion value. Adjust the external feedback device to provide for the maximum input signal and press ENTER. If an error occurred (i.e., min value > max value), CAL Error

will be displayed and the calibration must be repeated.

2. The input can be verified by monitoring the value of P206 (PID Feedback). It should read 0.00% with the minimum input signal and 100.00% with the maximum input signal.

Step 4 Output Calibration

1. By default, the MicroManager will provide a 0 to 10VDC (or 0-20mA) output signal. The following steps can be used to modify the calibration levels. **Warning! The steps below will force an output level even though the unit may be in the stop mode. Ensure that any connected devices are in a safe mode (i.e., will ignore any signal output from the MicroManager).**
2. Adjust P117 (Analog Output 1 Bias) until the minimum desired output level is reached.
3. Set P114 (Analog Output 1 Gain) to 0.00%.
4. Set P126 to 1 to force the Analog Output 1 signal to full output.
5. Adjust P114 (Analog Output 1 Gain) until the maximum desired output level is reached.
6. Once complete, set P126 back to zero.

Step 5 Final Tuning

1. Place the MicroManager in the run mode by closing the contact on Digital Input 1.
2. Check that the PID logic is correct. If the logic is inverted, place unit in the stop mode and set P30 to 100.00% and P32 to 0.00%.
3. Re-start the machine and adjust P196 (Proportional Gain) and P197 (Integral Time) until desired operation is obtained.
4. Once desired operation is obtained, set P1 to 1 to save parameters. Document the parameter changes. Refer to Section 6.14 MicroManager Configuration Documentation on page 42.

6.13 Taper Tension Adjustment

With winders, many times it is necessary to build tight packages with constant tension near the core and then taper (or decrease) the tension on the outer layers of the roll to prevent wrinkling and/or telescoping. The MicroManager can provide taper tension on loadcell applications, and on air-loaded dancer systems.

1. Monitor the roll as it is being built and make note of the diameter level at which constant tension problems begin to occur.
2. Set P247 (Taper Diameter) so that the tension will begin tapering at a level prior to the problem area observed in the previous step.
3. Set P248 (Taper Percentage) to control how much tension is reduced.
4. Wind another roll and make adjustments to P247 and P248 as necessary.

6.14 MicroManager Configuration Documentation

It is recommended that, once setup is complete, the configuration of the MicroManager be documented. This can be done on a PC with the MicroManager software (available online at www.carotron.com) or manually by following the procedure below.

Set P14 (List Modified Parameters) to 1. The display will show a list of all the parameters whose value has been modified from the factory preset. The Up and Down buttons are used to scroll through the list. Once the changed parameters have been documented, press the Enter button to exit.

Next, scroll through the parameters and display the value of each of the modified parameters that were listed above. Table 13 on page 68 provides a User column where the parameter values may be noted.

7 Programming & Adjustments

The MicroManager's parameters are grouped into numerous functional blocks. The blocks can be interconnected via links in different configurations to perform different application tasks. Please refer to drawing D13324 Sheet 1 on page 90 for an overall view of all the blocks. Each parameter has a descriptive name and a tag (or number) identifier. The following sections contain each software block diagram and descriptions of each parameter function. Refer to Figure 14 below 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. Remember that parameter changes must be saved by setting P1 to 1.

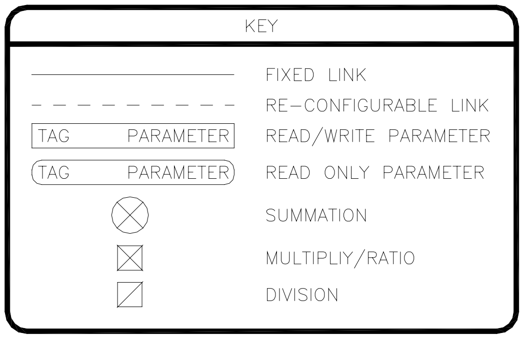

Figure 14: Block Diagram Key

7.1 Analog Inputs

The MicroManager has two configurable analog (voltage) inputs. Each input can be configured to write to any Read/Write parameter.

Destination (15-16, ICR, default: 0)
The tag of the target parameter that the analog input will control.

Status (17-18, Read Only)
The raw 12 bit analog-to-digital conversion (ADC) value.

Input Voltage	Status
12.0	4092
9.0	3069
6.0	2046
3.0	1023
0.0	0

Table 3: Analog Input Status Readings

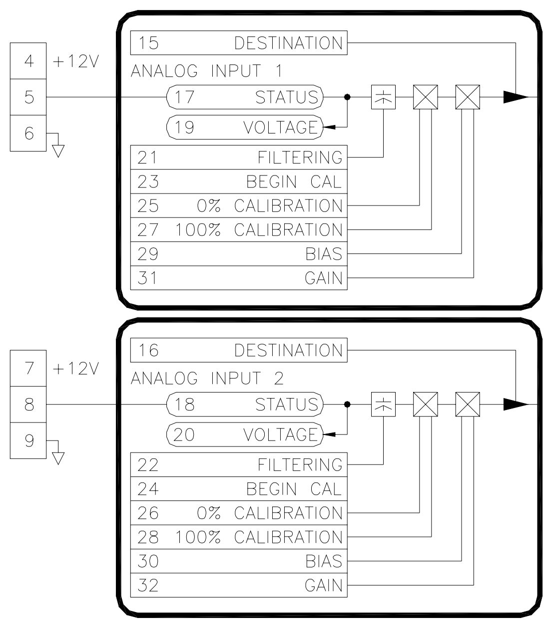

Figure 15: Analog Inputs

Voltage (19-20, Read Only)
The voltage level on the analog input.

Filtering (21-22, Read/Write, default: 0)
An averaging filter can be applied to the incoming signal to reduce the effects of noise. Increasing the value increases the filtering.

Begin Calibration (23-24, ICR, default: 0)
For proper measurement, the analog input must be calibrated to the range of the incoming signal. Calibration is performed by setting the **0% Calibration** and **100% Calibration** parameters. This can be done manually (see below) or by allowing the MicroManager to measure the levels.

Calibration is started by setting this parameter to 1. After the Enter button is pressed, the display will momentarily display LoCAL (Low Calibration). The display will then change showing the ADC value. The minimum signal should be applied to the input. When the Enter button is pressed, the ADC value will be recorded.

The display will then momentarily display HiCal (High Calibration) and then show the ADC value. The maximum signal should be applied to the input. When the Enter button is pressed, the ADC value will be recorded.

If the low calibration value is less than the high calibration value, the low and high value will be stored in the **0% Calibration** and **100% Calibration** parameters. Otherwise, the display will show CAL Error and the calibration values will be discarded and the routine will need to be repeated.

0% Calibration (25-26, Read/Write, default: 0)
This calibration value defines the minimum input signal. This value corresponds to the 12 bit ADC value when the analog input is at its minimum level. For proper operation, the **0% Calibration** value must be less than the **100% Calibration** value. Use the following formula to set the value manually.

$$\text{0\% Calibration} = \frac{\text{Minimum Input Voltage}}{\text{12V}} \times 4092$$

100% Calibration (27-28, Read/Write, default: 4092)
This calibration value defines the maximum input signal. This value corresponds to the 12 bit ADC value when the analog input is at its maximum level. For proper operation, the **100% Calibration** value must be greater than the **0% Calibration** value. Use the following formula to set the value manually.

$$\text{100\% Calibration} = \frac{\text{Maximum Input Voltage}}{\text{12V}} \times 4092$$

Bias (29-30, Read/Write, default: 0.00%)
This parameter defines the value sent to the target parameter when the input signal is at or below 0%.

Gain (31-32, Read/Write, default: 100.00%)
This parameter defines the value sent to the target parameter when the input signal is at or above 100%.

7.2 Digital Inputs

The MicroManager has four configurable digital inputs. Each input can write one of two values to any Read/Write parameter. Terminal 15 is used to select Sinking or Sourcing logic. Refer to D13429 on page 87 for more details.

Destination (41-44, ICR, default: 0)
The tag of the target parameter that the digital input will control.

Status (53-56, Read Only)
The state of the digital input, open or closed.

Open Value (45-48, Read/Write, default: 0)
The value in this parameter is sent to the target parameter when the digital input is open (off).

Closed Value (49-52, Read/Write, default: 1)
The value in this parameter is sent to the target parameter when the digital input is closed (on).

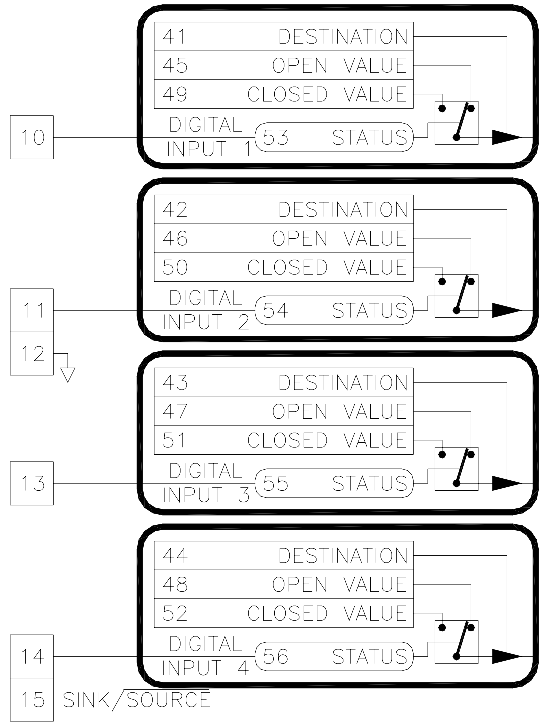

Figure 16: Digital Inputs

7.3 Frequency Input

The MicroManager has one configurable frequency input. It can be configured to write to any Read/Write parameter. Additionally, this input can simultaneously function as a pulse or revolution counter. Terminal 19 is used to select Sinking or Sourcing logic for the frequency input. Refer to D13429 on page 87 for more details.

Destination (65, ICR, default: 0)
The tag of the target parameter that the frequency input will control.

Status (66, Read Only)
The level of the input signal in Hertz.

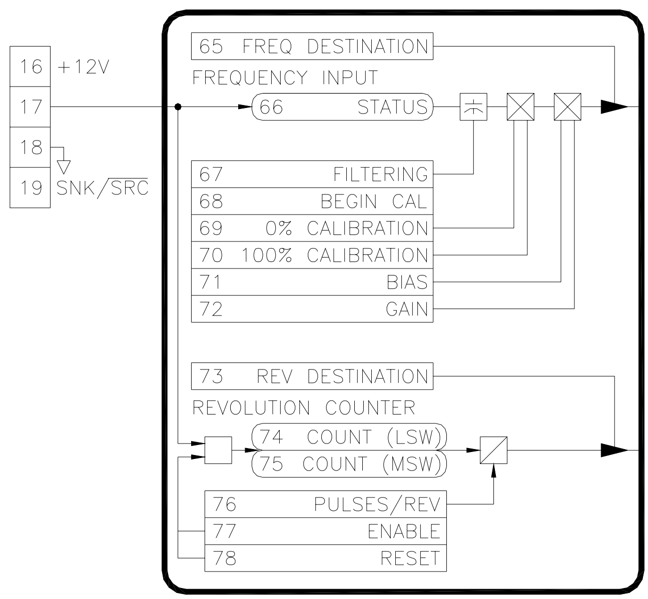

Figure 17: Frequency Input

Filtering (67, Read/Write, default: 0)
An averaging filter can be applied to the incoming signal to reduce the effects of noise. Increasing the value increases the filtering.

Begin Calibration (68, ICR, default: 0)
For proper measurement, the frequency input must be calibrated to the range of the incoming signal. Calibration is performed by setting the **0% Calibration** and **100% Calibration** parameters. This can be done manually (see below) or by allowing the MicroManager to measure the levels.

Calibration is started by setting this parameter to 1. After the Enter button is pressed, the display will momentarily display LoCAL (Low Calibration). The display will then change showing the frequency value in Hertz. The minimum signal should be applied to the input. When the Enter button is pressed, the frequency value will be recorded.

The display will then momentarily display HiCal (High Calibration) and then show the frequency value. The maximum signal should be applied to the input. When the Enter button is pressed, the frequency value will be recorded.

If the low calibration value is less than the high calibration value, the low and high value will be stored in the **0% Calibration** and **100% Calibration** parameters. Otherwise, the display will show CAL Error and the calibration values will be discarded and the routine will need to be repeated.

0% Calibration (69, Read/Write, default: 0)
This calibration value defines the minimum input signal in Hertz. This value corresponds to the frequency level when the input is at its minimum level. For proper operation, the **0% Calibration** value must be less than the **100% Calibration** value.

100% Calibration (70, Read/Write, default: 50000)
This calibration value defines the maximum input signal in Hertz. This value corresponds to the frequency level when the input is at its maximum level. For proper operation, the **100% Calibration** value must be greater than the **0% Calibration** value.

Bias (71, Read/Write, default: 0.00%)
This parameter defines the value sent to the target parameter when the input signal is at or below 0%.

Gain (72, Read/Write, default: 100.00%)
This parameter defines the value sent to the target parameter when the input signal is at or above 100%.

Revolution Destination (73, ICR, default: 0)
The tag of the target parameter that the revolution counter will control.

Count (74-75, Read Only)
The value of the pulse counter. When **Count Enable** is 1, every rising edge on the input signal causes the value to increase by 1. In order to accommodate for high resolution encoders, the value is a 32 bit integer and thus has a most significant (upper) 16 bits, and a least significant (lower) 16 bits. The counter has an upper limit of 4,294,967,295.

Pulses Per Revolution (76, Read/Write, default: 1)
This parameter is divided into the **Count** value to produce a revolution count. For example, if a 1024 line encoder is connected and this parameter is set to 1024, then the target parameter will increment once for each full revolution of the encoder.

Reset (78, Read/Write, default: 0)
When this parameter is 1, it resets **Count** to zero.

7.4 HMI

The HMI block provides for diagnostic monitoring of the buttons over the communications port. A status of zero indicates the button is not pressed. A status of 1 indicates the button is pressed.

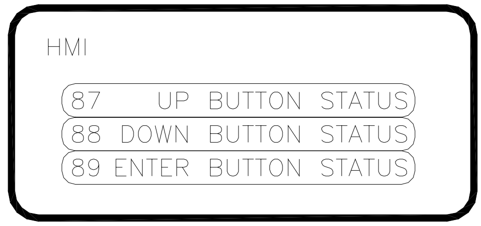

Figure 18: HMI

7.5 Communications

The MicroManager is equipped with a Modbus® RTU RS485 slave port. The port can operate in 2 or 4 wire mode. Refer to D13307 on page 102 for connection information. Refer to Modbus® Overview on page 75 for more details on the Modbus® protocol.

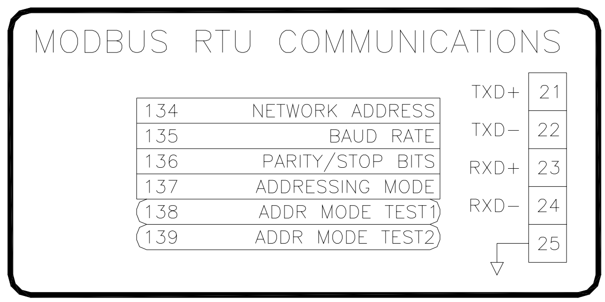

Figure 19: Communications

Network Address (134, Read/Write, default: 1)
The address of the MicroManager on the Modbus® network. Each device on the bus must have a unique network address.

Baud Rate (135, Read/Write, default: 4)
Sets the transmit and receive rate of data over the serial port.

Setting	Baud
0	2400
1	4800
2	9600
3	19200
4	**38400**

Table 4: Baud Rate Settings

Parity/Stop Bits (136, Read/Write, default: 1)
Sets the parity and number of stop bits for the serial port.

Setting	Parity, Stop Bits
0	None,1
1	**None,2**
2	Even,1
3	Odd,1

Table 5: Parity Stop Bits Settings

Addressing Mode (137, Read/Write, default: 1)
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 can be used to implement either scheme and "match up" the addresses so that the actual address is used to address that register (making programming much easier).

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.

Addressing Mode Test 1 (138, Read Only)
Test parameter that has a fixed value of 21845 (5555 in hex) .

Addressing Mode Test 2 (139, Read Only)
Test parameter that has a fixed value of 43690 (AAAA in hex) .

7.6 Digital Outputs

The MicroManager has two configurable open collector (sinking) type digital outputs.

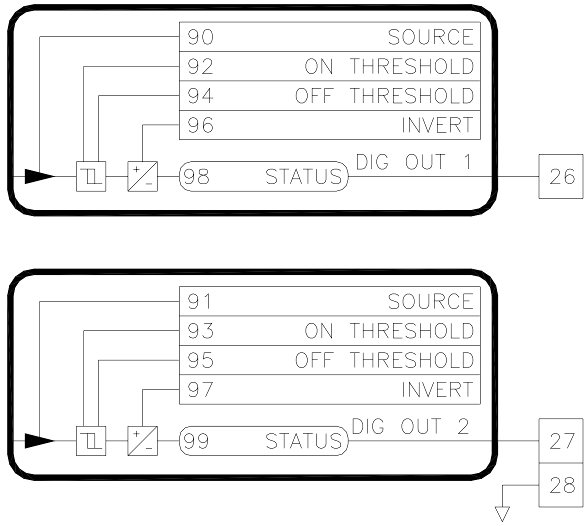

Figure 20: Digital Outputs

<u>Source (90-91, ICR, default: 0)</u>
The tag of the parameter that will control the digital output.

<u>On Threshold (92-93, Read/Write, default: 0.01%)</u>
The level that the source parameter must equal or exceed in order for the digital output to be on.

<u>Off Threshold (94-95, Read/Write, default: 0.00%)</u>
The level that the source parameter must be equal to or fall below in order for the digital output to be off.

<u>Invert (96-97, Read/Write, default: 0.01%)</u>
When this parameter is 1, the logic of the digital output is inverted.

<u>Status (98-99, Read Only)</u>
The state of the digital output. A zero indicates Off, and a 1 indicates On (sinking).

7.7 Analog Outputs

The MicroManager has three configurable analog outputs. Outputs 1 and 2 have 12 bit resolution and can be used as voltage and/or current outputs. Output 3 has 10 bit resolution and can only be used as a voltage output. Furthermore, output 3 must be connected to a high impedance input (>1megohm) for proper operation.

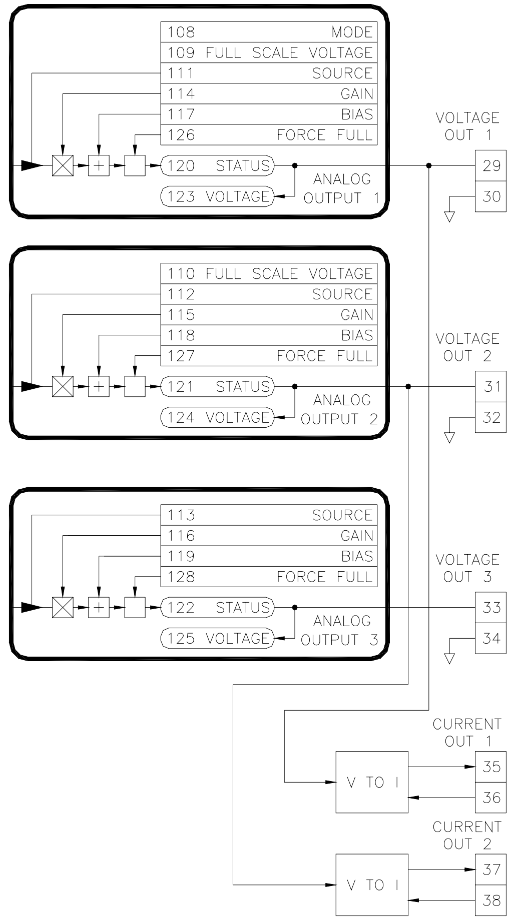

Figure 21: Analog Outputs

<u>Mode (108, ICR, default: 0)</u>
When Mode is 0 (unipolar), analog outputs 1 and 2 operate independently. When Mode is 1 (bipolar), both outputs are used in conjunction to provide a single bipolar output signal. Note that special wiring precautions are needed when using this mode. Terminal 29 is the positive output signal and Terminal 31 is the negative output signal. There must be no other connections between circuit common and the external device. An isolator board may be required. Refer to drawing D13429 on page 87 for an example bipolar connection. In this mode, the Source, Bias, & Gain parameters for Analog Output 2 are ignored.

<u>Full Scale Voltage (109-110, Read/Write, default: 1)</u>
The digital to analog converter (DAC) is capable of outputting a full scale voltage signal of 5V or 10V. By default, this parameter is set to 1 to provide a nominal 0 to +10VDC signal on the output. If only a 5VDC or lower signal is required, set this parameter to 0. This will reduce the full scale output voltage level to 5VDC while maintaining full 12 bit resolution. Further scaling of the output signal level is accomplished via the **Bias** and **Gain** parameters. Note that this setting also affects the full scale current output levels. For nominal 0 or 4 to 20mA outputs, this parameter must be set to 1.

<u>Source (111-113, ICR, default: 0)</u>
The tag of the parameter that will control the analog output.

<u>Gain (114-116, Read/Write, default: 100.00%)</u>
The maximum analog output level is controlled by the **Gain** parameter. A 10V or 20mA signal will be obtained when the **Gain** is at 100% and the value of the source parameter is also at 100.00%.

<u>Bias (117-119, Read/Write, default: 0.00%)</u>
The Bias parameter is used to set a minimum output voltage or current.

Status (120-122, Read Only)
The DAC bit values. Outputs 1 & 2 are 12 bits. Output 3 is 10 bit. The table below gives common readings assuming the Full Scale Voltage is set to 10V. If set to 5V, the Voltage and Current levels will be reduced by 50%.

Voltage	Current	12 Bit Status (1,2)	10 Bit Status (3)
10.0	20.0mA	4095	1023
7.5	15.0mA	3071	1021
5.0	10.0mA	2047	511
2.5	5.0mA	1024	255
0.0	0.0mA	0	0

Table 6: Analog Output Status Readings

Voltage (123-125, Read Only)
The voltage level of the analog outputs.

Force Full (126-128, Read/Write, default: 0)
When set to 1, this parameter forces the analog output to maximum output. This is typically only used during setup.

7.8 PID Loop

The MicroManager provides a PID Loop for system integration with dancer potentiometers, loadcells, etc…

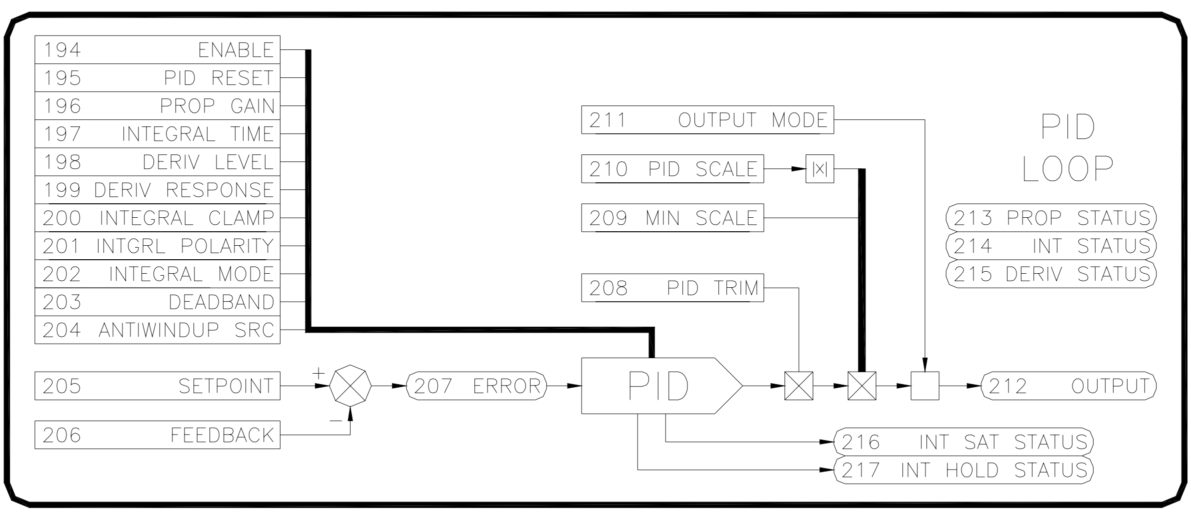

Figure 22: PID Loop Blocks

Enable (194, Read/Write, default: 0)
When this parameter has a value of 0, the **Proportional Status**, **Integral Status**, **Derivative Status**, and the **PID Output** are all reset to zero.

PID Reset (195, Read/Write, default: 0)
When this parameter has a value of 1, the **Proportional Status**, **Integral Status**, **Derivative Status**, and the **PID Output** are all reset to zero.

Proportional Gain (196, Read/Write, default: 5.00)
The **Proportional Gain** scales the output based upon the **Error**. Increasing the gain improves the loop response but can also increase overshoot.

Integral Time (197, Read/Write, default: 10.000s)
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 Level (198, Read/Write, default: 0.00%)
With derivative action, the controller output is proportional to the rate of change of the error. The **Derivative Level** adjustment is used to scale the derivative portion of the final PID Output. Setting this to 0 disables the derivative portion.

Derivative Response (199, Read/Write, default: 3.24ms)
With derivative action, the controller output is proportional to the rate of change of the error. The **Derivative Response** output is based upon the predicted **Error** by analyzing the previous error levels. This parameter determines the interval that the error levels are sampled. Thus, this parameter is a time adjustment in milliseconds. Higher values increase the time between samples.

Integral Clamp (200, Read/Write, default: 0)
When **Integral Clamp** is 1, the **Integral Status** is clamped to zero, yielding proportional and derivative control only.

Integral Polarity (201, Read/Write, default: 1)
A value of 0 sets the integral portion for unipolar (positive only) mode. A value of 1 sets the integral portion for bipolar (positive and negative) mode.

Integral Mode (202, Read/Write, default: 0)
The Integral portion has two modes of operation. A setting of 0 selects the Linear mode of operation, and 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. A setting of 1 selects the Standard mode of operation, and the rate of change of the integral is dependent on the amount of error (the greater the error, the faster the integration).

Deadband (203, Read/Write, default: 0.00%)
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.

Antiwindup Source (204, Read/Write, default: 0)
Integral windup refers to a situation in PID controllers where the integral portion continues to integrate (either up or down) and the output has saturated. Thus, changes in the integral signal are not reflected on the controller output. This parameter is designed to prevent the integral from winding up in the negative direction by sensing when the output has saturated and the integral is decreasing.

When this occurs, this function prevents the integral from decreasing. This mode is indicated by **Integral Hold Status** having a value of 1. The value of this parameter determines which parameter to monitor. Typically, when used, this value would be set to one of the Analog Output Status parameters (120-122). This is an optional parameter. This function is disabled when set to 0.

Setpoint (205, Read/Write, default: 0.00%)
This is the desired operating value of the controlled system. In dancer systems, this is the desired position that the dancer should operate. In loadcell systems, this is the desired tension.

Feedback (206, Read/Write, default: 0.00%)
This is the actual operating value of the controlled system. In dancer systems, this is the actual position of the dancer. In loadcell systems, this is the actual material tension. Typically, an analog input is linked to this parameter and thus controls its value.

Error (207, Read-Only)
The **Feedback** is subtracted from the **Setpoint** to produce the **Error**.

PID Trim (208, Read/Write, default: 100.00%)
The **PID Trim** adjustment controls the amount of correction that the **PID Output** can provide. In many systems, the PID only needs to provide a small amount of correction as other signals (line speed, diameter) provide the major portion of the output signal. In these cases, a general setting of 10-20% is a good starting point. This parameter can also be used to invert the action of the loop by inverting the sign.

PID Min Scale (209, Read/Write, default: 0.00%)
The **Min Scale** adjustment provides for a minimum level of scaling even when the **PID Scale** parameter is at zero.

PID Scale (210, Read/Write, default: 100.00%)
The **PID Scale** in concert with **PID Min Scale** provides a method for an external signal to scale the **PID Output**. This signal is typically a line speed signal from an analog or frequency input. This can give dancer or loadcell systems consistent control sensitivity over variations in line speed.

PID Output Mode (211, Read/Write, default: 0)
A setting of 0 allows for bipolar output. A setting of 1 allows for positive only output (i.e., when negative values are produced by the loop, the output is clamped at zero). A setting of 2 allows for negative only output (i.e., when positive values are produced by the loop, the output is clamped at zero).

PID Output (212, Read-Only)
The output of the PID loop after being modified by the **PID Trim, PID Min Scale, PID Scale,** and **PID Output Mode** parameters.

Proportional Status (213, Read-Only)
The individual proportional component of the **PID Output**. This parameter is provided

for aid in setup and tuning.

Integral Status (214, Read-Only)
The individual integral component of the **PID Output**. This parameter is provided for aid in setup and tuning.

Derivative Status (215, Read-Only)
The individual integral component of the **PID Output**. This parameter is provided for aid in setup and tuning.

Integral Saturation Status (216, Read-Only)
When the Integral signal saturates at ±100.00%, the **Integral Saturation Status** parameter becomes True. Typically, this indicates that the **PID Trim** parameter may need to be increased. This parameter is provided for aid in setup and tuning.

Integral Hold Status (217, Read-Only)
This indicates when the integral is placed on hold due to the Anti-Integral Windup function. Refer to **Antiwindup Source** above.

7.9 Roll Speed Calculator

A problem encountered in center driven velocity 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 center driven 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 (See Diameter Select in Diameter Calculator).

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.

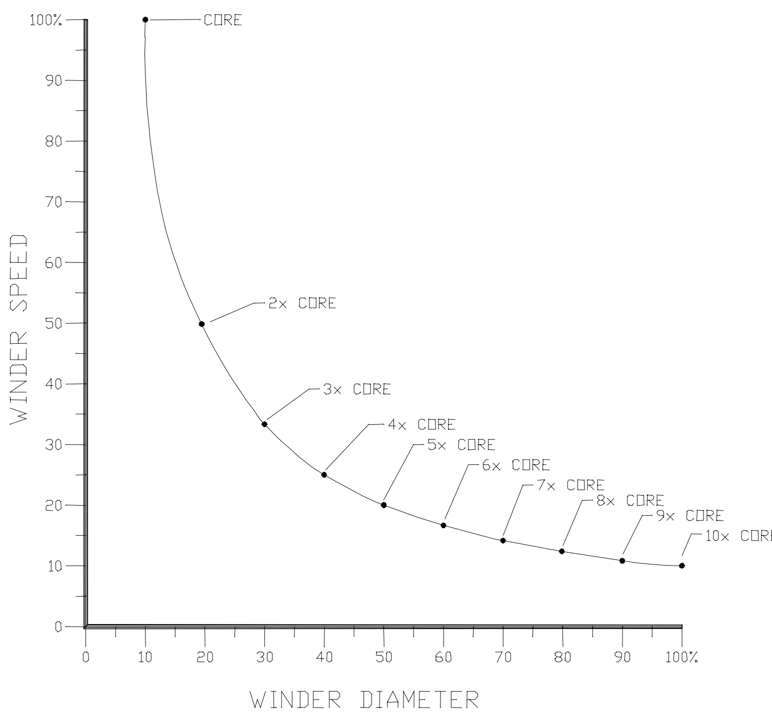

Figure 23: Winder Speed Vs Diameter

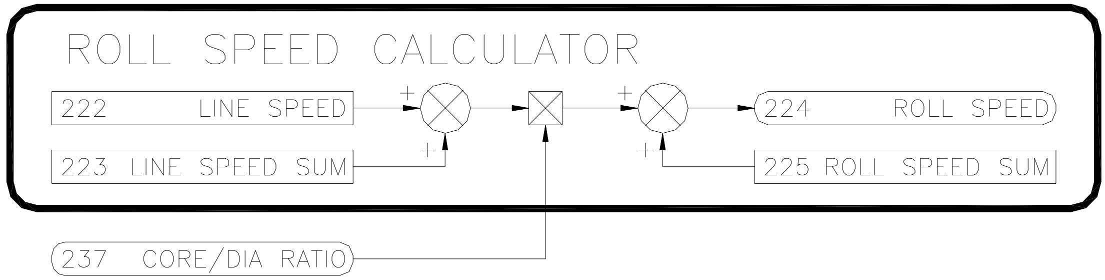

Figure 24: Roll Speed Calculator

<u>Line Speed (222, Read/Write, default: 0.00%)</u>
This signal is used along with the Core/Diameter Ratio to calculate the takeup or letoff **Roll Speed**.

<u>Line Speed Sum (223, Read/Write, default: 0.00%)</u>
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.

<u>Roll Speed (224, Read-Only)</u>
The calculated takeup or letoff roll speed.

<u>Roll Speed Sum (225, Read/Write, default: 0.00%)</u>
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.

7.10 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.

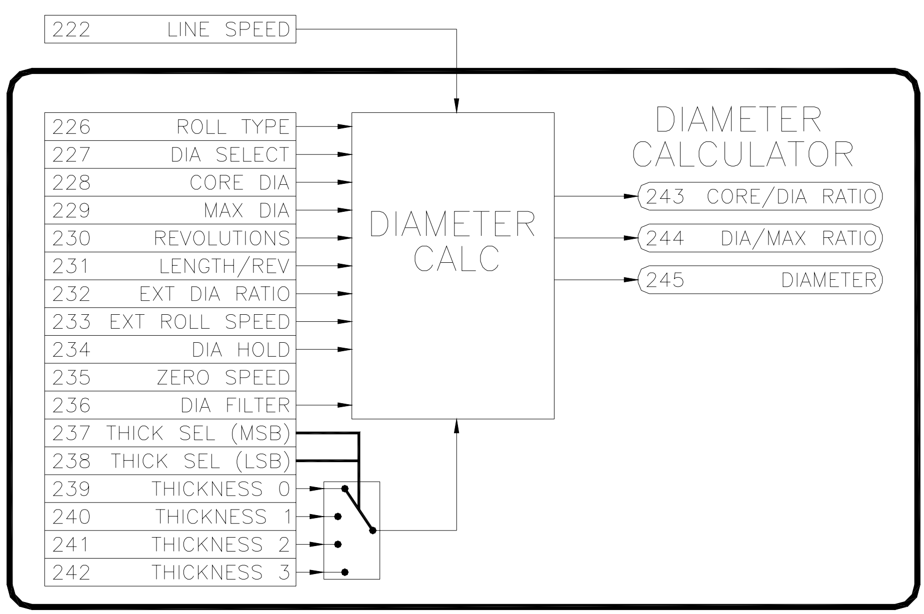

Figure 25: Diameter Calculator

Roll Type (226, Read/Write, default: 0)
Set to zero for winders, and one for unwinders. This parameter is needed by the Diameter Calculator only when **Diameter Select** is set for *2 (Roll Revolutions)* or *3 (Line Revolutions)*.

Diameter Select (227, Read/Write, default: 0)
Determines which method is used to calculate the diameter.

0=None
The diameter calculator is disabled, and the **Diameter** is equal to the **Core Diameter**.

1=External Diameter
An external diameter signal is provided to the calculator. This signal could come from an ultrasonic measuring unit, laser sensor, or from a mechanical measuring device such as a rider arm and pot.

2=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 from a pulse type encoder mounted on the takeup or letoff drive or roll.

3=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 from a pulse type encoder mounted on the line drive.

4=*Line Speed & Roll Speed*
The diameter is calculated by dividing the Line Speed signal by the Roll Speed signal. Note: This method of diameter calculation is not recommended.

Core Diameter (228, Read/Write, default: 1.00 unit)
The diameter of an empty core. If multiple size cores are used, enter the smallest diameter. The only exception is when Diameter Select is equal to two or three. In these cases, enter the average of the cores that will be used. Any unit of measurement (inches, millimeters, etc…) can be used.

Maximum Diameter (229, Read/Write, default 10.00 units)
The maximum roll diameter. If multiple size max diameter rolls are used, enter the largest diameter. The only exception is when Diameter Select is equal to two or three. In these cases, enter the average value of the maximum diameter. Unit of measurement must be the same as the **Core Diameter**.

Revolutions (230, Read/Write, default: 0)
The number of revolutions of the takeup/letoff roll or the line speed roll. This value is used to calculate the diameter when **Diameter Select** is set for *2 (Roll Revolutions)* or *3 (Line Revolutions)*. Typically, the Revolution Counter on the Frequency Input is linked to this parameter when it is used.

Length Per Revolution (231, Read/Write, default: 0.001 units)
The length of material per one revolution of the Line Speed pulse counter. Used to calculate the diameter when **Diameter Select** is set to *3 (Line Revolutions).* The unit of measurement must be the same as that used in the **Core Diameter**. Typically, when used, this would be set to the circumference of the line speed roller in contact with the material.

External Diameter Ratio (232, Read/Write, default: 0.00%)
A ratio that is proportional to the diameter of the takeup or letoff roll. Used to calculate the diameter when **Diameter Select** is set to *1 (External).* Typically, an external analog input is linked to this parameter to provide the diameter information. The signal should be scaled via the Gain and Bias of the analog input so that this value reads 0.00% at **Core Diameter** and 100.00% at **Maximum Diameter**.

External Roll Speed (233, Read/Write, default: 0.00%)
This signal is used along with **Line Speed** to calculate **Diameter** when **Diameter Select** is set to 4 *(Line Speed & Roll Speed).* Typically, an analog or frequency input is linked to this parameter to provide the calculator with the winder or unwinder speed.

Diameter Hold (234, Read/Write, default: 0)
When **Diameter Select** is set to *4 (Line Speed & Roll Speed)*, this parameter can be used to hold or pause the diameter calculation. This would need to be used only if the line will be stopped before completely winding or unwinding a full roll AND it is necessary to maintain tension on the material while stopped. Since the diameter is calculated from the Line and Roll speed signals (and these signals will go to zero when the process is stopped), the calculated diameter will fall to the **Core Diameter** setting. This in turn will cause the tension on the material to decrease. When the process is restarted, the Line and Roll speed signals are again present, and the diameter calculation will return to normal. For many applications, this decrease in tension while stopped is acceptable. However, for processes that require the tension to be maintained while stopped, external logic will be required to control the **Diameter Hold** parameter (typically linked from a digital input).

Initially, **Diameter Hold** should be zero when a new roll is started. Before the process is stopped, **Diameter Hold** should be set to one (pausing the diameter calculation). When the process is restarted, **Diameter Hold** should be set back to zero (allowing the calculation to be performed).

Zero Speed (235, Read/Write, default: 2.00%)
When Diameter Select = 4 (Line Speed and Roll Speed), and the Line Speed falls below this level, the diameter calculation is suspended and the **Diameter** is set to **Core Diameter**.

Diameter Filter (236, Read/Write, default: 0)
An averaging filter can be applied to Diameter calculation. Increasing the value increases the filtering.

Thickness Select (237-238, Read Write, default: 0)

In the cases where the thickness of the material is used to calculate the diameter (**Diameter Select** equals *2 (Roll Revolutions)* or *3 (Line Revolutions)*), the diameter calculator provides four thickness settings to accommodate different materials. Each of these four settings can be selected by the **Thickness Select** parameters. Typically, Digital Inputs 3 and 4 are setup to control the **Thickness Select** parameters so external contacts can be used to select the desired Thickness.

Thickness Select MSB	Thickness Select LSB	Thickness Used
0	**0**	**P239: Thickness 0**
0	1	P240: Thickness 1
1	0	P241: Thickness 2
1	1	P242: Thickness 3

Table 7: Thickness Selections

Thickness 0-3 (239-242, Read Write, default: 0.000 units)
These parameters allow four material thickness presets to be defined. The actual thickness used by the calculator is determined by the **Thickness Select** parameters. The unit of measurement should be the same as that of the **Core Diameter**.

Core/Diameter Ratio (243, Read Only)
The ratio obtained by dividing the **Core Diameter** by the calculated **Diameter**. This value is used along with **Line Speed** to calculate the **Roll Speed**.

Diameter/Max Ratio (244, Read Only)
The ratio obtained by dividing the calculated **Diameter** by the **Max Diameter**.

Diameter (245, Read Only)
The calculated diameter. Unit of measurement is the same as the **Core Diameter**.

7.11 Tension Calculator

The tension calculator is used to provide a tapered **Tension Demand** signal. 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 taper 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**.

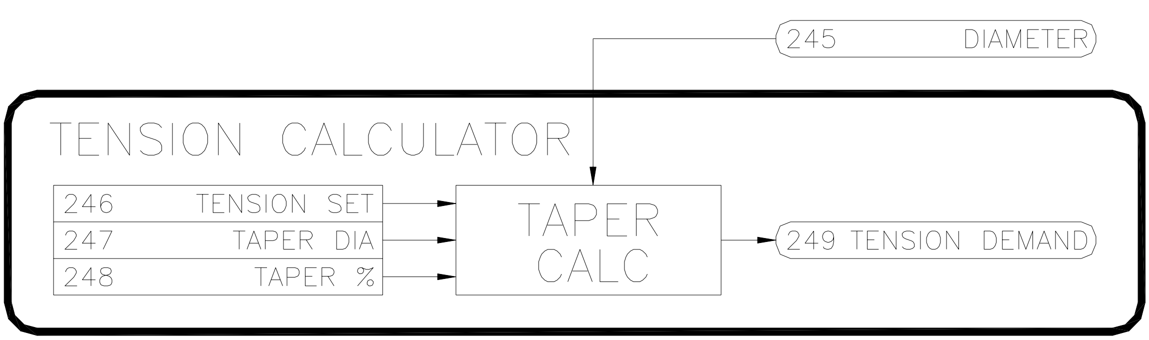

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Figure 26: Tension Calculator

Taper Percentage (248, Read/Write, default: 0.00%)

The desired percentage of the **Tension Setpoint** that the **Tension Demand** signal will be tapered when **Diameter** is at **Max Diameter**. Refer to Figure 27. 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 (249, Read Only)

The tapered tension demand output. **Tension Demand** will be equal to **Tension Setpoint** as the **Diameter** increases from Core Diameter up to the Taper Diameter point. As **Diameter** increases, **Tension Demand** is decreased at a rate controlled by the **Taper Percentage**.

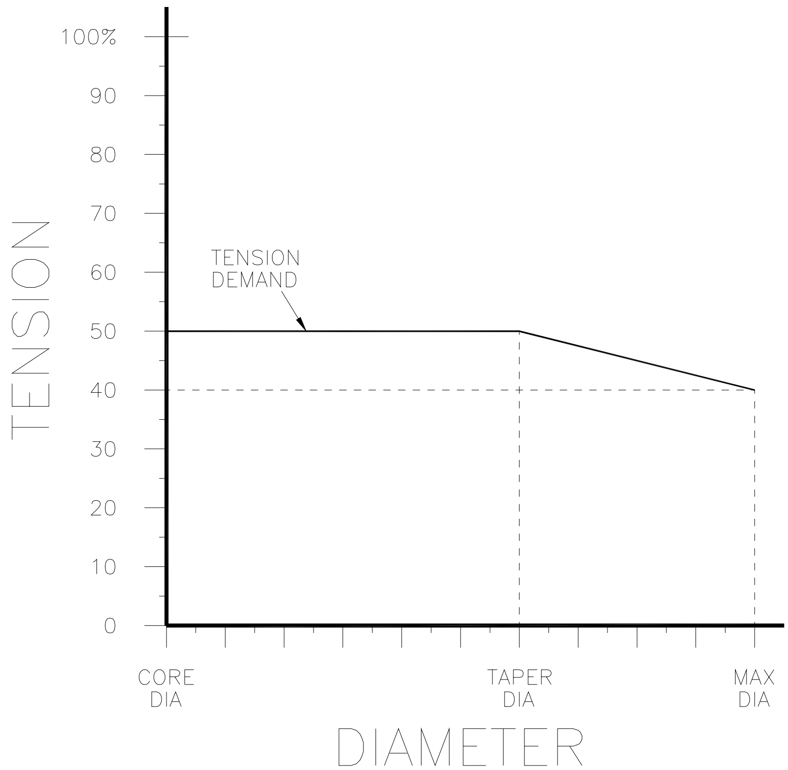


Figure 27: Taper Tension Example

7.12 Logic Gates

The 4 Logic Gate blocks provide logic and comparison functions.

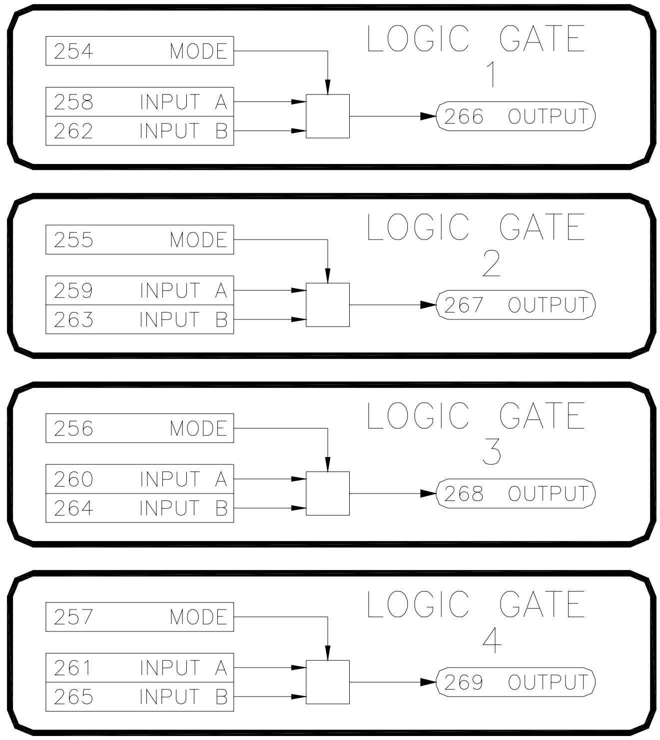


Figure 28: Logic Gate Blocks

Mode (254-257, Read/Write, default: 0)
Determines the function of the gate.

0=Off Switch
Output is equal to **Input B**.

1=On Switch
Output is equal to **Input A**.

2=And
Output is 1 if both **Input A** and **Input B** are 1. Otherwise, **Output** is False.

3=Nand
Inverted output of And.

4=Or
Output is 1 if either **Input A** or **Input B** is 1. Otherwise, **Output** is 0.

5=Nor
Inverted output of Or.

6=Exclusive Or (Xor)
Output is 1 if either **Input A** or **Input B** is 1, but not both.

7=Exclusive Nor (Xnor)
Inverted output of Exclusive Or.

8=Not
Output is 1 if **Input A** is 0. **Output** is 0 if **Input A** is 1.

9=Greater Than
Output is 1 if **Input A** > **Input B**. Otherwise Output is 0.

10=Greater Than or Equal
Output is 1 if **Input A** >= **Input B**. Otherwise Output is 0.

11=Less Than
Output is 1 if **Input A** < **Input B**. Otherwise Output is 0.

12=Less Than or Equal
Output is 1 if **Input A** <= **Input B**. Otherwise Output is 0.

13=Equal
Output is 1 if **Input A** equals **Input B**. Otherwise Output is 0.

14=Not Equal
Output is 1 if **Input A** and **Input B** are not equal. Otherwise Output is 0.

15=Absolute Value
Output is equal to the absolute value of **Input A**.

16=Negative Absolute Value

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

17=Invert

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

18=Sum

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

19=Difference

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

20=Ratio

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

21=Filter

Output is equal to the filtered (averaged) value of **Input A. Input B** ranges from 0 to 15 and controls the filter gain. The higher the gain, the more filtering that is applied.

22=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
0	0	No Change
0	1	0
1	0	1
1	1	0

Table 8: Set Reset Truth Table

23=Positive Edge Latch

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

24=Negative Edge Latch

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

25=On Delay Timer †

When Input A becomes True, the Output switches to True after a delay set by Input B. Output switches back to False when Input A becomes False.

26=Off Delay Timer †

When Input A becomes False, the Output switches to False after a delay set by Input B. Output switches back to True when Input A becomes True.

27=One Shot †

When Input A becomes True, the Output immediately switches from False to True. After a delay set by Input B, the Output switches back to False. The gate ignores any successive state changes on Input A (i.e. cannot be retriggered).

28=Retriggerable One Shot †

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

29=One Shot And †

Performs the same as the One Shot described above, except that the final Output is a One Shot gate ANDed with Input A. Thus, the Output can be reset before the Input B time has expired by Input A transitioning to False.

30=Repeat Cycle †

In this mode, the Output continually cycles between True and False when Input A is True. Input B sets the time in seconds.

<u>Input A (258-261, Read/Write, default: 0)</u>

First input to the logic gate.

<u>Input B (262-265, Read/Write, default: 0)</u>

Second input to the logic gate.

<u>Output (266-269, Read/Write, default: 0)</u>

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

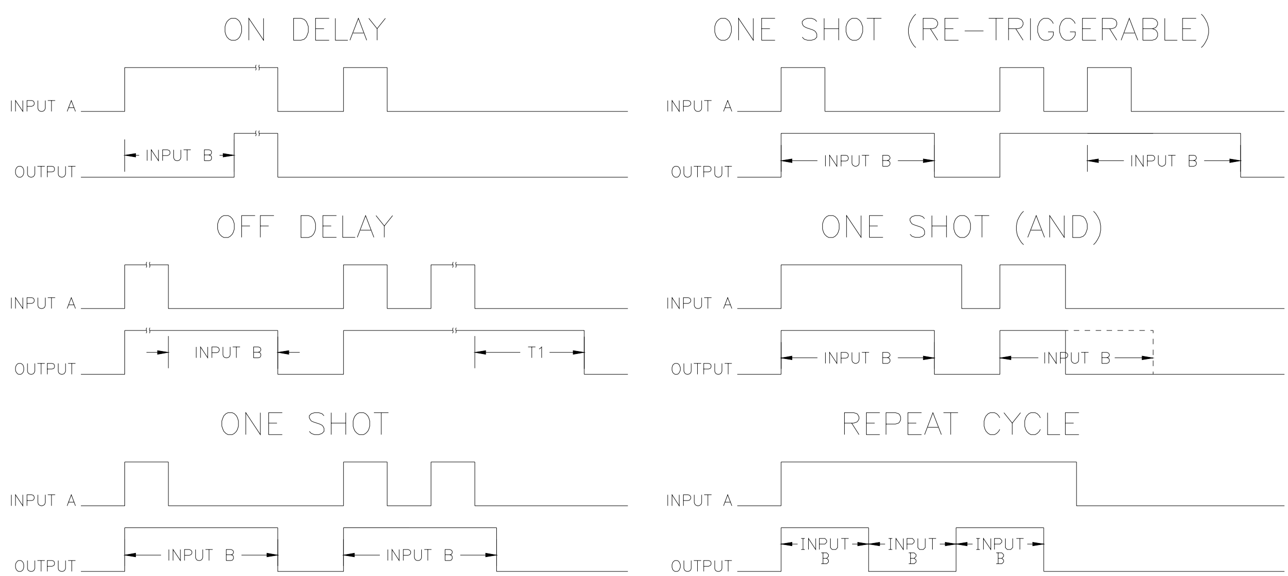


Figure 29: Logic Gate Timer Functions

† The typical operating range of Input B in Timer modes 25-30 is 0.1 to 400.0 seconds. Setting Input B for 0.0 seconds in modes 25 & 26 produces a delay of approx 7 to 12ms. Setting Input B for 0.0 seconds in mode 30 produces an output pulse train with a period of 30ms. Setting Input B to 0.0 seconds in the remaining timer modes effectively disables the timing function.

7.13 Reference Select Blocks

The Reference Select blocks select between multiple references.

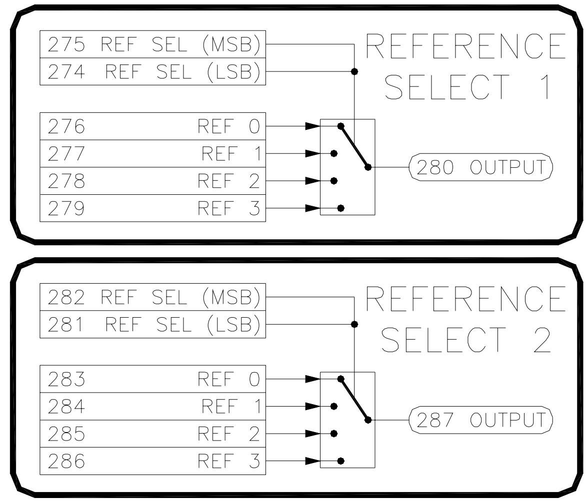


Figure 30: Reference Selects Blocks

<u>Reference n (276-279,283-286, Read/Write, default: 0.00%)</u>
References 0 through 3 are four independently adjustable references that can be selected by the **Reference Select** parameters.

<u>Reference Select (274-275,281-282, Read/Write, default: 0)</u>
The **Reference Select** parameters select between the four internal references and passes the value to the **Reference Select Output**. The parameter is divided into to parts, a Most Significant Bit and a Least Significant Bit to allow all four 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 9: Reference Selection

<u>Reference Select Output (280, 287, Read-Only)</u>
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** parameters.

7.14 Internal Links

The internal links can be used to connect or link parameters together. The MicroManager 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 thickness parameter (3 decimals), 12.34% is converted to an integer value of 1234, and then reformatted with 3 decimal places, 1.234. Therefore, the destination will contain the value 123.4.

<u>Source (ICR, default: 0)</u>
The tag of the source parameter.

<u>Destination (ICR, default: 0)</u>
The tag of the destination parameter.

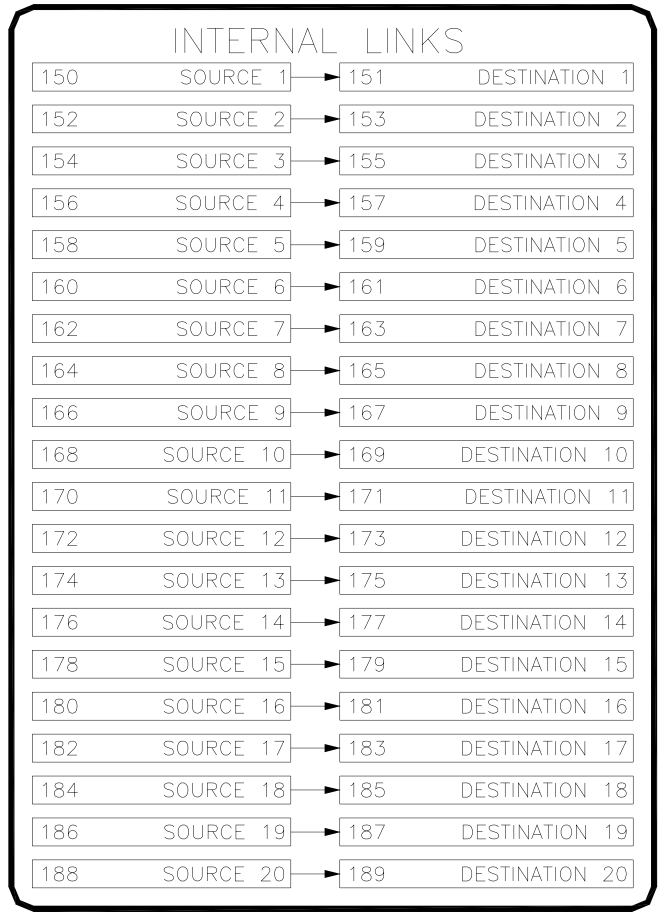


Figure 31: Internal Links

7.15 System Parameters

<u>Save (1, Read/Write, default: 0)</u>
Parameter changes take affect immediately. However, in order to make the changes permanent, the save command must be used. Setting this parameter to 1 causes all of the parameters to be written to the internal EEPROM. The Save Status parameter can be used to determine if the parameters were saved successfully.

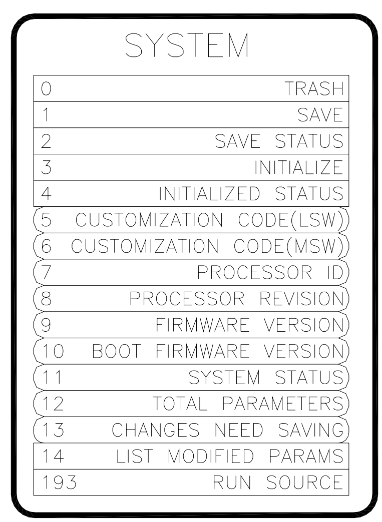


Figure 32: System Parameters

Save Status (2, Read Only)
Result of the Save command.

Save Status	Description
0	Saved Successfully
1	Saving in progress
2	Error

Table 10: Save Status Readings

Initialize (3, Read/Write, default: 0)
Used to initialize the MicroManager to one of the pre-defined control configurations. Refer to Table 1: Pre-defined Configurations on page 9 for more information. Set to 95 to re-initialize the unit to its factory preset state.

MicroManager Model (4, Read Only)
Each MicroManger model has a unique identifier. This parameter has a value of 2 on the PID models.

Customization Code (5-6, Read Only)
For engineering use only.

Processor ID (7, Read Only)
Identification code for the internal processor. For engineering use only.

Processor Revision (8, Read Only)
Hardware revision of the internal processor. For engineering use only.

Firmware Version (9, Read Only)
Version code of the internal firmware.

Boot Firmware Version (10, Read Only)
Version code of the internal boot firmware.

System Status (11, Read Only)
Status register that provides the source of the most recent reset. For engineering use only.

System Status	Description
1	Brown Out Reset
2	Power On Reset
4	Power Down Detection
8	Watchdog Timeout
16	Reset Instruction

Table 11: System Status Readings

Total Parameters (12, Read Only)
The total number of parameters.

Changes Need Saving (13, Read Only)
Status bit that indicates parameters have been changed but not saved.

List Modified Parameters (14, Read/Write, default: 0)
Setting this parameter to one allows the user to scroll through a list of all Read/Write parameters that have been modified from their default values by using the Up and Down buttons. If no parameters have been modified, the display shows **nonE.** The Enter button must be pressed to exit the list.

Run Source (149, Read/Write, default: 0)
The value of this parameter determines which parameter the MicroManager uses to determine if the unit is in the Run mode. When in the Run mode, ICR (Inhibit Change while Running) parameters cannot be changed. For example, this parameter is typically set to 53 (Digital Input 1 Status). The MicroManager is considered to be in the run mode when P53 =1 and stop when P53=0. Please note that this parameter does not affect in any way the operation or execution of any of the internal blocks.

7.16 Auxiliary Parameters

The MicroManager provides 10 auxiliary parameters for general use. One specific function of the auxiliary parameters is to serve as a tie point when linking and input directly to an output.

AUXILIARY

140	AUX 1
141	AUX 2
142	AUX 3
143	AUX 4
144	AUX 5
145	AUX 6
146	AUX 7
147	AUX 8
148	AUX 9
149	AUX 10

Figure 33: Auxiliary Parameters

7.17 Processing Order

The MicroManager 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 pre-configured when the unit is initialized via the P3 parameter. Changes to these settings may only be required if the MicroManager 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 MicroManager 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 **PO1** is executed first. Followed by **PO2**, etc… For example, in order to have the Internal Link 7 processed first, set P292 (**PO1**) to a value of 15. If an internal block's code is not entered into one of the Execution Order's block

PROCESSING ORDER

292	PO 1
293	PO 2
294	PO 3
295	PO 4
296	PO 5
297	PO 6
298	PO 7
299	PO 8
300	PO 9
301	PO 10
302	PO 11
303	PO 12
304	PO 13
305	PO 14
306	PO 15
307	PO 16
308	PO 17
309	PO 18
310	PO 19
311	PO 20
312	PO 21
313	PO 22
314	PO 23
315	PO 24
316	PO 25
317	PO 26
318	PO 27
319	PO 28

Figure 34: Processing Order Block

parameters, it will not be executed by the processor.

Block	Code	Block	Code
PID Loop 1	1	Internal Link 7	15
Application Calculators*	2	Internal Link 8	16
Logic Gate 1	3	Internal Link 9	17
Logic Gate 2	4	Internal Link 10	18
Logic Gate 3	5	Internal Link 11	19
Logic Gate 4	6	Internal Link 12	20
Reference Select 1	7	Internal Link 13	21
Reference Select 2	8	Internal Link 14	22
Internal Link 1	9	Internal Link 15	23
Internal Link 2	10	Internal Link 16	24
Internal Link 3	11	Internal Link 17	25
Internal Link 4	12	Internal Link 18	26
Internal Link 5	13	Internal Link 19	27
Internal Link 6	14	Internal Link 20	28

Table 12: Processing Order Codes

* The Application Calculators consists of the Roll Speed Calculator, Diameter Calculator, & the Tension Calculator. They are executed as a group.

7.18 Parameter Table

The following two tables lists all the MicroManager CRG parameters and their properties. Table 13 is sorted by Tag Number. ICR stands for ***I****nhibit* ***C****hange while* ***R****unning* and identifies the parameters that cannot be modified while the unit is in the Run mode. Furthermore, RO indicates ***R****ead-****O****nly* parameters.

Table 13: Parameters by Tag

Tag	Parameter Name	Min	Max	ICR	RO	Preset	User
0	Trash	0	65535			0	
1	Save	0:False	1:True			0:False	
2	Save Status	0: Save Successful 1: Saving in Progress 2: Save Error			RO	0:Save Successful	
3	Initialize	Refer to page 9		ICR		0	
4	MicroManager Model	0	65535		RO	2	
5	Customization Code (LSW)	0	65535		RO	0	
6	Customization Code (MSW)	0	65535		RO	0	
7	Processor ID	0	2047		RO	0	
8	Processor Hardware Revision	0	31		RO	0	
9	Firmware Version	0	9999		RO	-	
10	Boot Version	0	9999		RO	-	
11	System Status	0	65535		RO	0	
12	Total Parameters	0	65535		RO	-	
13	Changes Need Saving	0:False	1:True		RO	0:False	
14	List Modified Parameters	0:False	1:True			0:False	
15	Analog Input 1 Destination	0	331	ICR		0	
16	Analog Input 2 Destination	0	331	ICR		0	
17	Analog Input 1 Status	0	4092		RO	0	
18	Analog Input 2 Status	0	4092		RO	0	
19	Analog Input 1 Voltage	0.00V	12.00V		RO	0.00V	
20	Analog Input 2 Voltage	0.00V	12.00V		RO	0.00V	
21	Analog Input 1 Filtering	0	15			0	
22	Analog Input 2 Filtering	0	15			0	
23	Analog Input 1 Begin Calibration	0:False	1:True	ICR		0	
24	Analog Input 2 Begin Calibration	0:False	1:True	ICR		0	
25	Analog Input 1 0% Calibration	0	4092			0	
26	Analog Input 2 0% Calibration	0	4092			0	
27	Analog Input 1 100% Calibration	0	4092			4092	
28	Analog Input 2 100% Calibration	0	4092			4092	
29	Analog Input 1 Bias	-200.00%♦	200.00%♦			0.00%♦	
30	Analog Input 2 Bias	-200.00%♦	200.00%♦			0.00%♦	
31	Analog Input 1 Gain	-200.00%♦	200.00%♦			100.00%♦	
32	Analog Input 2 Gain	-200.00%♦	200.00%♦			100.00%♦	
33	Reserved	0	65535		RO	0	
34	Reserved	0	65535		RO	0	
35	Reserved	0	65535		RO	0	
36	Reserved	0	65535		RO	0	
37	Reserved	0	65535		RO	0	
38	Reserved	0	65535		RO	0	
39	Reserved	0	65535		RO	0	
40	Reserved	0	65535		RO	0	
41	Digital Input 1 Destination	0	331	ICR		0	
42	Digital Input 2 Destination	0	331	ICR		0	
43	Digital Input 3 Destination	0	331	ICR		0	
44	Digital Input 4 Destination	0	331	ICR		0	
45	Digital Input 1 Open Value	-200.00%♦	200.00%♦			0.00%♦	
46	Digital Input 2 Open Value	-200.00%♦	200.00%♦			0.00%♦	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	User
47	Digital Input 3 Open Value	-200.00%♦	200.00%♦			0.00%♦	
48	Digital Input 4 Open Value	-200.00%♦	200.00%♦			0.00%♦	
49	Digital Input 1 Closed Value	-200.00%♦	200.00%♦			0.01%♦	
50	Digital Input 2 Closed Value	-200.00%♦	200.00%♦			0.01%♦	
51	Digital Input 3 Closed Value	-200.00%♦	200.00%♦			0.01%♦	
52	Digital Input 4 Closed Value	-200.00%♦	200.00%♦			0.01%♦	
53	Digital Input 1 Status	0:Off	1:On		RO	0:Off	
54	Digital Input 2 Status	0:Off	1:On		RO	0:Off	
55	Digital Input 3 Status	0:Off	1:On		RO	0:Off	
56	Digital Input 4 Status	0:Off	1:On		RO	0:Off	
57	Reserved	0	65535		RO	0	
58	Reserved	0	65535		RO	0	
59	Reserved	0	65535		RO	0	
60	Reserved	0	65535		RO	0	
61	Reserved	0	65535		RO	0	
62	Reserved	0	65535		RO	0	
63	Reserved	0	65535		RO	0	
64	Reserved	0	65535		RO	0	
65	Frequency Input Destination	0	331	ICR		0	
66	Frequency Input Status	0	50000Hz		RO	0Hz	
67	Frequency Input Filtering	0	15			0	
68	Frequency Input Begin Calibration	0:False	1:True	ICR		0:False	
69	Frequency Input 0% Calibration	0	50000Hz			0Hz	
70	Frequency Input 100% Calibration	0	50000Hz			50000Hz	
71	Frequency Input Bias	-200.00%♦	200.00%♦			0.00%♦	
72	Frequency Input Gain	-200.00%♦	200.00%♦			100.00%♦	
73	Revolution Count Destination	0	331	ICR		0	
74	Count (LSW)	0	65535		RO	0	
75	Count (MSW)	0	65535		RO	0	
76	Pulses Per Revolution	1	65535			1	
77	Count Enable	0:False	1:True			0:False	
78	Count Reset	0:False	1:True			0:False	
79	Reserved	0	65535		RO	0	
80	Reserved	0	65535		RO	0	
81	Reserved	0	65535		RO	0	
82	Reserved	0	65535		RO	0	
83	Reserved	0	65535		RO	0	
84	Reserved	0	65535		RO	0	
85	Reserved	0	65535		RO	0	
86	Reserved	0	65535		RO	0	
87	Up Button Status	0:Off	1:On		RO	0:Off	
88	Down Button Status	0:Off	1:On		RO	0:Off	
89	Enter Button Status	0:Off	1:On		RO	0:Off	
90	Digital Output 1 Source	0	331	ICR		0	
91	Digital Output 2 Source	0	331	ICR		0	
92	Digital Output 1 On Threshold	-200.00%♦	200.00%♦			0.01%♦	
93	Digital Output 2 On Threshold	-200.00%♦	200.00%♦			0.01%♦	
94	Digital Output 1 Off Threshold	-200.00%♦	200.00%♦			0.00%♦	
95	Digital Output 2 Off Threshold	-200.00%♦	200.00%♦			0.00%♦	
96	Digital Output 1 Invert	0:False	1:True			0:False	
97	Digital Output 2 Invert	0:False	1:True			0:False	
98	Digital Output 1 Status	0:Off	1:On		RO	0:Off	
99	Digital Output 2 Status	0:Off	1:On		RO	0:Off	
100	Reserved	0	65535		RO	0	
101	Reserved	0	65535		RO	0	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	User
102	Reserved	0	65535		RO	0	
103	Reserved	0	65535		RO	0	
104	Reserved	0	65535		RO	0	
105	Reserved	0	65535		RO	0	
106	Reserved	0	65535		RO	0	
107	Reserved	0	65535		RO	0	
108	Analog Output Mode	0:Unipolar	1:Bipolar	ICR		0:Unipolar	
109	Analog Output 1 Full Scale Voltage	0:5V	1:10V			1:10V	
110	Analog Output 2 Full Scale Voltage	0:5V	1:10V			1:10V	
111	Analog Output 1 Source	0	331	ICR		0	
112	Analog Output 2 Source	0	331	ICR		0	
113	Analog Output 3 Source	0	331	ICR		0	
114	Analog Output 1 Gain	-200.00%	200.00%			100.00%	
115	Analog Output 2 Gain	-200.00%	200.00%			100.00%	
116	Analog Output 3 Gain	-200.00%	200.00%			100.00%	
117	Analog Output 1 Bias	-200.00%	100.00%			0.00%	
118	Analog Output 2 Bias	-200.00%	100.00%			0.00%	
119	Analog Output 3 Bias	-200.00%	100.00%			0.00%	
120	Analog Output 1 Status	0	4095		RO	0	
121	Analog Output 2 Status	0	4095		RO	0	
122	Analog Output 3 Status	0	4095		RO	0	
123	Analog Output 1 Voltage	0.00V	10.00V		RO	0.00V	
124	Analog Output 2 Voltage	0.00V	10.00V		RO	0.00V	
125	Analog Output 3 Voltage	0.00V	10.00V		RO	0.00V	
126	Analog Output 1 Force	0:Off	1:On			0:Off	
127	Analog Output 2 Force	0:Off	1:On			0:Off	
128	Analog Output 3 Force	0:Off	1:On			0:Off	
129	Reserved	0	65535		RO	0	
130	Reserved	0	65535		RO	0	
131	Reserved	0	65535		RO	0	
132	Reserved	0	65535		RO	0	
133	Reserved	0	65535		RO	0	
134	Network Address	1	247			1	
135	Baud Rate	0: 2400 1: 4800 2: 9600 3: 19200 4: 38400				4: 38400	
136	Parity-Stop Bits	0: No Parity, 1 Stop Bit 1: No Parity, 2 Stop Bits 2: Even Parity, 1 Stop Bit 3: Odd Parity, 1 Stop Bit				1: No Parity, 2 Stop Bits	
137	Addressing Mode	0	1			1	
138	Addressing Mode Test 1	21845	21845		RO	21845	
139	Addressing Mode Test 2	43690	43690		RO	43690	
140	Aux 1	0	65535			0	
141	Aux 2	0	65535			0	
142	Aux 3	0	65535			0	
143	Aux 4	0	65535			0	
144	Aux 5	0	65535			0	
145	Aux 6	0	65535			0	
146	Aux 7	0	65535			0	
147	Aux 8	0	65535			0	
148	Aux 9	0	65535			0	
149	Aux 10	0	65535			0	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	User
150	Internal Link 1 Source	0	331	ICR		0	
151	Internal Link 1 Destination	0	331	ICR		0	
152	Internal Link 2 Source	0	331	ICR		0	
153	Internal Link 2 Destination	0	331	ICR		0	
154	Internal Link 3 Source	0	331	ICR		0	
155	Internal Link 3 Destination	0	331	ICR		0	
156	Internal Link 4 Source	0	331	ICR		0	
157	Internal Link 4 Destination	0	331	ICR		0	
158	Internal Link 5 Source	0	331	ICR		0	
159	Internal Link 5 Destination	0	331	ICR		0	
160	Internal Link 6 Source	0	331	ICR		0	
161	Internal Link 6 Destination	0	331	ICR		0	
162	Internal Link 7 Source	0	331	ICR		0	
163	Internal Link 7 Destination	0	331	ICR		0	
164	Internal Link 8 Source	0	331	ICR		0	
165	Internal Link 8 Destination	0	331	ICR		0	
166	Internal Link 9 Source	0	331	ICR		0	
167	Internal Link 9 Destination	0	331	ICR		0	
168	Internal Link 10 Source	0	331	ICR		0	
169	Internal Link 10 Destination	0	331	ICR		0	
170	Internal Link 11 Source	0	331	ICR		0	
171	Internal Link 11 Destination	0	331	ICR		0	
172	Internal Link 12 Source	0	331	ICR		0	
173	Internal Link 12 Destination	0	331	ICR		0	
174	Internal Link 13 Source	0	331	ICR		0	
175	Internal Link 13 Destination	0	331	ICR		0	
176	Internal Link 14 Source	0	331	ICR		0	
177	Internal Link 14 Destination	0	331	ICR		0	
178	Internal Link 15 Source	0	331	ICR		0	
179	Internal Link 15 Destination	0	331	ICR		0	
180	Internal Link 16 Source	0	331	ICR		0	
181	Internal Link 16 Destination	0	331	ICR		0	
182	Internal Link 17 Source	0	331	ICR		0	
183	Internal Link 17 Destination	0	331	ICR		0	
184	Internal Link 18 Source	0	331	ICR		0	
185	Internal Link 18 Destination	0	331	ICR		0	
186	Internal Link 19 Source	0	331	ICR		0	
187	Internal Link 19 Destination	0	331	ICR		0	
188	Internal Link 20 Source	0	331	ICR		0	
189	Internal Link 20 Destination	0	331	ICR		0	
190	Reserved	0	65535		RO	0	
191	Reserved	0	65535		RO	0	
192	Reserved	0	65535		RO	0	
193	Run Source	0	331			0	
194	PID Enable	0:False	1:True			0:False	
195	PID Reset	0:False	1:True			0:False	
196	Proportional Gain	0.00	10.00			5.00	
197	Integral Time	0.100s	30.000s			10.000s	
198	Derivative Level	0.00%	100.00%			0.00%	
199	Derivative Response	3.24ms	100.44ms			3.24ms	
200	Integral Clamp	0:False	1:True			0:False	
201	Integral Polarity	0:Unipolar	1:Bipolar			1:Bipolar	
202	Integral Mode	0:Linear	1:Standard			0:Linear	
203	Deadband	0.00%	30.00%			0.00%	
204	PID Anti-Windup Source	0	331	ICR		0	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	User
205	PID Setpoint	-100.00%	100.00%			0.00%	
206	PID Feedback	-100.00%	100.00%			0.00%	
207	PID Error	-200.00%	200.00%		RO	0.00%	
208	PID Trim	-100.00%	100.00%			100.00%	
209	PID Min Scale	0.00%	100.00%			0.00%	
210	PID Scale	-100.00%	100.00%			100.00%	
211	PID Output Mode	0: Bipolar 1: Positive Only 2: Negative Only				0: Bipolar	
212	PID Output	-100.00%	100.00%		RO	0.00%	
213	Proportional Status	-100.00%	100.00%		RO	0.00%	
214	Integral Status	-100.00%	100.00%		RO	0.00%	
215	Derivative Status	-100.00%	100.00%		RO	0.00%	
216	Integral Saturation Status	0:False	1:True		RO	0:False	
217	Integral Hold Status	0:False	1:True		RO	0:False	
218	Reserved	0	65535		RO	0	
219	Reserved	0	65535		RO	0	
220	Reserved	0	65535		RO	0	
221	Reserved	0	65535		RO	0	
222	Line Speed	-100.00%	100.00%			0.00%	
223	Line Speed Sum	-100.00%	100.00%			0.00%	
224	Roll Speed	-100.00%	100.00%		RO	0.00%	
225	Roll Speed Sum	-100.00%	100.00%		RO	0	
226	Roll Type	0: Winder	1: Unwinder	ICR		0: Winder	
227	Diameter Select	0: None 1: External 2: Roll Revolutions 3: Line Revolutions 4: Line Speed/Roll Speed				0: None	
228	Core Diameter	0.01 UU♣	200.00 UU♣			1.00 UU♣	
229	Max Diameter	0.01 UU♣	200.00 UU♣			10.00 UU♣	
230	Revolutions	0	65535			0	
231	Length Per Revolution	0.001 UU♣	20.000 UU♣			0.001 UU♣	
232	External Diameter Ratio	0.00%	100.00%			0.00%	
233	External Roll Speed	0.00%	100.00%			0.00%	
234	Diameter Hold	0:False	1:True			0:False	
235	Zero Speed	0.00%	100.00%			2.00%	
236	Diameter Filter	0	15			0	
237	Thickness Select (MSB)	0	1			0	
238	Thickness Select (LSB)	0	3			0	
239	Thickness 0	0.001 UU♣	20.000 UU♣			0.001 UU♣	
240	Thickness 1	0.001 UU♣	20.000 UU♣			0.001 UU♣	
241	Thickness 2	0.001 UU♣	20.000 UU♣			0.001 UU♣	
242	Thickness 3	0.001 UU♣	20.000 UU♣			0.001 UU♣	
243	Core/Diameter Ratio	0.00%	100.00%		RO	100.00%	
244	Diameter/Max Ratio	0.00%	100.00%		RO	10.00%	
245	Diameter	0.01 UU♣	200.00 UU♣		RO	1.00 UU♣	
246	Tension Setpoint	0.00%	100.00%			0.00%	
247	Taper Diameter	0.01 UU♣	200.00 UU♣			0.01 UU♣	
248	Taper Percentage	0.00%	100.00%			0.00%	
249	Tension Demand	0.00%	100.00%		RO	0.00%	
250	Reserved	0	65535		RO	0	
251	Reserved	0	65535		RO	0	
252	Reserved	0	65535		RO	0	
253	Reserved	0	65535		RO	0	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	User
254	Logic Gate 1 Mode	0: Off Switch 1: On Switch 2: AND 3: NAND 4: OR 5: NOR 6: XOR 7: XNOR 8: NOT 9: Greater Than 10: Greater Than or Equal 11: Less Than 12:Less Than or Equal 13: Equal 14: Not Equal 15: Absolute Value 16: Negative Absolute Value 17: Invert 18: Sum 19: Difference 20: Ratio 21: Filter 22: Set-Reset Flip Flop 23: Positive Edge Latch 24: Negative Edge Latch 25: On Delay Timer 26: Off Delay Timer 27: One Shot Timer 28: One Shot (Retrigger) 29: One Shot (AND) 30: Repeat Cycle				0: Off Switch	
255	Logic Gate 2 Mode	Same as Logic Gate 1 Mode				0: Off Switch	
256	Logic Gate 3 Mode	Same as Logic Gate 1 Mode				0: Off Switch	
257	Logic Gate 4 Mode	Same as Logic Gate 1 Mode				0: Off Switch	
258	Logic Gate 1 Input A	-200.00%♠	200.00%♠			0.00%♠	
259	Logic Gate 2 Input A	-200.00%♠	200.00%♠			0.00%♠	
260	Logic Gate 3 Input A	-200.00%♠	200.00%♠			0.00%♠	
261	Logic Gate 4 Input A	-200.00%♠	200.00%♠			0.00%♠	
262	Logic Gate 1 Input B	-200.00%♠	200.00%♠			0.00%♠	
263	Logic Gate 2 Input B	-200.00%♠	200.00%♠			0.00%♠	
264	Logic Gate 3 Input B	-200.00%♠	200.00%♠			0.00%♠	
265	Logic Gate 4 Input B	-200.00%♠	200.00%♠			0.00%♠	
266	Logic Gate 1 Output	-200.00%♠	200.00%♠		RO	0.00%♠	
267	Logic Gate 2 Output	-200.00%♠	200.00%♠		RO	0.00%♠	
268	Logic Gate 3 Output	-200.00%♠	200.00%♠		RO	0.00%♠	
269	Logic Gate 4 Output	-200.00%♠	200.00%♠		RO	0.00%♠	
270	Reserved	0	65535		RO	0	
271	Reserved	0	65535		RO	0	
272	Reserved	0	65535		RO	0	
273	Reserved	0	65535		RO	0	
274	Reference Select 1 (LSB)	0	3			0	
275	Reference Select 1 (MSB)	0	1			0	
276	Reference Select 1 Reference 0	-200.00%	200.00%			0.00%	
277	Reference Select 1 Reference 1	-200.00%	200.00%			0.00%	
278	Reference Select 1 Reference 2	-200.00%	200.00%			0.00%	
279	Reference Select 1 Reference 3	-200.00%	200.00%			0.00%	
280	Reference Select 1 Output	-200.00%	200.00%		RO	0.00%	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	User
281	Reference Select 2 (LSB)	0	3			0	
282	Reference Select 2 (MSB)	0	1			0	
283	Reference Select 2 Reference 0	-200.00%	200.00%			0.00%	
284	Reference Select 2 Reference 1	-200.00%	200.00%			0.00%	
285	Reference Select 2 Reference 2	-200.00%	200.00%			0.00%	
286	Reference Select 2 Reference 3	-200.00%	200.00%			0.00%	
287	Reference Select 2 Output	-200.00%	200.00%		RO	0.00%	
288	Reserved	0	65535		RO	0	
289	Reserved	0	65535		RO	0	
290	Reserved	0	65535		RO	0	
291	Reserved	0	65535		RO	0	
292	Processing Order 1	0	28			1	
293	Processing Order 2	0	28			2	
294	Processing Order 3	0	28			3	
295	Processing Order 4	0	28			4	
296	Processing Order 5	0	28			5	
297	Processing Order 6	0	28			6	
298	Processing Order 7	0	28			7	
299	Processing Order 8	0	28			8	
300	Processing Order 9	0	28			9	
301	Processing Order 10	0	28			10	
302	Processing Order 11	0	28			11	
303	Processing Order 12	0	28			12	
304	Processing Order 13	0	28			13	
305	Processing Order 14	0	28			14	
306	Processing Order 15	0	28			15	
307	Processing Order 16	0	28			16	
308	Processing Order 17	0	28			17	
309	Processing Order 18	0	28			18	
310	Processing Order 19	0	28			19	
311	Processing Order 20	0	28			20	
312	Processing Order 21	0	28			21	
313	Processing Order 22	0	28			22	
314	Processing Order 23	0	28			23	
315	Processing Order 24	0	28			24	
316	Processing Order 25	0	28			25	
317	Processing Order 26	0	28			26	
318	Processing Order 27	0	28			27	
319	Processing Order 28	0	28			28	
320	Reserved	0	65535		RO	0	
321	Reserved	0	65535		RO	0	
322	Reserved	0	65535		RO	0	
323	Reserved	0	65535		RO	0	
324	Reserved	0	65535		RO	0	
325	Reserved	0	65535		RO	0	
326	Reserved	0	65535		RO	0	
327	Reserved	0	65535		RO	0	
328	Reserved	0	65535		RO	0	
329	Reserved	0	65535		RO	0	
330	Reserved	0	65535		RO	0	
331	Reserved	0	65535		RO	0	

♣UU=User Units. Can be any type of length in engineering units such as inches, millimeters, etc… All parameters of this type must be entered in the same units.

♦Note: The units and decimal places shown are the default. However, these values will change to match those of the source or destination parameter.

♠Note: The units and decimal places shown are the default. However, these values will change dependent upon the logic gate mode.

8 Modbus® Overview

8.1 Modbus® Protocol

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

In the MicroManager, 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 MicroManager 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 MicroManager 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 MicroManager'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 14: Supported Modbus® Functions

Function Code 1 (01h) Read Bits
In this example, Function Code 1 is used to read the status of the 4 digital inputs (i.e. parameters 53-56). Digital Inputs 1, 2, & 4 are on.

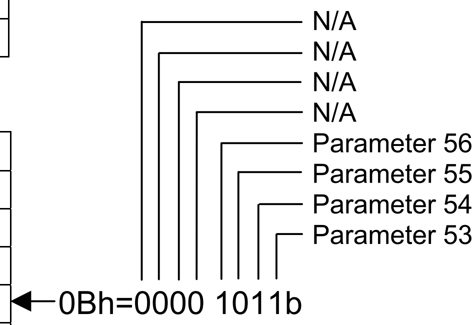
Master Command

Description		Data
Slave Address		01h
Function Code		01h
Starting Address	Upper	00h
	Lower	34h
Quantity	Upper	00h
	Lower	04h
CRC-16	Lower	7Ch
	Upper	07h

53-1=0034h*

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 MicroManager Addressing Mode (parameter 137) 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 0035h would be used.

Function Code 2 (02h) Read Bits

In this example, Function Code 2 is used to read the status of the 4 digital inputs (i.e. parameters 53-56). Digital Inputs 2 & 3 are on.

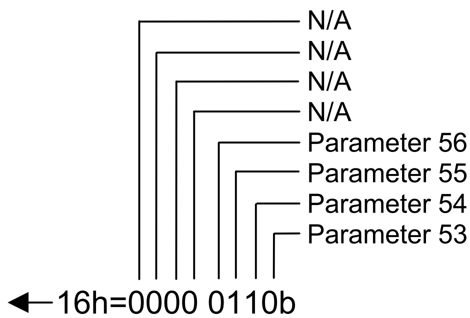
Master Command

Description		Data
Slave Address		01h
Function Code		02h
Starting Address	Upper	00h
	Lower	34h
Quantity	Upper	00h
	Lower	04h
CRC-16	Lower	38h
	Upper	07h

} 53-1=0034h*

Normal Slave Response

Description		Data
Slave Address		01h
Function Code		02h
Byte Count		01h
Data		06h
CRC-16	Lower	21h
	Upper	8Ah



Error Slave Response

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

*This assumes the MicroManager Addressing Mode (parameter 137) 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 0035h 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 17-18).

Master Command

Description		Data	
Slave Address		01h	
Function Code		03h	
Starting Address	Upper	00h	17-1=0010h*
	Lower	10h	
Quantity	Upper	00h	
	Lower	02h	
CRC-16	Lower	C5h	
	Upper	CEh	

Normal Slave Response

Description		Data	
Slave Address		01h	
Function Code		03h	
Byte Count		04h	
Register Data	Upper	07h	0764h=1892
	Lower	64h	
Register Data	Upper	0Bh	0BF4h=3060
	Lower	F4h	
CRC-16	Lower	BCh	
	Upper	2Fh	

Error Slave Response

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

*This assumes the MicroManager Addressing Mode (parameter 137) 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 0011h 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 222). When read, the value of Line Speed was 56.47%.

Master Command

Description		Data	
Slave Address		01h	
Function Code		04h	
Starting Address	Upper	00h	} 222-1=00DDh*
	Lower	DDh	
Quantity	Upper	00h	
	Lower	01h	
CRC-16	Lower	A1h	
	Upper	F0h	

Normal Slave Response

Description		Data	
Slave Address		01h	
Function Code		04h	
Byte Count		02h	
Register Data	Upper	16h	} 160Fh=5647
	Lower	0Fh	
CRC-16	Lower	F7h	
	Upper	54h	

Error Slave Response

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

*This assumes the MicroManager Addressing Mode (parameter 137) 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 00DEh 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 194).

Master Command

Description		Data	
Slave Address		01h	
Function Code		05h	
Address	Upper	00h	194-1=00C1h*
	Lower	C1h	
Data	Upper	FFh	FF00h is used to turn bit on. 0000h would be used to turn bit off.
	Lower	00h	
CRC-16	Lower	DDh	
	Upper	C6h	

Normal Slave Response

Description		Data
Slave Address		01h
Function Code		05h
Address	Upper	00h
	Lower	C1h
Register Data	Upper	FFh
	Lower	00h
CRC-16	Lower	DDh
	Upper	C6h

Error Slave Response

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

*This assumes the MicroManager Addressing Mode (parameter 137) 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 00C2h 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 246).

Master Command

Description		Data	
Slave Address		01h	
Function Code		06h	
Address	Upper	00h	246-1=00F5h*
	Lower	F5h	
Data	Upper	0Dh	3456=0D80h
	Lower	80h	
CRC-16	Lower	9Ch	
	Upper	C8h	

Normal Slave Response

Description		Data
Slave Address		01h
Function Code		06h
Address	Upper	00h
	Lower	F5h
Register Data	Upper	0Dh
	Lower	80h
CRC-16	Lower	9Ch
	Upper	C8h

Error Slave Response

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

*This assumes the MicroManager Addressing Mode (parameter 137) 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 00F6h 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	5Eh
	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

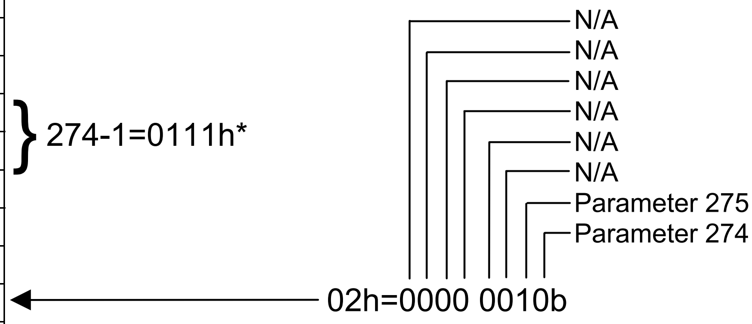
Function Code 15 (0Fh) Write Multiple Bits

In this example, Function Code 15 is used to write a value of 0 to Ref Select 1 LSB and a value of 1 to Ref Select 1 MSB (i.e. parameters 274 & 275).

Master Command

Description		Data
Slave Address		01h
Function Code		0Fh
Start Address	Upper	01h
	Lower	11h
Num Bits	Upper	00h
	Lower	02h
Byte Count		01h
Data		02h
CRC-16	Lower	A2h
	Upper	84h

Start Address: 274-1=0111h*



Normal Slave Response

Description		Data
Slave Address		01h
Function Code		0Fh
Start Address	Upper	01h
	Lower	11h
Num Bits	Upper	00h
	Lower	02h
CRC-16	Lower	85h
	Upper	F3h

Error Slave Response

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

*This assumes the MicroManager Addressing Mode (parameter 137) 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 0112h would be used.

Function Code 16 (10h) Write Multiple Registers
In this example, Function Code 16 is used to write the values 1.234 and 5.678 to the Thickness 0 and Thickness 1 (i.e. parameters 239 & 240).

Master Command

Description		Data	
Slave Address		01h	
Function Code		10h	
Start Address	Upper	00h	239-1=00EEh*
	Lower	EEh	
Register Count	Upper	00h	
	Lower	02h	
Byte Count		04h	
Register Data	Upper	04h	1234=04D2h
	Lower	D2h	
Register Data	Upper	16h	5678=162Eh
	Lower	2Eh	
CRC-16	Lower	53h	
	Upper	1Eh	

Normal Slave Response

Description		Data
Slave Address		01h
Function Code		10h
Start Address	Upper	00h
	Lower	EEh
Register Count	Upper	00h
	Lower	02h
CRC-16	Lower	21h
	Upper	FDh

Error Slave Response

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

*This assumes the MicroManager Addressing Mode (parameter 137) 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 00EFh would be used.

8.3 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 pre-calculated 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) ;
    }
```

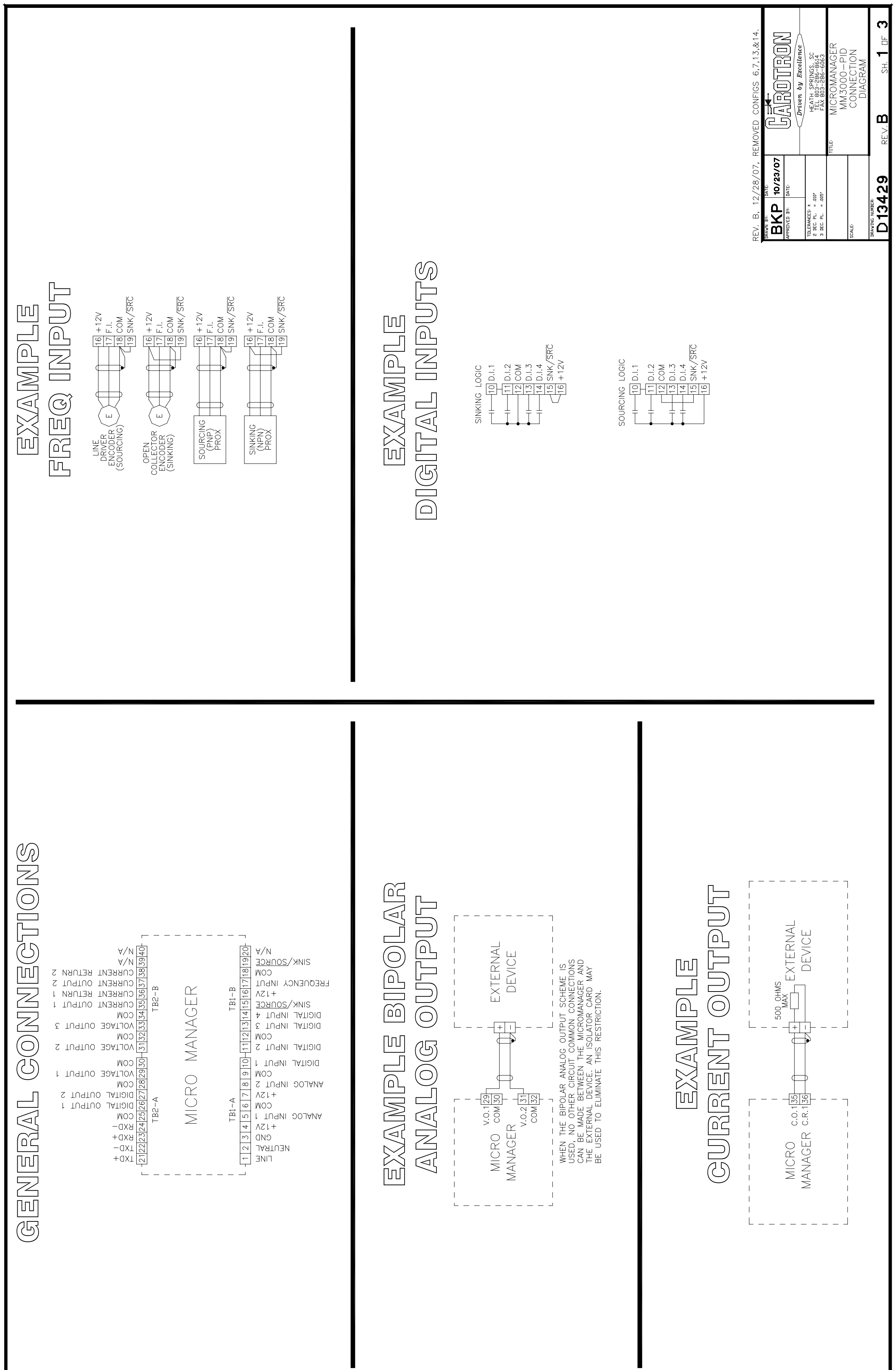
High-Order Byte Table

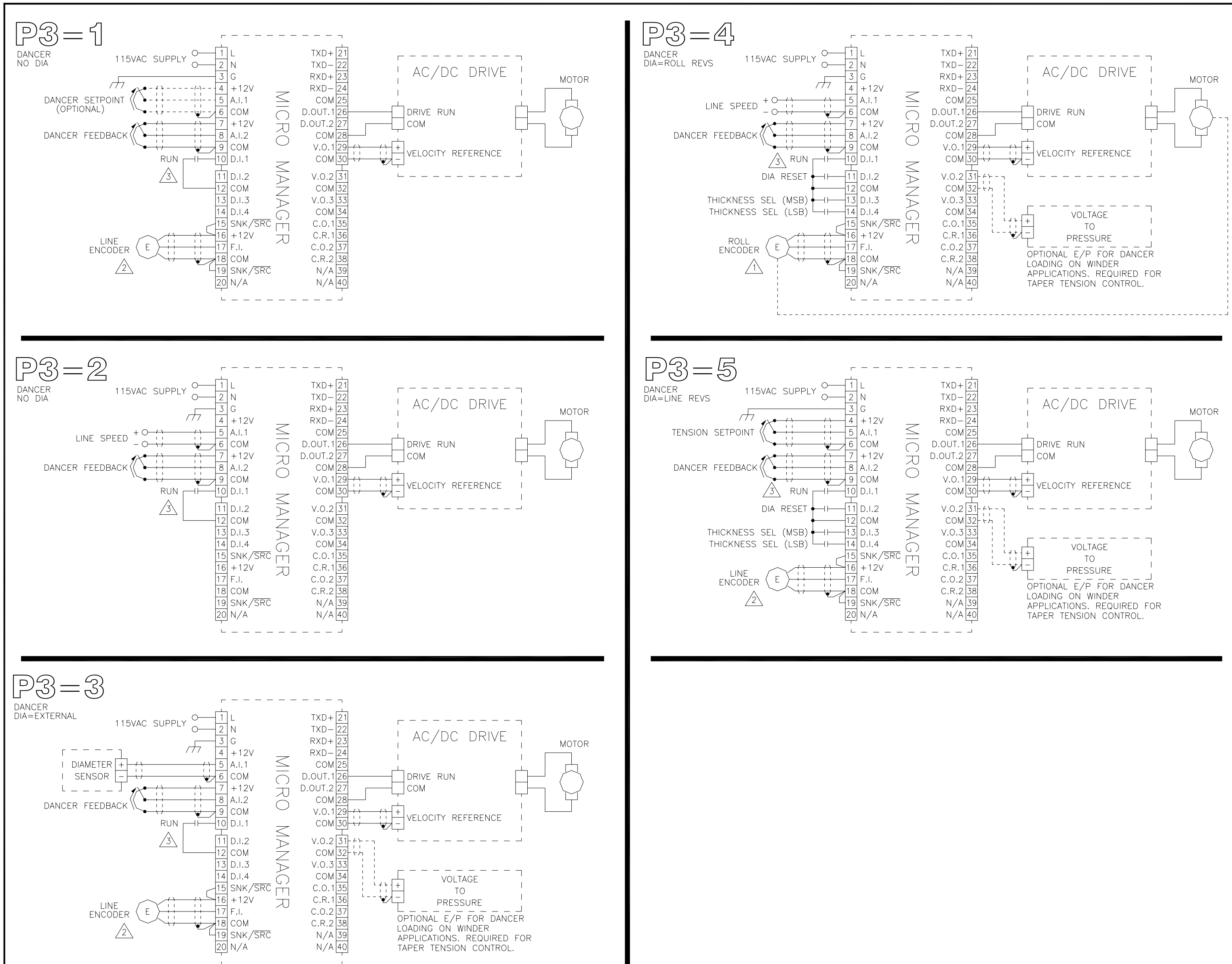
```
// Table of CRC values for high–order byte
static unsigned char CRCHi[] = {
    0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
    0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
    0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
    0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
    0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
    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,
    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,
    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
    } ;
```

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 Prints

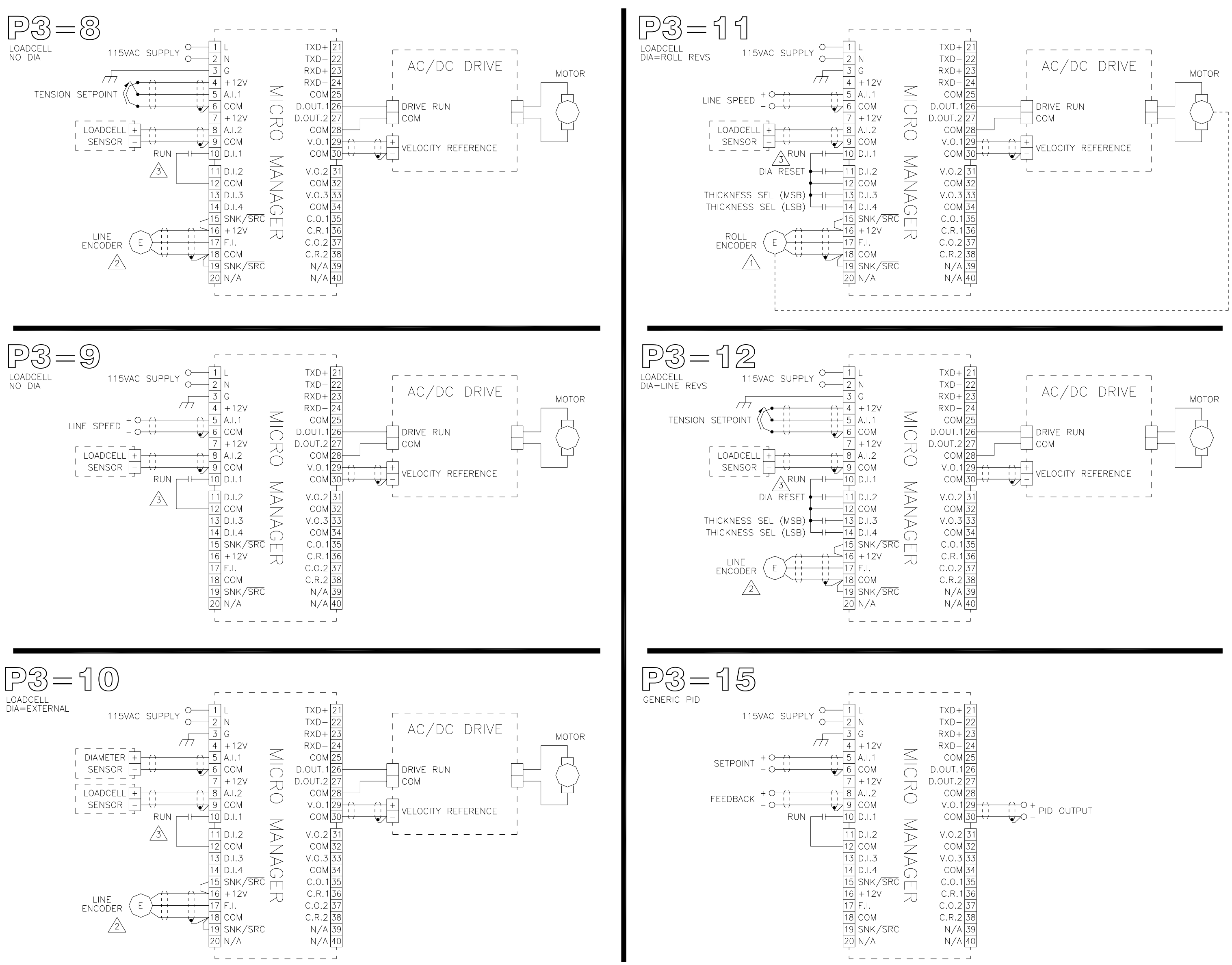

GENERAL CONNECTIONS
MICRO MANAGER
TB2-A
TB2-B
TB1-A
TB1-B
TXD+
TXD-
RXD+
RXD-
COM
DIGITAL OUTPUT 1
DIGITAL OUTPUT 2
COM
VOLTAGE OUTPUT 1
COM
VOLTAGE OUTPUT 2
COM
VOLTAGE OUTPUT 3
COM
CURRENT OUTPUT 1
CURRENT RETURN 1
CURRENT OUTPUT 2
CURRENT RETURN 2
N/A
N/A
LINE
NEUTRAL
GND
+12V
ANALOG INPUT 1
COM
+12V
ANALOG INPUT 2
COM
DIGITAL INPUT 1
DIGITAL INPUT 2
DIGITAL INPUT 3
DIGITAL INPUT 4
SINK/SOURCE
+12V
COM
FREQUENCY INPUT
COM
SINK/SOURCE
N/A
EXAMPLE FREQ INPUT
LINE DRIVER ENCODER (SOURCING)
OPEN COLLECTOR ENCODER (SINKING)
SOURCING (PNP) PROX
SINKING (NPN) PROX
+12V
F.I.
COM
SNK/SRC
EXAMPLE DIGITAL INPUTS
SINKING LOGIC
SOURCING LOGIC
D.I.1
D.I.2
COM
D.I.3
D.I.4
SNK/SRC
+12V
EXAMPLE BIPOLAR ANALOG OUTPUT
MICRO MANAGER
V.O.1
COM
V.O.2
COM
EXTERNAL DEVICE
WHEN THE BIPOLAR ANALOG OUTPUT SCHEME IS USED, NO OTHER CIRCUIT COMMON CONNECTIONS CAN BE MADE BETWEEN THE MICROMANAGER AND THE EXTERNAL DEVICE. AN ISOLATOR CARD MAY BE USED TO ELIMINATE THIS RESTRICTION.
EXAMPLE CURRENT OUTPUT
MICRO MANAGER
C.O.1
C.R.1
500 OHMS MAX
EXTERNAL DEVICE
REV. B, 12/28/07, REMOVED CONFIGS 6,7,13,&14.
DRAWN BY: BKP
DATE: 10/23/07
APPROVED BY:
DATE:
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: MICROMANAGER MM3000-PID CONNECTION DIAGRAM
DRAWING NUMBER: D13429
REV. B
SH. 1 OF 3



1. IN THIS DIAGRAM, A MOTOR MOUNTED ENCODER PROVIDES THE ROLL REVOLUTIONS FEEDBACK. THIS SIGNAL COULD ALSO BE PROVIDED BY A PROXIMITY SWITCH ON THE MOTOR OR ROLL SHAFT. SEE THE EXAMPLE FREQ INPUT SECTION ON SHEET 1 FOR OTHER WIRING SCHEMES.
2. IN THIS DIAGRAM, A MOTOR MOUNTED ENCODER PROVIDES THE LINE SPEED FEEDBACK. THIS SIGNAL COULD ALSO BE PROVIDED BY A PROXIMITY SWITCH ON THE MOTOR OR ROLL SHAFT. SEE THE EXAMPLE FREQ INPUT SECTION ON SHEET 1 FOR OTHER WIRING SCHEMES.
3. THE MICROMANAGER RUN CONTACT (DIGITAL INPUT 1) IS OFTEN SUPPLIED BY A RUN CONTACT ON THE LINE SPEED DRIVE (CONTACT IS CLOSED ANYTIME THE DRIVE IS RUNNING).

REV. B, 12/28/07, REMOVED CONFIGS 6,7,13,&14.

DRAWN BY: BKP	DATE: 10/23/07	CAROTRON Driven by Excellence
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: ± 2 DEC PL. = .010" 3 DEC PL. = .005"		TITLE: MICROMANAGER MM3000-PID CONNECTION DIAGRAM
SCALE:		
DRAWING NUMBER: D13429	REV. B	SH. 2 OF 3



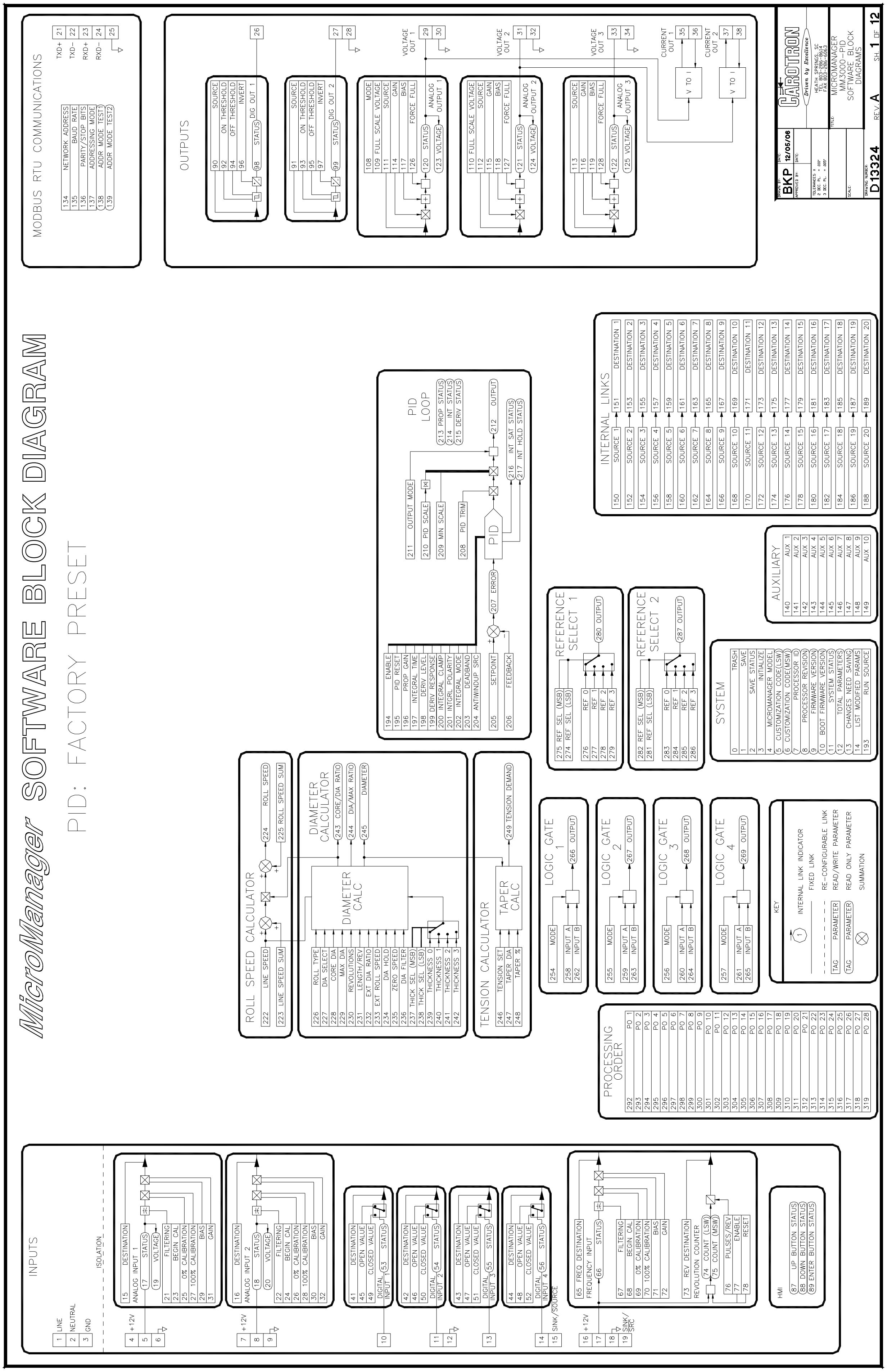
1. IN THIS DIAGRAM, A MOTOR MOUNTED ENCODER PROVIDES THE ROLL REVOLUTIONS FEEDBACK. THIS SIGNAL COULD ALSO BE PROVIDED BY A PROXIMITY SWITCH ON THE MOTOR OR ROLL SHAFT. SEE THE EXAMPLE FREQ INPUT SECTION ON SHEET 1 FOR OTHER WIRING SCHEMES.

2. IN THIS DIAGRAM, A MOTOR MOUNTED ENCODER PROVIDES THE LINE SPEED FEEDBACK. THIS SIGNAL COULD ALSO BE PROVIDED BY A PROXIMITY SWITCH ON THE MOTOR OR ROLL SHAFT. SEE THE EXAMPLE FREQ INPUT SECTION ON SHEET 1 FOR OTHER WIRING SCHEMES.

3. THE MICROMANAGER RUN CONTACT (DIGITAL INPUT 1) IS OFTEN SUPPLIED BY A RUN CONTACT ON THE LINE SPEED DRIVE (CONTACT IS CLOSED ANYTIME THE DRIVE IS RUNNING).

REV. B, 12/28/07, REMOVED CONFIGS 6,7,13,&14.

DRAWN BY: BKP	DATE: 10/23/07
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. ± .010" 3 DEC. PL. ± .005"	CAROTRON — Driven by Excellence — HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE:	TITLE: MICROMANAGER MM3000-PID CONNECTION DIAGRAM
DRAWING NUMBER: D13429	REV. B — SH. 3 OF 3


MicroManager SOFTWARE BLOCK DIAGRAM
PID: FACTORY PRESET
INPUTS
ISOLATION
ANALOG INPUT 1
ANALOG INPUT 2
DIGITAL INPUT 1
DIGITAL INPUT 2
DIGITAL INPUT 3
DIGITAL INPUT 4
FREQUENCY INPUT
REVOLUTION COUNTER
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
PROCESSING ORDER
ROLL SPEED CALCULATOR
DIAMETER CALCULATOR
DIAMETER CALC
TENSION CALCULATOR
TAPER CALC
LOGIC GATE 1
LOGIC GATE 2
LOGIC GATE 3
LOGIC GATE 4
KEY
INTERNAL LINK INDICATOR
FIXED LINK
RE-CONFIGURABLE LINK
READ/WRITE PARAMETER
READ ONLY PARAMETER
SUMMATION
PID LOOP
REFERENCE SELECT 1
REFERENCE SELECT 2
SYSTEM
AUXILIARY
INTERNAL LINKS
MODBUS RTU COMMUNICATIONS
OUTPUTS
DIG OUT 1
DIG OUT 2
ANALOG OUTPUT 1
ANALOG OUTPUT 2
ANALOG OUTPUT 3
VOLTAGE OUT 1
VOLTAGE OUT 2
VOLTAGE OUT 3
CURRENT OUT 1
CURRENT OUT 2
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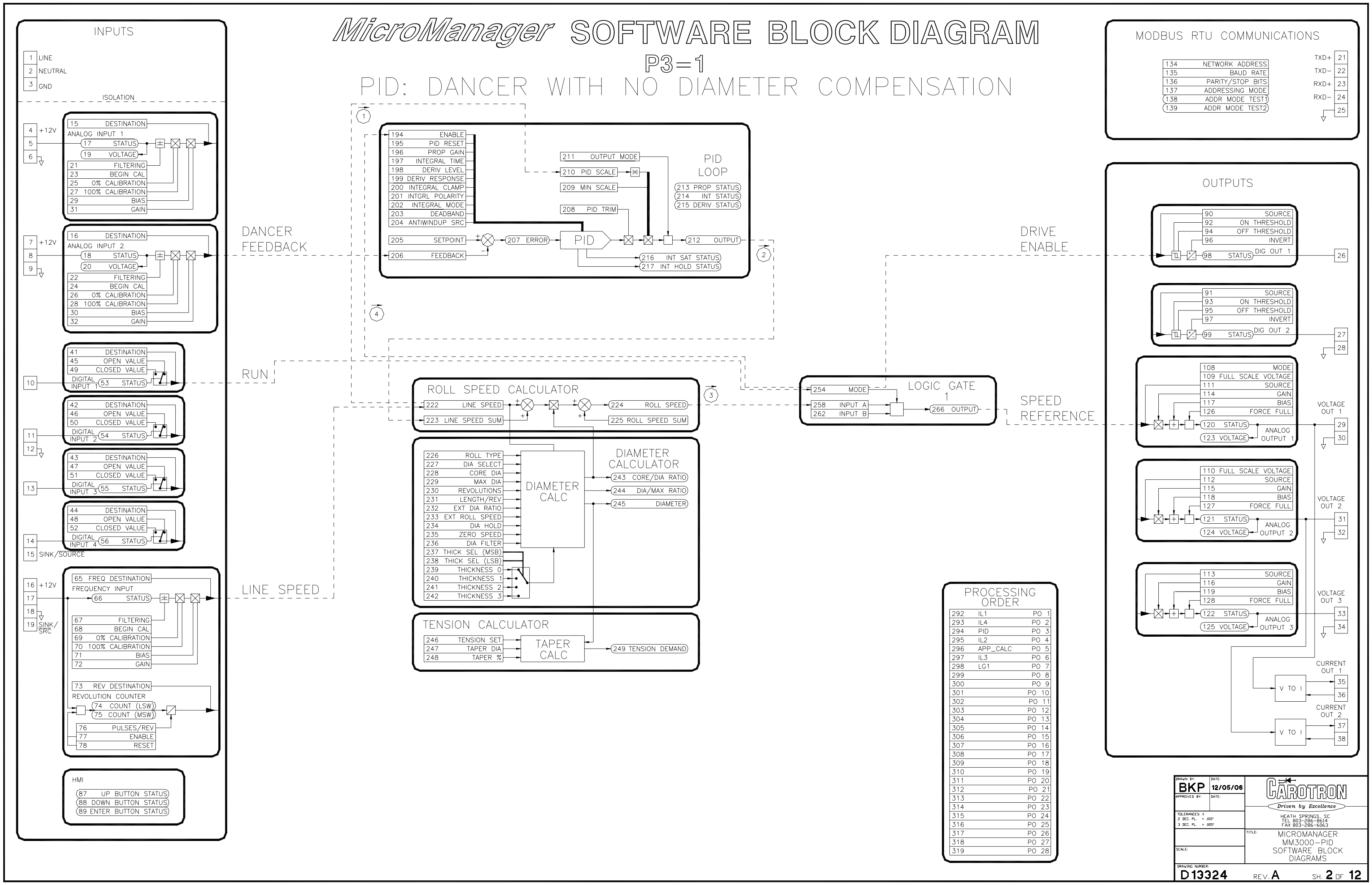
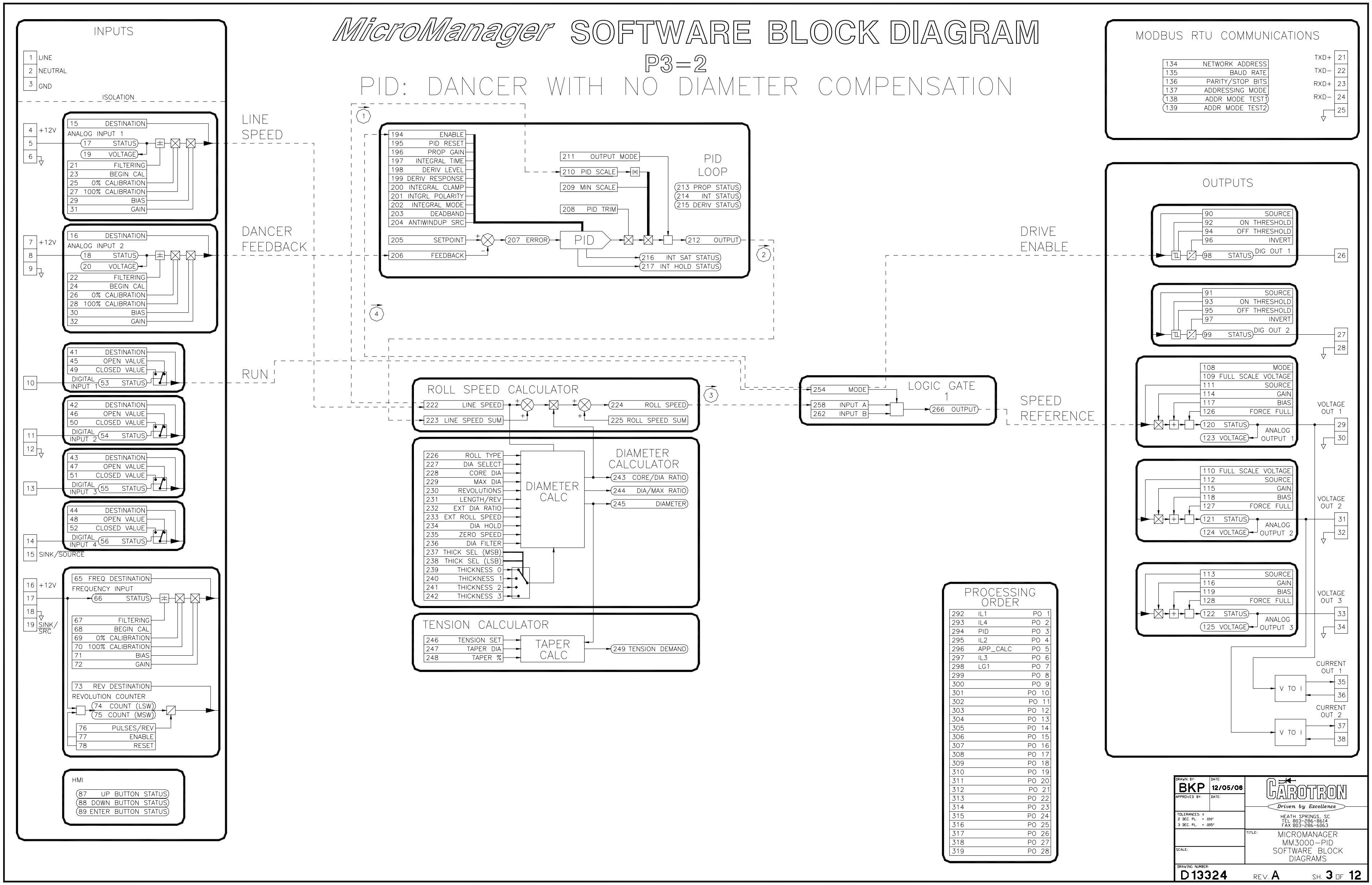
MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
BKP
12/05/06
D13324
REV A
SH 1 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3=1
PID: DANCER WITH NO DIAMETER COMPENSATION
INPUTS
1 LINE
2 NEUTRAL
3 GND
ISOLATION
4 +12V
5
6
15 DESTINATION
ANALOG INPUT 1
17 STATUS
19 VOLTAGE
21 FILTERING
23 BEGIN CAL
25 0% CALIBRATION
27 100% CALIBRATION
29 BIAS
31 GAIN
7 +12V
8
9
16 DESTINATION
ANALOG INPUT 2
18 STATUS
20 VOLTAGE
22 FILTERING
24 BEGIN CAL
26 0% CALIBRATION
28 100% CALIBRATION
30 BIAS
32 GAIN
DANCER FEEDBACK
10
41 DESTINATION
45 OPEN VALUE
49 CLOSED VALUE
DIGITAL INPUT 1
53 STATUS
RUN
11
12
42 DESTINATION
46 OPEN VALUE
50 CLOSED VALUE
DIGITAL INPUT 2
54 STATUS
13
43 DESTINATION
47 OPEN VALUE
51 CLOSED VALUE
DIGITAL INPUT 3
55 STATUS
14
15 SINK/SOURCE
44 DESTINATION
48 OPEN VALUE
52 CLOSED VALUE
DIGITAL INPUT 4
56 STATUS
16 +12V
17
18
19 SINK/SRC
65 FREQ DESTINATION
FREQUENCY INPUT
66 STATUS
67 FILTERING
68 BEGIN CAL
69 0% CALIBRATION
70 100% CALIBRATION
71 BIAS
72 GAIN
73 REV DESTINATION
REVOLUTION COUNTER
74 COUNT (LSW)
75 COUNT (MSW)
76 PULSES/REV
77 ENABLE
78 RESET
LINE SPEED
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
194 ENABLE
195 PID RESET
196 PROP GAIN
197 INTEGRAL TIME
198 DERIV LEVEL
199 DERIV RESPONSE
200 INTEGRAL CLAMP
201 INTGRL POLARITY
202 INTEGRAL MODE
203 DEADBAND
204 ANTIWINDUP SRC
205 SETPOINT
206 FEEDBACK
207 ERROR
PID
211 OUTPUT MODE
210 PID SCALE
209 MIN SCALE
208 PID TRIM
PID LOOP
213 PROP STATUS
214 INT STATUS
215 DERIV STATUS
212 OUTPUT
216 INT SAT STATUS
217 INT HOLD STATUS
1
2
3
4
ROLL SPEED CALCULATOR
222 LINE SPEED
223 LINE SPEED SUM
224 ROLL SPEED
225 ROLL SPEED SUM
226 ROLL TYPE
227 DIA SELECT
228 CORE DIA
229 MAX DIA
230 REVOLUTIONS
231 LENGTH/REV
232 EXT DIA RATIO
233 EXT ROLL SPEED
234 DIA HOLD
235 ZERO SPEED
236 DIA FILTER
237 THICK SEL (MSB)
238 THICK SEL (LSB)
239 THICKNESS 0
240 THICKNESS 1
241 THICKNESS 2
242 THICKNESS 3
DIAMETER CALC
DIAMETER CALCULATOR
243 CORE/DIA RATIO
244 DIA/MAX RATIO
245 DIAMETER
TENSION CALCULATOR
246 TENSION SET
247 TAPER DIA
248 TAPER %
TAPER CALC
249 TENSION DEMAND
254 MODE
258 INPUT A
262 INPUT B
LOGIC GATE 1
266 OUTPUT
DRIVE ENABLE
SPEED REFERENCE
MODBUS RTU COMMUNICATIONS
134 NETWORK ADDRESS
135 BAUD RATE
136 PARITY/STOP BITS
137 ADDRESSING MODE
138 ADDR MODE TEST1
139 ADDR MODE TEST2
TXD+ 21
TXD- 22
RXD+ 23
RXD- 24
25
OUTPUTS
90 SOURCE
92 ON THRESHOLD
94 OFF THRESHOLD
96 INVERT
98 STATUS
DIG OUT 1
26
91 SOURCE
93 ON THRESHOLD
95 OFF THRESHOLD
97 INVERT
99 STATUS
DIG OUT 2
27
28
108 MODE
109 FULL SCALE VOLTAGE
111 SOURCE
114 GAIN
117 BIAS
126 FORCE FULL
120 STATUS
123 VOLTAGE
ANALOG OUTPUT 1
VOLTAGE OUT 1
29
30
110 FULL SCALE VOLTAGE
112 SOURCE
115 GAIN
118 BIAS
127 FORCE FULL
121 STATUS
124 VOLTAGE
ANALOG OUTPUT 2
VOLTAGE OUT 2
31
32
113 SOURCE
116 GAIN
119 BIAS
128 FORCE FULL
122 STATUS
125 VOLTAGE
ANALOG OUTPUT 3
VOLTAGE OUT 3
33
34
CURRENT OUT 1
V TO I
35
36
CURRENT OUT 2
V TO I
37
38
PROCESSING ORDER
292 IL1 PO 1
293 IL4 PO 2
294 PID PO 3
295 IL2 PO 4
296 APP_CALC PO 5
297 IL3 PO 6
298 LG1 PO 7
299 PO 8
300 PO 9
301 PO 10
302 PO 11
303 PO 12
304 PO 13
305 PO 14
306 PO 15
307 PO 16
308 PO 17
309 PO 18
310 PO 19
311 PO 20
312 PO 21
313 PO 22
314 PO 23
315 PO 24
316 PO 25
317 PO 26
318 PO 27
319 PO 28
DRAWN BY: BKP
DATE: 12/05/06
APPROVED BY:
DATE:
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
SCALE:
DRAWING NUMBER: D13324
REV. A
SH. 2 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3=2
PID: DANCER WITH NO DIAMETER COMPENSATION
INPUTS
1 LINE
2 NEUTRAL
3 GND
ISOLATION
4 +12V
5
6
15 DESTINATION
ANALOG INPUT 1
17 STATUS
19 VOLTAGE
21 FILTERING
23 BEGIN CAL
25 0% CALIBRATION
27 100% CALIBRATION
29 BIAS
31 GAIN
7 +12V
8
9
16 DESTINATION
ANALOG INPUT 2
18 STATUS
20 VOLTAGE
22 FILTERING
24 BEGIN CAL
26 0% CALIBRATION
28 100% CALIBRATION
30 BIAS
32 GAIN
10
41 DESTINATION
45 OPEN VALUE
49 CLOSED VALUE
DIGITAL INPUT 1
53 STATUS
11
12
42 DESTINATION
46 OPEN VALUE
50 CLOSED VALUE
DIGITAL INPUT 2
54 STATUS
13
43 DESTINATION
47 OPEN VALUE
51 CLOSED VALUE
DIGITAL INPUT 3
55 STATUS
14
15 SINK/SOURCE
44 DESTINATION
48 OPEN VALUE
52 CLOSED VALUE
DIGITAL INPUT 4
56 STATUS
16 +12V
17
18
19 SINK/SRC
65 FREQ DESTINATION
FREQUENCY INPUT
66 STATUS
67 FILTERING
68 BEGIN CAL
69 0% CALIBRATION
70 100% CALIBRATION
71 BIAS
72 GAIN
73 REV DESTINATION
REVOLUTION COUNTER
74 COUNT (LSW)
75 COUNT (MSW)
76 PULSES/REV
77 ENABLE
78 RESET
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
LINE SPEED
DANCER FEEDBACK
RUN
PID LOOP
194 ENABLE
195 PID RESET
196 PROP GAIN
197 INTEGRAL TIME
198 DERIV LEVEL
199 DERIV RESPONSE
200 INTEGRAL CLAMP
201 INTGRL POLARITY
202 INTEGRAL MODE
203 DEADBAND
204 ANTIWINDUP SRC
205 SETPOINT
206 FEEDBACK
207 ERROR
PID
208 PID TRIM
209 MIN SCALE
210 PID SCALE
211 OUTPUT MODE
212 OUTPUT
213 PROP STATUS
214 INT STATUS
215 DERIV STATUS
216 INT SAT STATUS
217 INT HOLD STATUS
ROLL SPEED CALCULATOR
222 LINE SPEED
223 LINE SPEED SUM
224 ROLL SPEED
225 ROLL SPEED SUM
DIAMETER CALCULATOR
226 ROLL TYPE
227 DIA SELECT
228 CORE DIA
229 MAX DIA
230 REVOLUTIONS
231 LENGTH/REV
232 EXT DIA RATIO
233 EXT ROLL SPEED
234 DIA HOLD
235 ZERO SPEED
236 DIA FILTER
237 THICK SEL (MSB)
238 THICK SEL (LSB)
239 THICKNESS 0
240 THICKNESS 1
241 THICKNESS 2
242 THICKNESS 3
DIAMETER CALC
243 CORE/DIA RATIO
244 DIA/MAX RATIO
245 DIAMETER
TENSION CALCULATOR
246 TENSION SET
247 TAPER DIA
248 TAPER %
TAPER CALC
249 TENSION DEMAND
LOGIC GATE 1
254 MODE
258 INPUT A
262 INPUT B
266 OUTPUT
DRIVE ENABLE
SPEED REFERENCE
PROCESSING ORDER
292 IL1 PO 1
293 IL4 PO 2
294 PID PO 3
295 IL2 PO 4
296 APP_CALC PO 5
297 IL3 PO 6
298 LG1 PO 7
299 PO 8
300 PO 9
301 PO 10
302 PO 11
303 PO 12
304 PO 13
305 PO 14
306 PO 15
307 PO 16
308 PO 17
309 PO 18
310 PO 19
311 PO 20
312 PO 21
313 PO 22
314 PO 23
315 PO 24
316 PO 25
317 PO 26
318 PO 27
319 PO 28
MODBUS RTU COMMUNICATIONS
134 NETWORK ADDRESS
135 BAUD RATE
136 PARITY/STOP BITS
137 ADDRESSING MODE
138 ADDR MODE TEST1
139 ADDR MODE TEST2
TXD+ 21
TXD- 22
RXD+ 23
RXD- 24
25
OUTPUTS
90 SOURCE
92 ON THRESHOLD
94 OFF THRESHOLD
96 INVERT
98 STATUS
DIG OUT 1
26
91 SOURCE
93 ON THRESHOLD
95 OFF THRESHOLD
97 INVERT
99 STATUS
DIG OUT 2
27
28
108 MODE
109 FULL SCALE VOLTAGE
111 SOURCE
114 GAIN
117 BIAS
126 FORCE FULL
120 STATUS
123 VOLTAGE
ANALOG OUTPUT 1
VOLTAGE OUT 1
29
30
110 FULL SCALE VOLTAGE
112 SOURCE
115 GAIN
118 BIAS
127 FORCE FULL
121 STATUS
124 VOLTAGE
ANALOG OUTPUT 2
VOLTAGE OUT 2
31
32
113 SOURCE
116 GAIN
119 BIAS
128 FORCE FULL
122 STATUS
125 VOLTAGE
ANALOG OUTPUT 3
VOLTAGE OUT 3
33
34
CURRENT OUT 1
V TO I
35
36
CURRENT OUT 2
V TO I
37
38
DRAWN BY: BKP
DATE: 12/05/06
APPROVED BY:
DATE:
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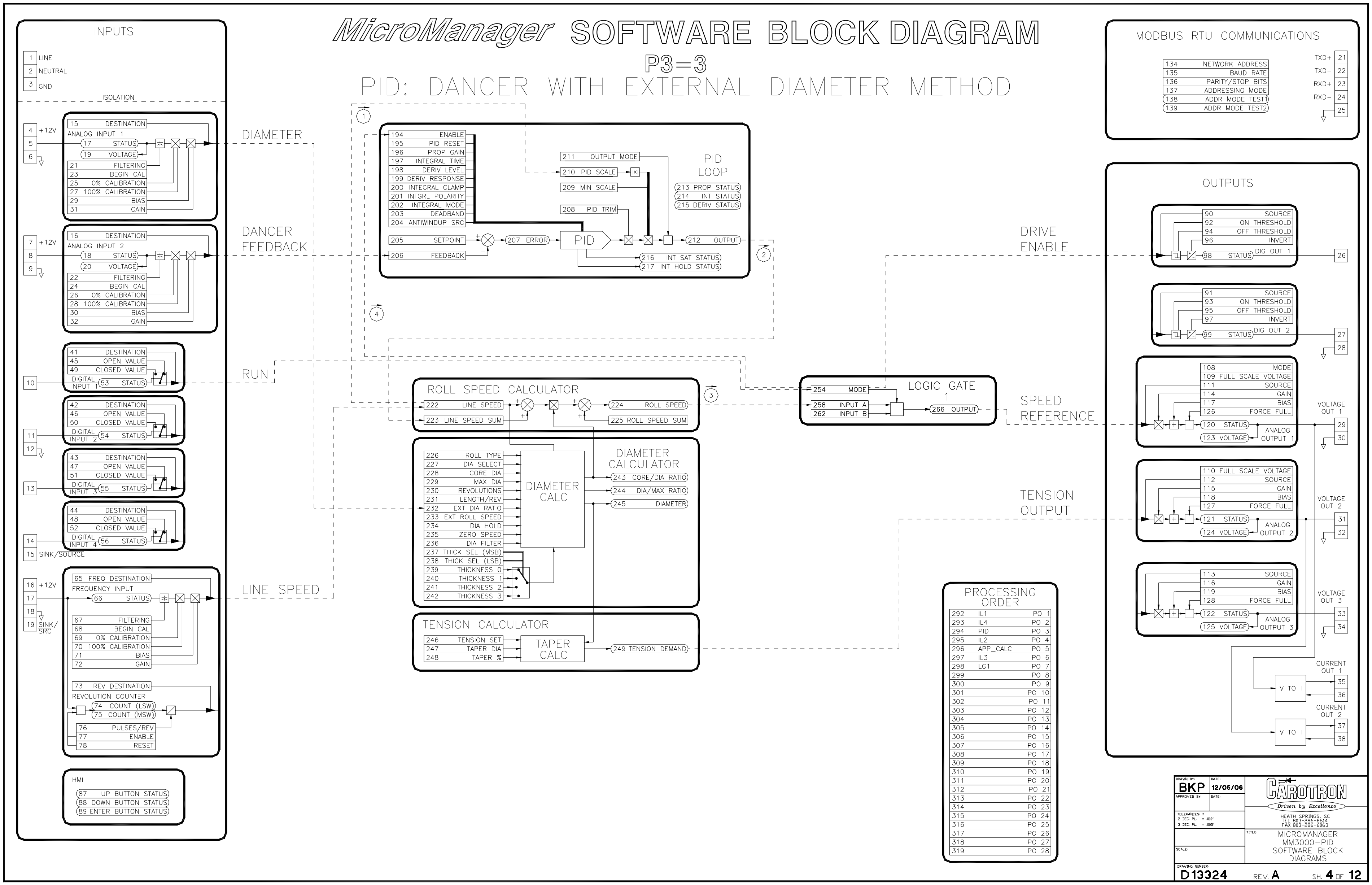
TITLE: MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
SCALE:
DRAWING NUMBER: D13324
REV. A
SH. 3 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3=3
PID: DANCER WITH EXTERNAL DIAMETER METHOD
INPUTS
1 LINE
2 NEUTRAL
3 GND
ISOLATION
4 +12V
5
6
15 DESTINATION
ANALOG INPUT 1
17 STATUS
19 VOLTAGE
21 FILTERING
23 BEGIN CAL
25 0% CALIBRATION
27 100% CALIBRATION
29 BIAS
31 GAIN
7 +12V
8
9
16 DESTINATION
ANALOG INPUT 2
18 STATUS
20 VOLTAGE
22 FILTERING
24 BEGIN CAL
26 0% CALIBRATION
28 100% CALIBRATION
30 BIAS
32 GAIN
10
41 DESTINATION
45 OPEN VALUE
49 CLOSED VALUE
DIGITAL INPUT 1
53 STATUS
11
12
42 DESTINATION
46 OPEN VALUE
50 CLOSED VALUE
DIGITAL INPUT 2
54 STATUS
13
43 DESTINATION
47 OPEN VALUE
51 CLOSED VALUE
DIGITAL INPUT 3
55 STATUS
14
15 SINK/SOURCE
44 DESTINATION
48 OPEN VALUE
52 CLOSED VALUE
DIGITAL INPUT 4
56 STATUS
16 +12V
17
18
19 SINK/SRC
65 FREQ DESTINATION
FREQUENCY INPUT
66 STATUS
67 FILTERING
68 BEGIN CAL
69 0% CALIBRATION
70 100% CALIBRATION
71 BIAS
72 GAIN
73 REV DESTINATION
REVOLUTION COUNTER
74 COUNT (LSW)
75 COUNT (MSW)
76 PULSES/REV
77 ENABLE
78 RESET
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
DIAMETER
DANCER FEEDBACK
RUN
LINE SPEED
1
2
3
4
194 ENABLE
195 PID RESET
196 PROP GAIN
197 INTEGRAL TIME
198 DERIV LEVEL
199 DERIV RESPONSE
200 INTEGRAL CLAMP
201 INTGRL POLARITY
202 INTEGRAL MODE
203 DEADBAND
204 ANTIWINDUP SRC
205 SETPOINT
206 FEEDBACK
207 ERROR
PID
211 OUTPUT MODE
210 PID SCALE
209 MIN SCALE
208 PID TRIM
PID LOOP
213 PROP STATUS
214 INT STATUS
215 DERIV STATUS
212 OUTPUT
216 INT SAT STATUS
217 INT HOLD STATUS
ROLL SPEED CALCULATOR
222 LINE SPEED
223 LINE SPEED SUM
224 ROLL SPEED
225 ROLL SPEED SUM
226 ROLL TYPE
227 DIA SELECT
228 CORE DIA
229 MAX DIA
230 REVOLUTIONS
231 LENGTH/REV
232 EXT DIA RATIO
233 EXT ROLL SPEED
234 DIA HOLD
235 ZERO SPEED
236 DIA FILTER
237 THICK SEL (MSB)
238 THICK SEL (LSB)
239 THICKNESS 0
240 THICKNESS 1
241 THICKNESS 2
242 THICKNESS 3
DIAMETER CALC
DIAMETER CALCULATOR
243 CORE/DIA RATIO
244 DIA/MAX RATIO
245 DIAMETER
TENSION CALCULATOR
246 TENSION SET
247 TAPER DIA
248 TAPER %
TAPER CALC
249 TENSION DEMAND
254 MODE
258 INPUT A
262 INPUT B
LOGIC GATE 1
266 OUTPUT
DRIVE ENABLE
SPEED REFERENCE
TENSION OUTPUT
MODBUS RTU COMMUNICATIONS
134 NETWORK ADDRESS
135 BAUD RATE
136 PARITY/STOP BITS
137 ADDRESSING MODE
138 ADDR MODE TEST1
139 ADDR MODE TEST2
TXD+ 21
TXD- 22
RXD+ 23
RXD- 24
25
OUTPUTS
90 SOURCE
92 ON THRESHOLD
94 OFF THRESHOLD
96 INVERT
98 STATUS
DIG OUT 1
26
91 SOURCE
93 ON THRESHOLD
95 OFF THRESHOLD
97 INVERT
99 STATUS
DIG OUT 2
27
28
108 MODE
109 FULL SCALE VOLTAGE
111 SOURCE
114 GAIN
117 BIAS
126 FORCE FULL
120 STATUS
123 VOLTAGE
ANALOG OUTPUT 1
VOLTAGE OUT 1
29
30
110 FULL SCALE VOLTAGE
112 SOURCE
115 GAIN
118 BIAS
127 FORCE FULL
121 STATUS
124 VOLTAGE
ANALOG OUTPUT 2
VOLTAGE OUT 2
31
32
113 SOURCE
116 GAIN
119 BIAS
128 FORCE FULL
122 STATUS
125 VOLTAGE
ANALOG OUTPUT 3
VOLTAGE OUT 3
33
34
CURRENT OUT 1
V TO I
35
36
CURRENT OUT 2
V TO I
37
38
PROCESSING ORDER
292 IL1 PO 1
293 IL4 PO 2
294 PID PO 3
295 IL2 PO 4
296 APP_CALC PO 5
297 IL3 PO 6
298 LG1 PO 7
299 PO 8
300 PO 9
301 PO 10
302 PO 11
303 PO 12
304 PO 13
305 PO 14
306 PO 15
307 PO 16
308 PO 17
309 PO 18
310 PO 19
311 PO 20
312 PO 21
313 PO 22
314 PO 23
315 PO 24
316 PO 25
317 PO 26
318 PO 27
319 PO 28
DRAWN BY: BKP
DATE: 12/05/06
APPROVED BY:
DATE:
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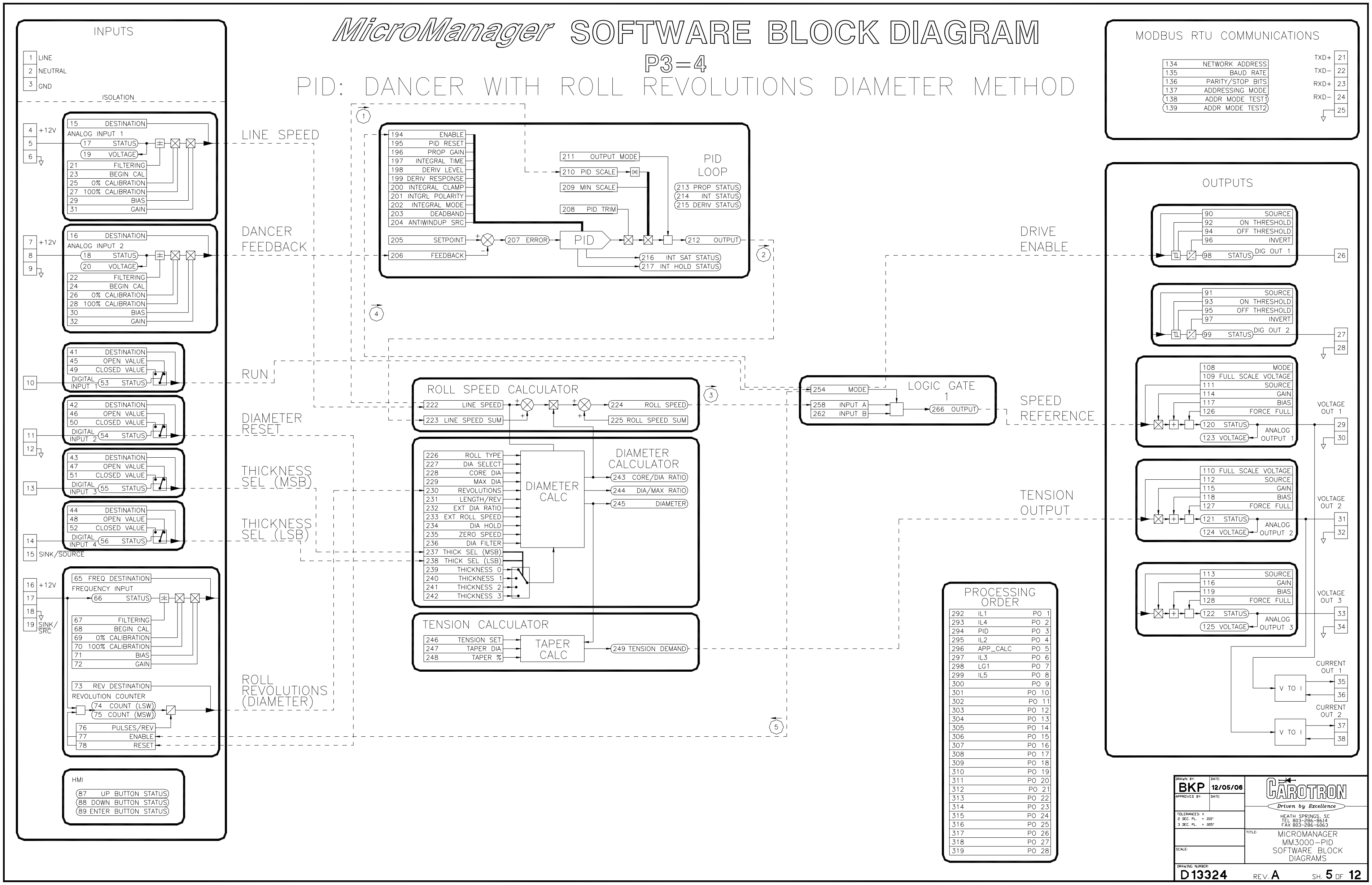
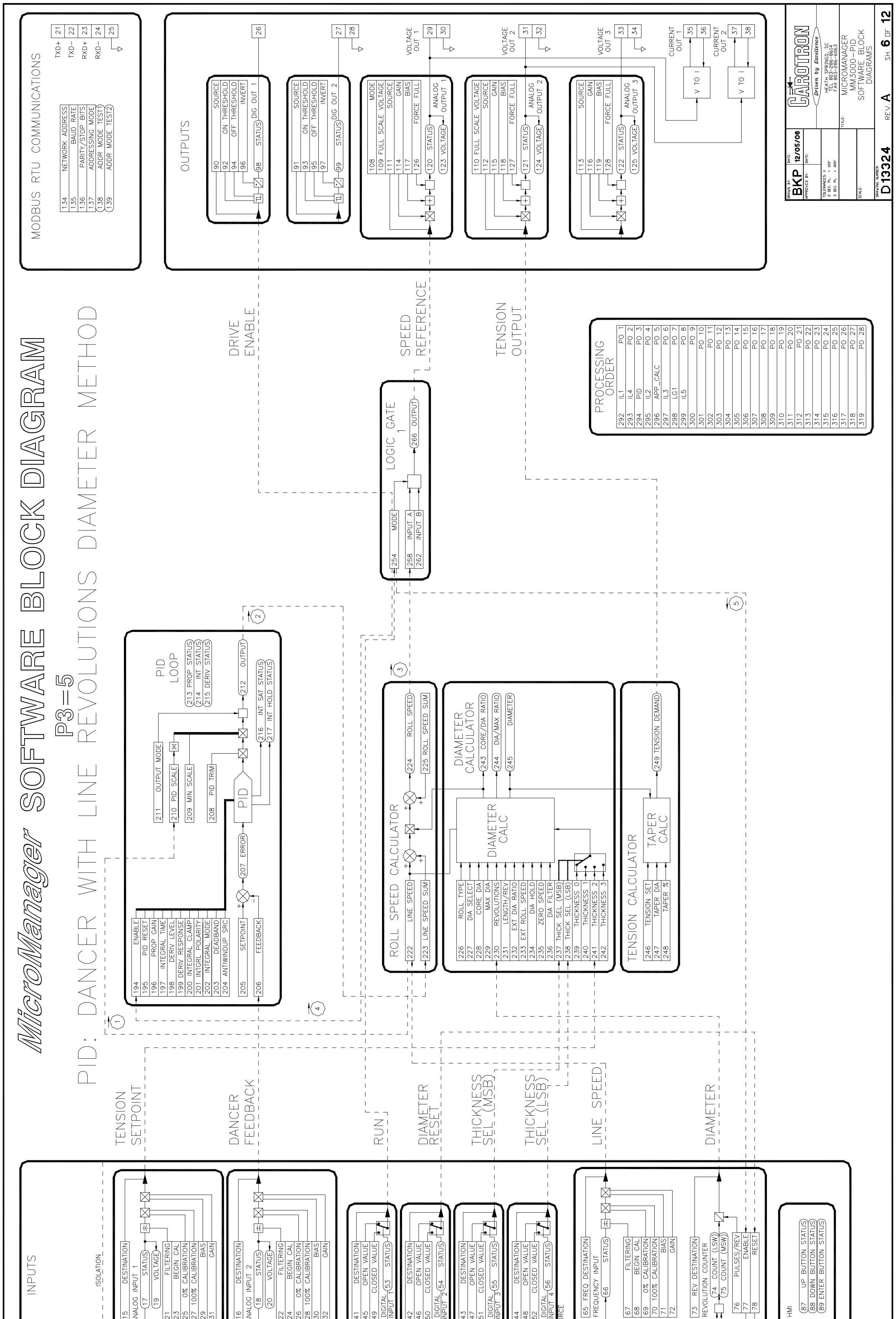
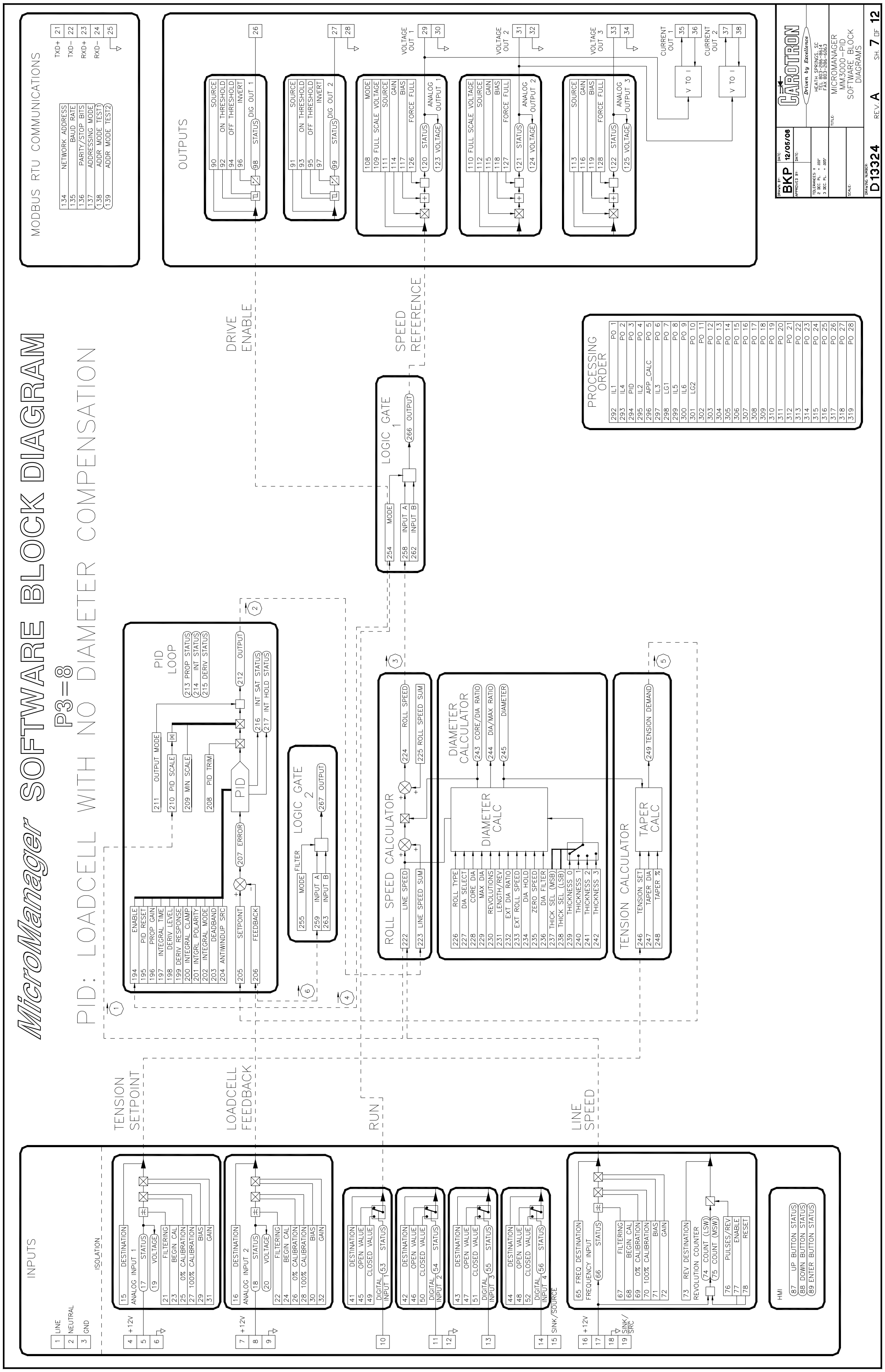
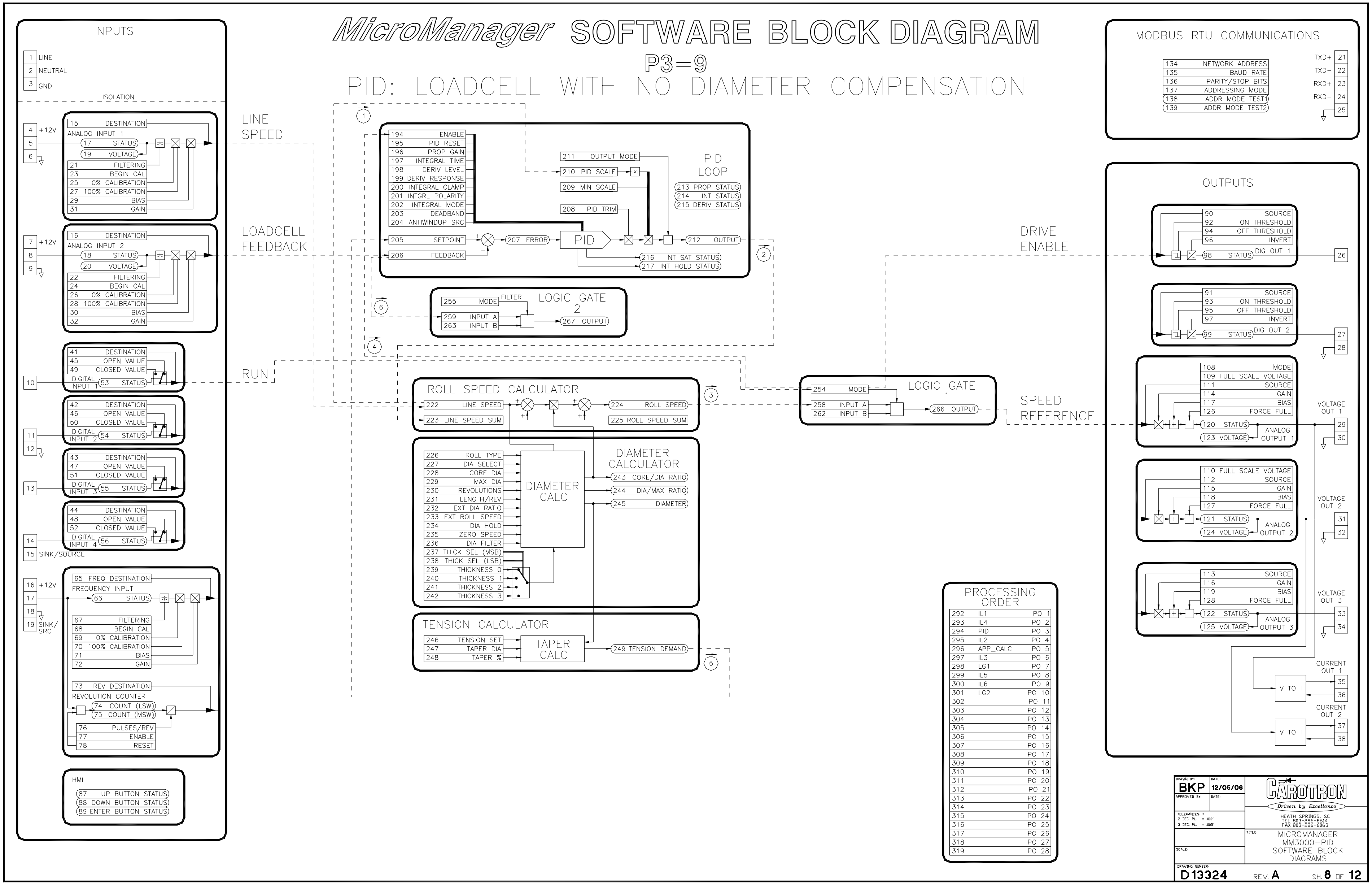
TITLE: MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
SCALE:
DRAWING NUMBER: D13324
REV. A
SH. 4 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3=4
PID: DANCER WITH ROLL REVOLUTIONS DIAMETER METHOD
INPUTS
1 LINE
2 NEUTRAL
3 GND
ISOLATION
4 +12V
5
6
15 DESTINATION
ANALOG INPUT 1
17 STATUS
19 VOLTAGE
21 FILTERING
23 BEGIN CAL
25 0% CALIBRATION
27 100% CALIBRATION
29 BIAS
31 GAIN
7 +12V
8
9
16 DESTINATION
ANALOG INPUT 2
18 STATUS
20 VOLTAGE
22 FILTERING
24 BEGIN CAL
26 0% CALIBRATION
28 100% CALIBRATION
30 BIAS
32 GAIN
10
41 DESTINATION
45 OPEN VALUE
49 CLOSED VALUE
DIGITAL INPUT 1
53 STATUS
11
12
42 DESTINATION
46 OPEN VALUE
50 CLOSED VALUE
DIGITAL INPUT 2
54 STATUS
13
43 DESTINATION
47 OPEN VALUE
51 CLOSED VALUE
DIGITAL INPUT 3
55 STATUS
14
15 SINK/SOURCE
44 DESTINATION
48 OPEN VALUE
52 CLOSED VALUE
DIGITAL INPUT 4
56 STATUS
16 +12V
17
18
19 SINK/SRC
65 FREQ DESTINATION
FREQUENCY INPUT
66 STATUS
67 FILTERING
68 BEGIN CAL
69 0% CALIBRATION
70 100% CALIBRATION
71 BIAS
72 GAIN
73 REV DESTINATION
REVOLUTION COUNTER
74 COUNT (LSW)
75 COUNT (MSW)
76 PULSES/REV
77 ENABLE
78 RESET
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
LINE SPEED
DANCER FEEDBACK
RUN
DIAMETER RESET
THICKNESS SEL (MSB)
THICKNESS SEL (LSB)
ROLL REVOLUTIONS (DIAMETER)
194 ENABLE
195 PID RESET
196 PROP GAIN
197 INTEGRAL TIME
198 DERIV LEVEL
199 DERIV RESPONSE
200 INTEGRAL CLAMP
201 INTGRL POLARITY
202 INTEGRAL MODE
203 DEADBAND
204 ANTIWINDUP SRC
205 SETPOINT
206 FEEDBACK
207 ERROR
PID
211 OUTPUT MODE
210 PID SCALE
209 MIN SCALE
208 PID TRIM
PID LOOP
213 PROP STATUS
214 INT STATUS
215 DERIV STATUS
212 OUTPUT
216 INT SAT STATUS
217 INT HOLD STATUS
ROLL SPEED CALCULATOR
222 LINE SPEED
223 LINE SPEED SUM
224 ROLL SPEED
225 ROLL SPEED SUM
226 ROLL TYPE
227 DIA SELECT
228 CORE DIA
229 MAX DIA
230 REVOLUTIONS
231 LENGTH/REV
232 EXT DIA RATIO
233 EXT ROLL SPEED
234 DIA HOLD
235 ZERO SPEED
236 DIA FILTER
237 THICK SEL (MSB)
238 THICK SEL (LSB)
239 THICKNESS 0
240 THICKNESS 1
241 THICKNESS 2
242 THICKNESS 3
DIAMETER CALC
DIAMETER CALCULATOR
243 CORE/DIA RATIO
244 DIA/MAX RATIO
245 DIAMETER
TENSION CALCULATOR
246 TENSION SET
247 TAPER DIA
248 TAPER %
TAPER CALC
249 TENSION DEMAND
254 MODE
258 INPUT A
262 INPUT B
LOGIC GATE 1
266 OUTPUT
DRIVE ENABLE
SPEED REFERENCE
TENSION OUTPUT
MODBUS RTU COMMUNICATIONS
134 NETWORK ADDRESS
135 BAUD RATE
136 PARITY/STOP BITS
137 ADDRESSING MODE
138 ADDR MODE TEST1
139 ADDR MODE TEST2
TXD+ 21
TXD- 22
RXD+ 23
RXD- 24
25
OUTPUTS
90 SOURCE
92 ON THRESHOLD
94 OFF THRESHOLD
96 INVERT
98 STATUS
DIG OUT 1
26
91 SOURCE
93 ON THRESHOLD
95 OFF THRESHOLD
97 INVERT
99 STATUS
DIG OUT 2
27
28
108 MODE
109 FULL SCALE VOLTAGE
111 SOURCE
114 GAIN
117 BIAS
126 FORCE FULL
120 STATUS
123 VOLTAGE
ANALOG OUTPUT 1
VOLTAGE OUT 1
29
30
110 FULL SCALE VOLTAGE
112 SOURCE
115 GAIN
118 BIAS
127 FORCE FULL
121 STATUS
124 VOLTAGE
ANALOG OUTPUT 2
VOLTAGE OUT 2
31
32
113 SOURCE
116 GAIN
119 BIAS
128 FORCE FULL
122 STATUS
125 VOLTAGE
ANALOG OUTPUT 3
VOLTAGE OUT 3
33
34
V TO I
CURRENT OUT 1
35
36
V TO I
CURRENT OUT 2
37
38
PROCESSING ORDER
292 IL1 PO 1
293 IL4 PO 2
294 PID PO 3
295 IL2 PO 4
296 APP_CALC PO 5
297 IL3 PO 6
298 LG1 PO 7
299 IL5 PO 8
300 PO 9
301 PO 10
302 PO 11
303 PO 12
304 PO 13
305 PO 14
306 PO 15
307 PO 16
308 PO 17
309 PO 18
310 PO 19
311 PO 20
312 PO 21
313 PO 22
314 PO 23
315 PO 24
316 PO 25
317 PO 26
318 PO 27
319 PO 28
DRAWN BY: BKP
DATE: 12/05/06
APPROVED BY:
DATE:
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
SCALE:
DRAWING NUMBER: D13324
REV. A
SH. 5 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3-5
PID: DANCER WITH LINE REVOLUTIONS DIAMETER METHOD
INPUTS
OUTPUTS
MODBUS RTU COMMUNICATIONS
TENSION SETPOINT
DANCER FEEDBACK
RUN
DIAMETER RESET
THICKNESS SEL (MSB)
THICKNESS SEL (LSB)
LINE SPEED
DIAMETER
DRIVE ENABLE
SPEED REFERENCE
TENSION OUTPUT
PID LOOP
LOGIC GATE 1
ROLL SPEED CALCULATOR
DIAMETER CALCULATOR
TENSION CALCULATOR
PROCESSING ORDER
DIAMETER CALC
TAPER CALC
HMI
CAROTRON
MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
D13324
BKP 12/05/08
REV. A
SH. 6 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3=8
PID: LOADCELL WITH NO DIAMETER COMPENSATION
INPUTS
OUTPUTS
MODBUS RTU COMMUNICATIONS
TENSION SETPOINT
LOADCELL FEEDBACK
RUN
LINE SPEED
DRIVE ENABLE
SPEED REFERENCE
PID LOOP
LOGIC GATE 1
LOGIC GATE 2
ROLL SPEED CALCULATOR
DIAMETER CALCULATOR
TENSION CALCULATOR
PROCESSING ORDER
HMI
CAROTRON
MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
BKP
12/05/06
D13324
REV. A
SH. 7 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3=9
PID: LOADCELL WITH NO DIAMETER COMPENSATION
INPUTS
1 LINE
2 NEUTRAL
3 GND
ISOLATION
4 +12V
5
6
15 DESTINATION
ANALOG INPUT 1
17 STATUS
19 VOLTAGE
21 FILTERING
23 BEGIN CAL
25 0% CALIBRATION
27 100% CALIBRATION
29 BIAS
31 GAIN
7 +12V
8
9
16 DESTINATION
ANALOG INPUT 2
18 STATUS
20 VOLTAGE
22 FILTERING
24 BEGIN CAL
26 0% CALIBRATION
28 100% CALIBRATION
30 BIAS
32 GAIN
10
41 DESTINATION
45 OPEN VALUE
49 CLOSED VALUE
DIGITAL INPUT 1
53 STATUS
11
12
42 DESTINATION
46 OPEN VALUE
50 CLOSED VALUE
DIGITAL INPUT 2
54 STATUS
13
43 DESTINATION
47 OPEN VALUE
51 CLOSED VALUE
DIGITAL INPUT 3
55 STATUS
14
15 SINK/SOURCE
44 DESTINATION
48 OPEN VALUE
52 CLOSED VALUE
DIGITAL INPUT 4
56 STATUS
16 +12V
17
18
19 SINK/SRC
65 FREQ DESTINATION
FREQUENCY INPUT
66 STATUS
67 FILTERING
68 BEGIN CAL
69 0% CALIBRATION
70 100% CALIBRATION
71 BIAS
72 GAIN
73 REV DESTINATION
REVOLUTION COUNTER
74 COUNT (LSW)
75 COUNT (MSW)
76 PULSES/REV
77 ENABLE
78 RESET
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
LINE SPEED
LOADCELL FEEDBACK
RUN
PID LOOP
194 ENABLE
195 PID RESET
196 PROP GAIN
197 INTEGRAL TIME
198 DERIV LEVEL
199 DERIV RESPONSE
200 INTEGRAL CLAMP
201 INTGRL POLARITY
202 INTEGRAL MODE
203 DEADBAND
204 ANTIWINDUP SRC
205 SETPOINT
206 FEEDBACK
207 ERROR
PID
211 OUTPUT MODE
210 PID SCALE
209 MIN SCALE
208 PID TRIM
212 OUTPUT
213 PROP STATUS
214 INT STATUS
215 DERIV STATUS
216 INT SAT STATUS
217 INT HOLD STATUS
LOGIC GATE 2
255 MODE
FILTER
259 INPUT A
263 INPUT B
267 OUTPUT
ROLL SPEED CALCULATOR
222 LINE SPEED
223 LINE SPEED SUM
224 ROLL SPEED
225 ROLL SPEED SUM
DIAMETER CALCULATOR
226 ROLL TYPE
227 DIA SELECT
228 CORE DIA
229 MAX DIA
230 REVOLUTIONS
231 LENGTH/REV
232 EXT DIA RATIO
233 EXT ROLL SPEED
234 DIA HOLD
235 ZERO SPEED
236 DIA FILTER
237 THICK SEL (MSB)
238 THICK SEL (LSB)
239 THICKNESS 0
240 THICKNESS 1
241 THICKNESS 2
242 THICKNESS 3
DIAMETER CALC
243 CORE/DIA RATIO
244 DIA/MAX RATIO
245 DIAMETER
TENSION CALCULATOR
246 TENSION SET
247 TAPER DIA
248 TAPER %
TAPER CALC
249 TENSION DEMAND
LOGIC GATE 1
254 MODE
258 INPUT A
262 INPUT B
266 OUTPUT
DRIVE ENABLE
SPEED REFERENCE
PROCESSING ORDER
292 IL1 PO 1
293 IL4 PO 2
294 PID PO 3
295 IL2 PO 4
296 APP_CALC PO 5
297 IL3 PO 6
298 LG1 PO 7
299 IL5 PO 8
300 IL6 PO 9
301 LG2 PO 10
302 PO 11
303 PO 12
304 PO 13
305 PO 14
306 PO 15
307 PO 16
308 PO 17
309 PO 18
310 PO 19
311 PO 20
312 PO 21
313 PO 22
314 PO 23
315 PO 24
316 PO 25
317 PO 26
318 PO 27
319 PO 28
MODBUS RTU COMMUNICATIONS
134 NETWORK ADDRESS
135 BAUD RATE
136 PARITY/STOP BITS
137 ADDRESSING MODE
138 ADDR MODE TEST1
139 ADDR MODE TEST2
TXD+ 21
TXD- 22
RXD+ 23
RXD- 24
25
OUTPUTS
90 SOURCE
92 ON THRESHOLD
94 OFF THRESHOLD
96 INVERT
98 STATUS
DIG OUT 1
26
91 SOURCE
93 ON THRESHOLD
95 OFF THRESHOLD
97 INVERT
99 STATUS
DIG OUT 2
27
28
108 MODE
109 FULL SCALE VOLTAGE
111 SOURCE
114 GAIN
117 BIAS
126 FORCE FULL
120 STATUS
123 VOLTAGE
ANALOG OUTPUT 1
VOLTAGE OUT 1
29
30
110 FULL SCALE VOLTAGE
112 SOURCE
115 GAIN
118 BIAS
127 FORCE FULL
121 STATUS
124 VOLTAGE
ANALOG OUTPUT 2
VOLTAGE OUT 2
31
32
113 SOURCE
116 GAIN
119 BIAS
128 FORCE FULL
122 STATUS
125 VOLTAGE
ANALOG OUTPUT 3
VOLTAGE OUT 3
33
34
CURRENT OUT 1
V TO I
35
36
CURRENT OUT 2
V TO I
37
38
DRAWN BY: BKP
DATE: 12/05/08
APPROVED BY:
DATE:
CAROTRON
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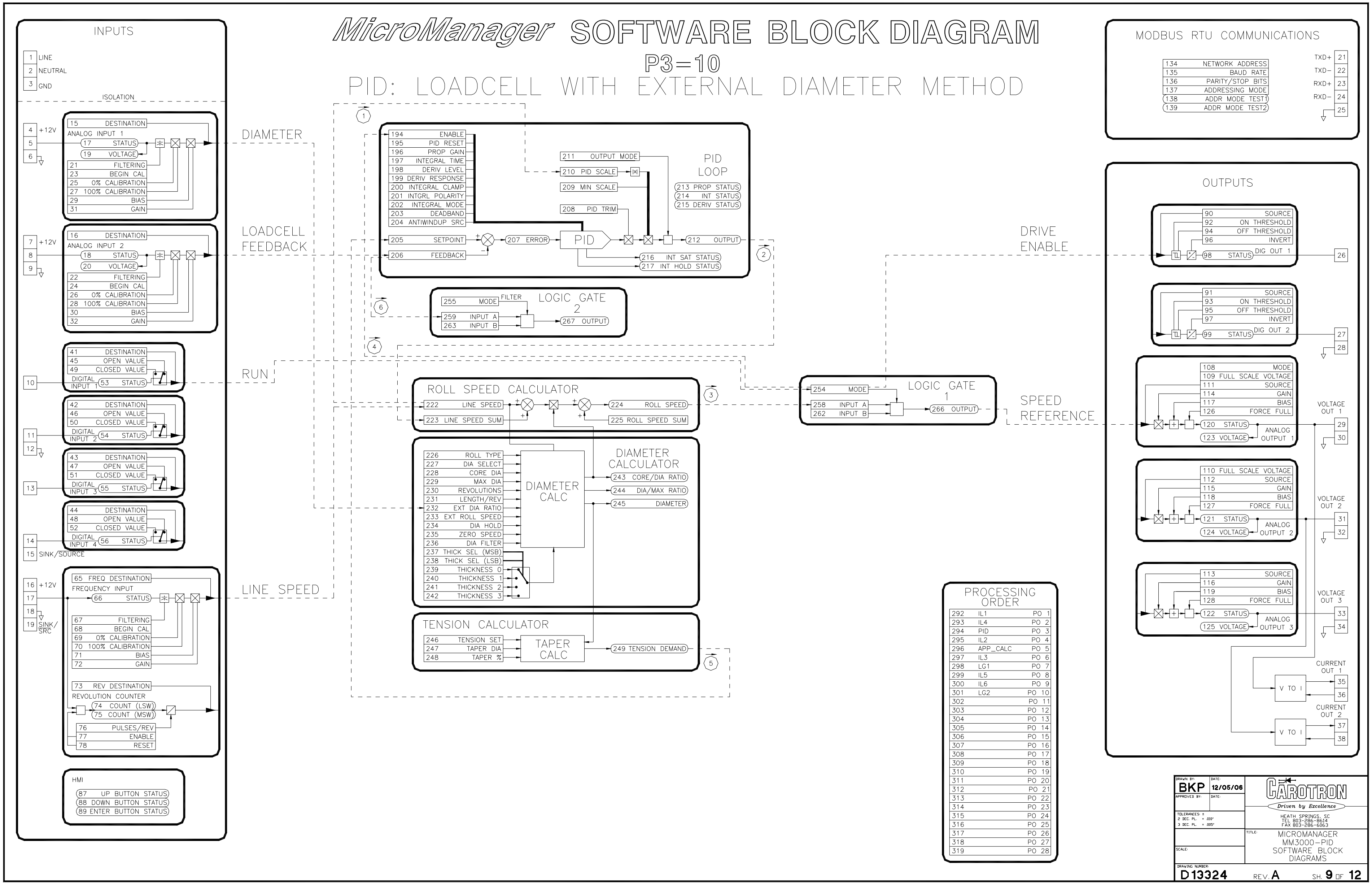
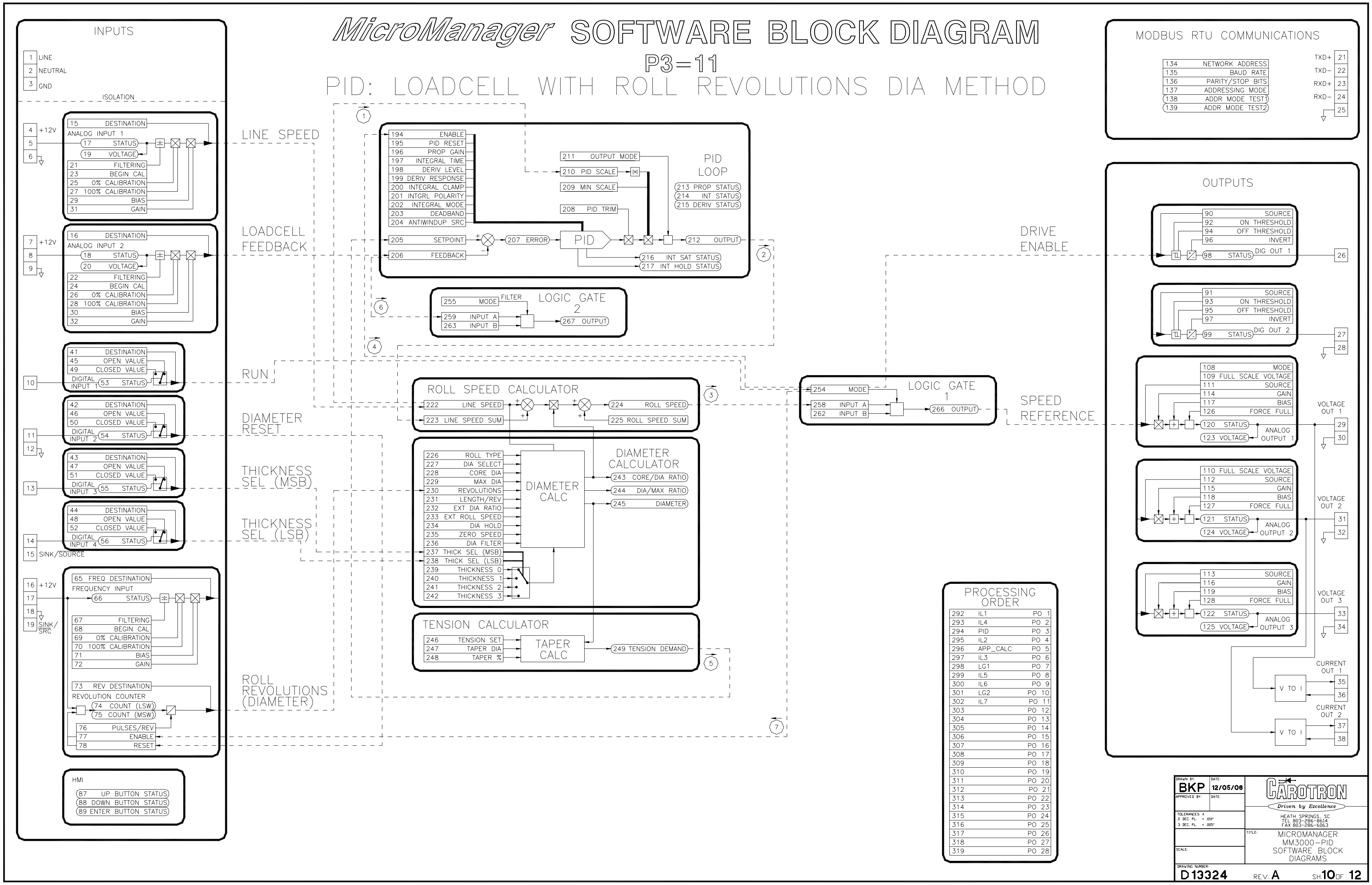
TITLE: MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
SCALE:
DRAWING NUMBER: D13324
REV. A
SH. 8 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3=10
PID: LOADCELL WITH EXTERNAL DIAMETER METHOD
INPUTS
1 LINE
2 NEUTRAL
3 GND
ISOLATION
4 +12V
5
6
15 DESTINATION
ANALOG INPUT 1
17 STATUS
19 VOLTAGE
21 FILTERING
23 BEGIN CAL
25 0% CALIBRATION
27 100% CALIBRATION
29 BIAS
31 GAIN
7 +12V
8
9
16 DESTINATION
ANALOG INPUT 2
18 STATUS
20 VOLTAGE
22 FILTERING
24 BEGIN CAL
26 0% CALIBRATION
28 100% CALIBRATION
30 BIAS
32 GAIN
41 DESTINATION
45 OPEN VALUE
49 CLOSED VALUE
DIGITAL INPUT 1
53 STATUS
10
42 DESTINATION
46 OPEN VALUE
50 CLOSED VALUE
DIGITAL INPUT 2
54 STATUS
11
12
43 DESTINATION
47 OPEN VALUE
51 CLOSED VALUE
DIGITAL INPUT 3
55 STATUS
13
44 DESTINATION
48 OPEN VALUE
52 CLOSED VALUE
DIGITAL INPUT 4
56 STATUS
14
15 SINK/SOURCE
16 +12V
17
18
19 SINK/SRC
65 FREQ DESTINATION
FREQUENCY INPUT
66 STATUS
67 FILTERING
68 BEGIN CAL
69 0% CALIBRATION
70 100% CALIBRATION
71 BIAS
72 GAIN
73 REV DESTINATION
REVOLUTION COUNTER
74 COUNT (LSW)
75 COUNT (MSW)
76 PULSES/REV
77 ENABLE
78 RESET
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
DIAMETER
LOADCELL FEEDBACK
RUN
LINE SPEED
194 ENABLE
195 PID RESET
196 PROP GAIN
197 INTEGRAL TIME
198 DERIV LEVEL
199 DERIV RESPONSE
200 INTEGRAL CLAMP
201 INTGRL POLARITY
202 INTEGRAL MODE
203 DEADBAND
204 ANTIWINDUP SRC
205 SETPOINT
206 FEEDBACK
207 ERROR
PID
211 OUTPUT MODE
210 PID SCALE
209 MIN SCALE
208 PID TRIM
PID LOOP
213 PROP STATUS
214 INT STATUS
215 DERIV STATUS
212 OUTPUT
216 INT SAT STATUS
217 INT HOLD STATUS
255 MODE
FILTER
LOGIC GATE 2
259 INPUT A
263 INPUT B
267 OUTPUT
ROLL SPEED CALCULATOR
222 LINE SPEED
223 LINE SPEED SUM
224 ROLL SPEED
225 ROLL SPEED SUM
226 ROLL TYPE
227 DIA SELECT
228 CORE DIA
229 MAX DIA
230 REVOLUTIONS
231 LENGTH/REV
232 EXT DIA RATIO
233 EXT ROLL SPEED
234 DIA HOLD
235 ZERO SPEED
236 DIA FILTER
237 THICK SEL (MSB)
238 THICK SEL (LSB)
239 THICKNESS 0
240 THICKNESS 1
241 THICKNESS 2
242 THICKNESS 3
DIAMETER CALC
DIAMETER CALCULATOR
243 CORE/DIA RATIO
244 DIA/MAX RATIO
245 DIAMETER
TENSION CALCULATOR
246 TENSION SET
247 TAPER DIA
248 TAPER %
TAPER CALC
249 TENSION DEMAND
254 MODE
LOGIC GATE 1
258 INPUT A
262 INPUT B
266 OUTPUT
DRIVE ENABLE
SPEED REFERENCE
PROCESSING ORDER
292 IL1 PO 1
293 IL4 PO 2
294 PID PO 3
295 IL2 PO 4
296 APP_CALC PO 5
297 IL3 PO 6
298 LG1 PO 7
299 IL5 PO 8
300 IL6 PO 9
301 LG2 PO 10
302 PO 11
303 PO 12
304 PO 13
305 PO 14
306 PO 15
307 PO 16
308 PO 17
309 PO 18
310 PO 19
311 PO 20
312 PO 21
313 PO 22
314 PO 23
315 PO 24
316 PO 25
317 PO 26
318 PO 27
319 PO 28
MODBUS RTU COMMUNICATIONS
134 NETWORK ADDRESS
135 BAUD RATE
136 PARITY/STOP BITS
137 ADDRESSING MODE
138 ADDR MODE TEST1
139 ADDR MODE TEST2
TXD+ 21
TXD- 22
RXD+ 23
RXD- 24
25
OUTPUTS
90 SOURCE
92 ON THRESHOLD
94 OFF THRESHOLD
96 INVERT
98 STATUS
DIG OUT 1
26
91 SOURCE
93 ON THRESHOLD
95 OFF THRESHOLD
97 INVERT
99 STATUS
DIG OUT 2
27
28
108 MODE
109 FULL SCALE VOLTAGE
111 SOURCE
114 GAIN
117 BIAS
126 FORCE FULL
120 STATUS
123 VOLTAGE
ANALOG OUTPUT 1
VOLTAGE OUT 1
29
30
110 FULL SCALE VOLTAGE
112 SOURCE
115 GAIN
118 BIAS
127 FORCE FULL
121 STATUS
124 VOLTAGE
ANALOG OUTPUT 2
VOLTAGE OUT 2
31
32
113 SOURCE
116 GAIN
119 BIAS
128 FORCE FULL
122 STATUS
125 VOLTAGE
ANALOG OUTPUT 3
VOLTAGE OUT 3
33
34
CURRENT OUT 1
V TO I
35
36
CURRENT OUT 2
V TO I
37
38
DRAWN BY: BKP
DATE: 12/05/06
APPROVED BY:
DATE:
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
SCALE:
DRAWING NUMBER: D13324
REV. A
SH. 9 OF 12



MicroManager SOFTWARE BLOCK DIAGRAM
P3=11
PID: LOADCELL WITH ROLL REVOLUTIONS DIA METHOD
INPUTS
ISOLATION
LINE SPEED
LOADCELL FEEDBACK
RUN
DIAMETER RESET
THICKNESS SEL (MSB)
THICKNESS SEL (LSB)
ROLL REVOLUTIONS (DIAMETER)
PID LOOP
LOGIC GATE 2
ROLL SPEED CALCULATOR
DIAMETER CALCULATOR
DIAMETER CALC
TENSION CALCULATOR
TAPER CALC
LOGIC GATE 1
DRIVE ENABLE
SPEED REFERENCE
MODBUS RTU COMMUNICATIONS
OUTPUTS
PROCESSING ORDER
HMI
CAROTRON
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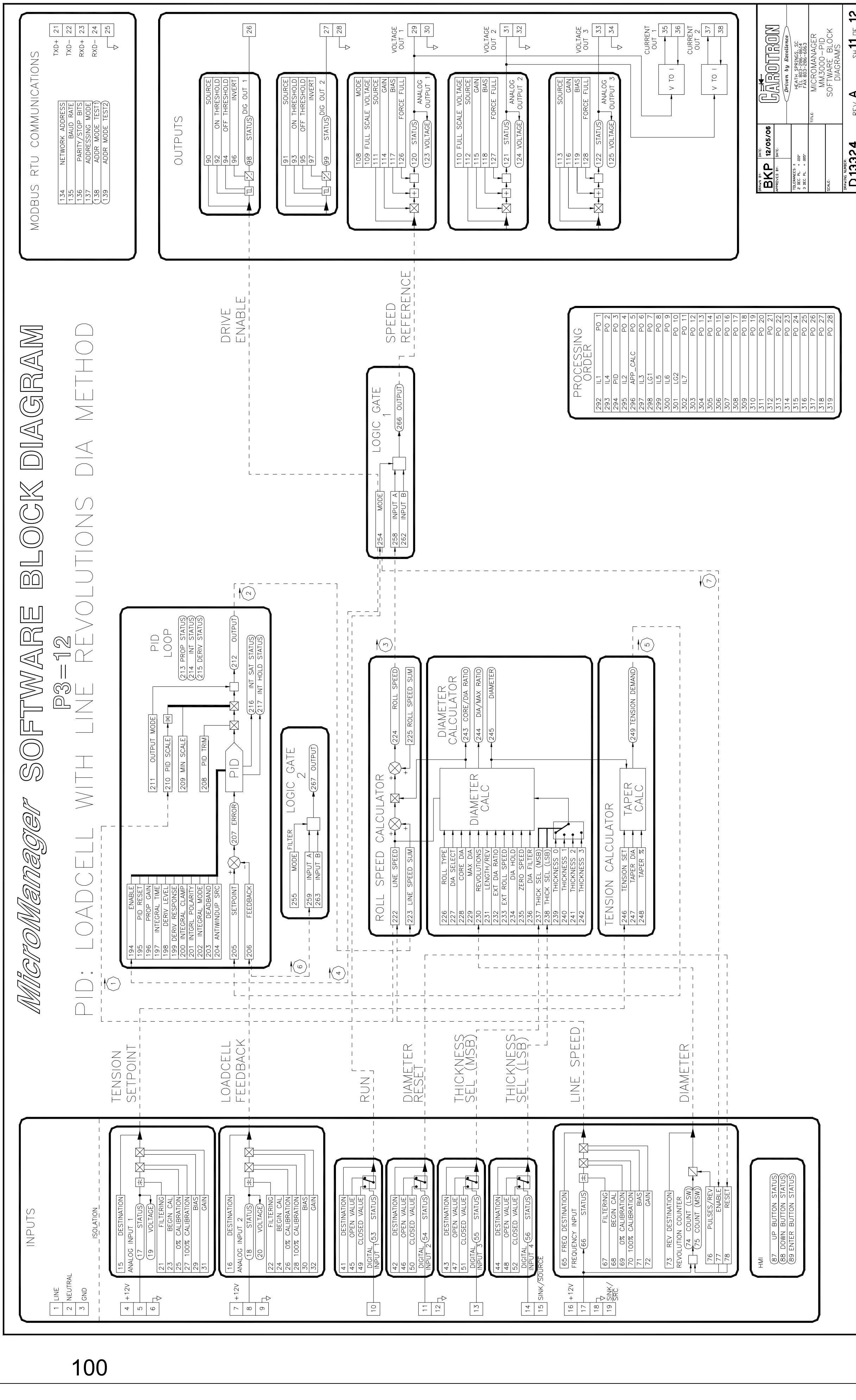
MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
DRAWN BY: BKP
DATE: 12/05/06
DRAWING NUMBER: D13324
REV. A
SH. 10 OF 12



MicroManager SOFTWARE BLOCK DIAGRAM
P3=12
PID: LOADCELL WITH LINE REVOLUTIONS DIA METHOD
INPUTS
ISOLATION
TENSION SETPOINT
LOADCELL FEEDBACK
RUN
DIAMETER RESET
THICKNESS SEL (MSB)
THICKNESS SEL (LSB)
LINE SPEED
DIAMETER
PID LOOP
LOGIC GATE 2
LOGIC GATE 1
ROLL SPEED CALCULATOR
DIAMETER CALCULATOR
DIAMETER CALC
TENSION CALCULATOR
TAPER CALC
DRIVE ENABLE
SPEED REFERENCE
PROCESSING ORDER
OUTPUTS
MODBUS RTU COMMUNICATIONS
134 NETWORK ADDRESS
135 BAUD RATE
136 PARITY/STOP BITS
137 ADDRESSING MODE
138 ADDR MODE TEST1
139 ADDR MODE TEST2
TXD+ 21
TXD- 22
RXD+ 23
RXD- 24
25
DIG OUT 1
DIG OUT 2
ANALOG OUTPUT 1
ANALOG OUTPUT 2
ANALOG OUTPUT 3
VOLTAGE OUT 1
VOLTAGE OUT 2
VOLTAGE OUT 3
CURRENT OUT 1
CURRENT OUT 2
V TO I
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
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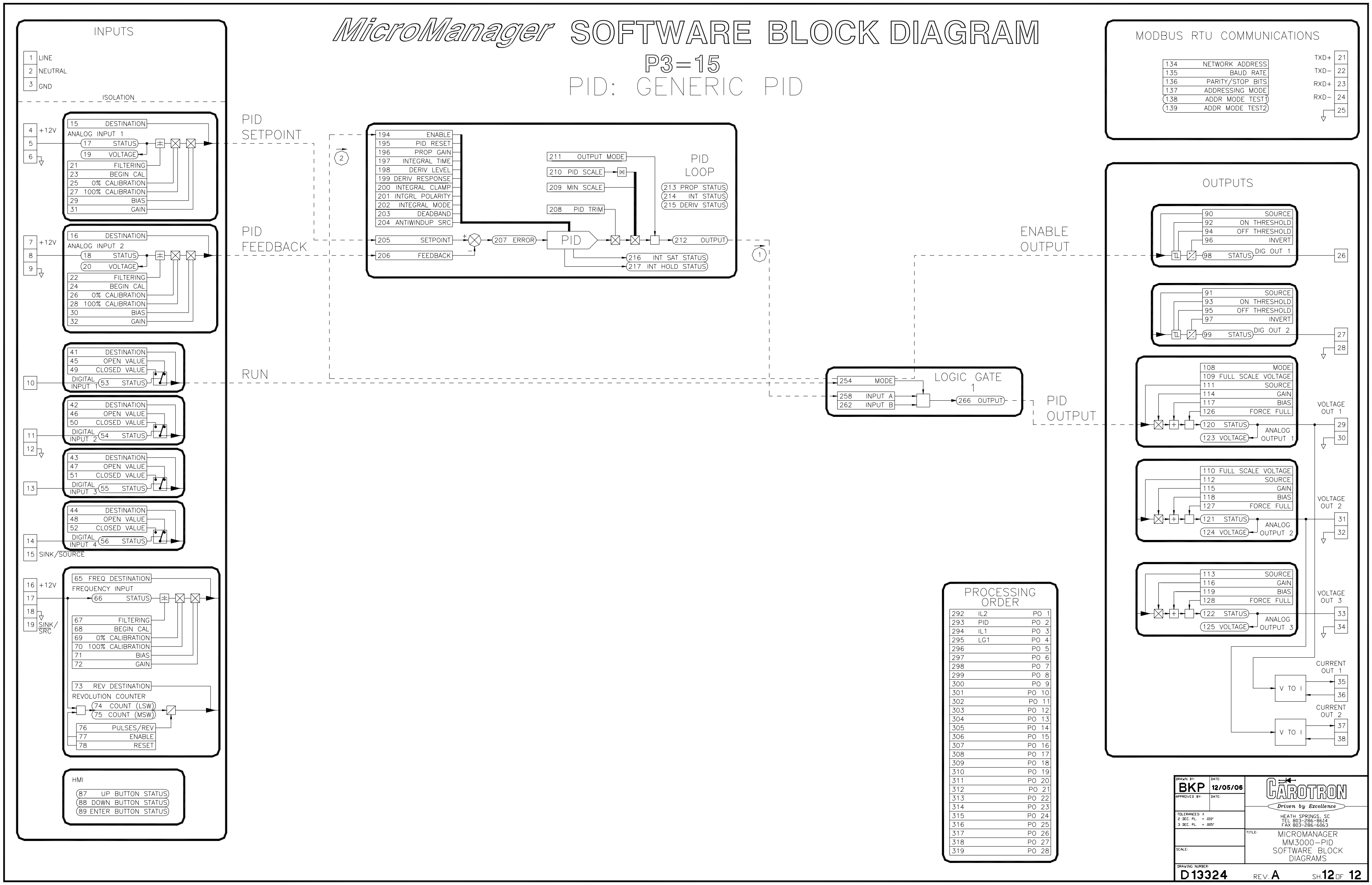
DRAWN BY: BKP
DATE: 12/05/06
MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
D13324
REV A
SH 11 OF 12


MicroManager SOFTWARE BLOCK DIAGRAM
P3=15
PID: GENERIC PID
INPUTS
1 LINE
2 NEUTRAL
3 GND
ISOLATION
4 +12V
5
6
15 DESTINATION
ANALOG INPUT 1
17 STATUS
19 VOLTAGE
21 FILTERING
23 BEGIN CAL
25 0% CALIBRATION
27 100% CALIBRATION
29 BIAS
31 GAIN
7 +12V
8
9
16 DESTINATION
ANALOG INPUT 2
18 STATUS
20 VOLTAGE
22 FILTERING
24 BEGIN CAL
26 0% CALIBRATION
28 100% CALIBRATION
30 BIAS
32 GAIN
10
41 DESTINATION
45 OPEN VALUE
49 CLOSED VALUE
DIGITAL INPUT 1
53 STATUS
11
12
42 DESTINATION
46 OPEN VALUE
50 CLOSED VALUE
DIGITAL INPUT 2
54 STATUS
13
43 DESTINATION
47 OPEN VALUE
51 CLOSED VALUE
DIGITAL INPUT 3
55 STATUS
14
15 SINK/SOURCE
44 DESTINATION
48 OPEN VALUE
52 CLOSED VALUE
DIGITAL INPUT 4
56 STATUS
16 +12V
17
18
19 SINK/SRC
65 FREQ DESTINATION
FREQUENCY INPUT
66 STATUS
67 FILTERING
68 BEGIN CAL
69 0% CALIBRATION
70 100% CALIBRATION
71 BIAS
72 GAIN
73 REV DESTINATION
REVOLUTION COUNTER
74 COUNT (LSW)
75 COUNT (MSW)
76 PULSES/REV
77 ENABLE
78 RESET
HMI
87 UP BUTTON STATUS
88 DOWN BUTTON STATUS
89 ENTER BUTTON STATUS
PID SETPOINT
PID FEEDBACK
RUN
194 ENABLE
195 PID RESET
196 PROP GAIN
197 INTEGRAL TIME
198 DERIV LEVEL
199 DERIV RESPONSE
200 INTEGRAL CLAMP
201 INTGRL POLARITY
202 INTEGRAL MODE
203 DEADBAND
204 ANTIWINDUP SRC
205 SETPOINT
206 FEEDBACK
207 ERROR
PID
211 OUTPUT MODE
210 PID SCALE
209 MIN SCALE
208 PID TRIM
PID LOOP
213 PROP STATUS
214 INT STATUS
215 DERIV STATUS
212 OUTPUT
216 INT SAT STATUS
217 INT HOLD STATUS
1
2
LOGIC GATE 1
254 MODE
258 INPUT A
262 INPUT B
266 OUTPUT
ENABLE OUTPUT
PID OUTPUT
MODBUS RTU COMMUNICATIONS
134 NETWORK ADDRESS
135 BAUD RATE
136 PARITY/STOP BITS
137 ADDRESSING MODE
138 ADDR MODE TEST1
139 ADDR MODE TEST2
TXD+ 21
TXD- 22
RXD+ 23
RXD- 24
25
OUTPUTS
90 SOURCE
92 ON THRESHOLD
94 OFF THRESHOLD
96 INVERT
98 STATUS
DIG OUT 1
26
91 SOURCE
93 ON THRESHOLD
95 OFF THRESHOLD
97 INVERT
99 STATUS
DIG OUT 2
27
28
108 MODE
109 FULL SCALE VOLTAGE
111 SOURCE
114 GAIN
117 BIAS
126 FORCE FULL
120 STATUS
123 VOLTAGE
ANALOG OUTPUT 1
VOLTAGE OUT 1
29
30
110 FULL SCALE VOLTAGE
112 SOURCE
115 GAIN
118 BIAS
127 FORCE FULL
121 STATUS
124 VOLTAGE
ANALOG OUTPUT 2
VOLTAGE OUT 2
31
32
113 SOURCE
116 GAIN
119 BIAS
128 FORCE FULL
122 STATUS
125 VOLTAGE
ANALOG OUTPUT 3
VOLTAGE OUT 3
33
34
CURRENT OUT 1
V TO I
35
36
CURRENT OUT 2
V TO I
37
38
PROCESSING ORDER
292 IL2 PO 1
293 PID PO 2
294 IL1 PO 3
295 LG1 PO 4
296 PO 5
297 PO 6
298 PO 7
299 PO 8
300 PO 9
301 PO 10
302 PO 11
303 PO 12
304 PO 13
305 PO 14
306 PO 15
307 PO 16
308 PO 17
309 PO 18
310 PO 19
311 PO 20
312 PO 21
313 PO 22
314 PO 23
315 PO 24
316 PO 25
317 PO 26
318 PO 27
319 PO 28
DRAWN BY: BKP
DATE: 12/05/06
APPROVED BY:
DATE:
TOLERANCES: ±
2 DEC PL. ± .000"
3 DEC PL. ± .005"
SCALE:
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
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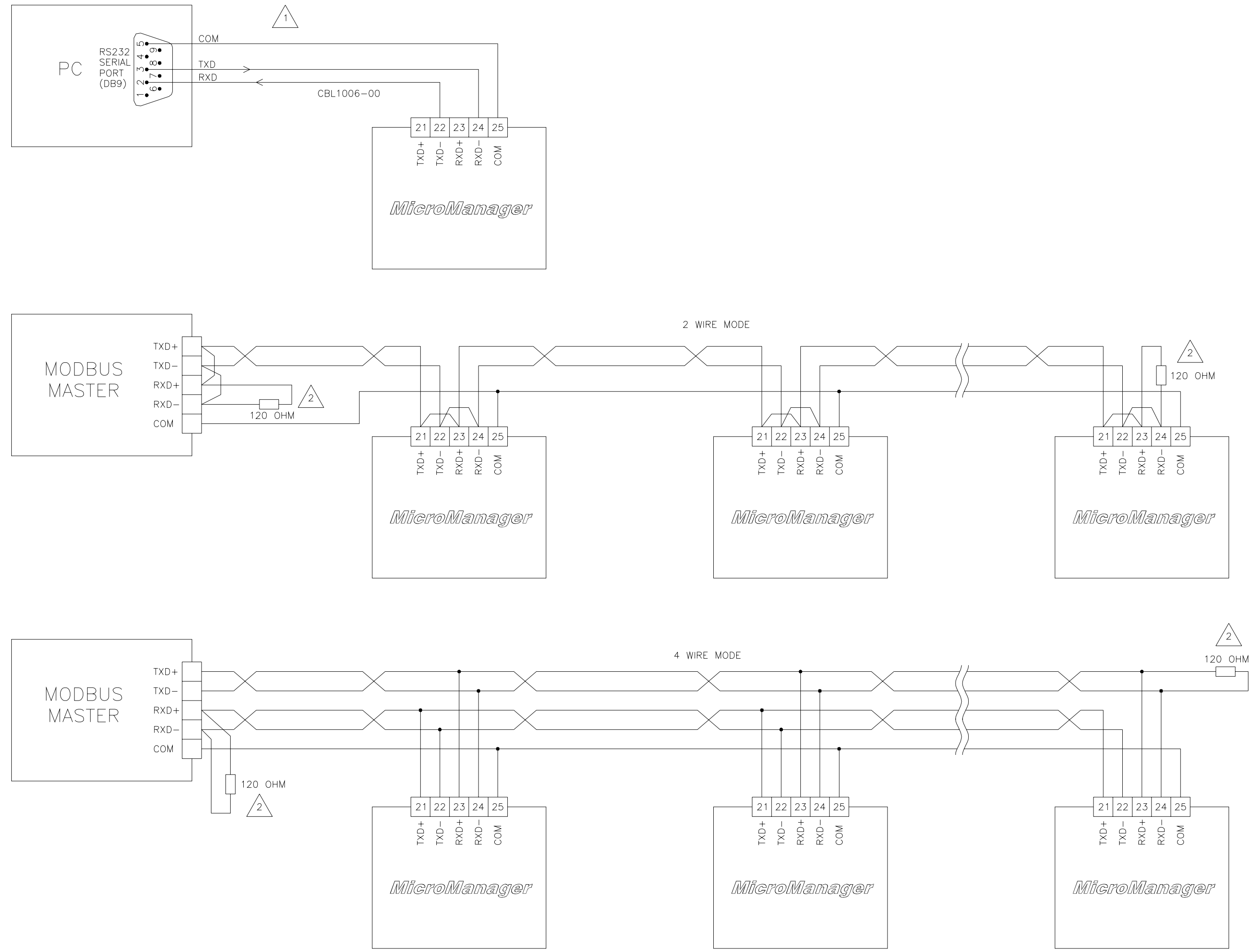
TITLE: MICROMANAGER MM3000-PID SOFTWARE BLOCK DIAGRAMS
DRAWING NUMBER: D13324
REV. A
SH. 12 OF 12



NOTES:

1. THE PC CONNECTION SHOWN IS FOR TEMPORARY SETUP ONLY. PERMANENT INSTALLATIONS REQUIRE AN RS232 TO RS485 CONVERTER.
2. IT IS RECOMMENDED THAT A TERMINATING RESISTOR BE INSTALLED AT EACH END OF THE NETWORK AS SHOWN.
3. MAXIMUM TOTAL NETWORK LENGTH IS 4000 FEET.
4. THE COMMUNICATION WIRING SHOULD BE ROUTED SEPARATELY FROM HIGH LEVEL WIRING SUCH AS ARMATURE, FIELD, OPERATOR AND RELAY CONTROL WIRING. WHEN THESE TWO TYPES OF WIRING MUST CROSS, THEY SHOULD DO SO AT RIGHT ANGLES.

REV. B, 7/27/09, CORRECT PC CONNECTIONS

DRAWN BY: BKP	DATE: 10/18/06	CAROTRON Driven by Excellence
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES ± 2 DEC. PL. ± .010" 3 DEC. PL. ± .005"		TITLE: MICROMANAGER MODBUS NETWORK CONNECTIONS
SCALE:		
DRAWING NUMBER D13307	REV B	SH. 1 OF 1

10 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 Cc) 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 warrant 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, (l) 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 ”RETURNTAG” 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

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