

CORTEX^â INDUSTRIAL SYSTEM CONTROLLER

Loadcell Tension Control

Instruction Manual

Model CORTEX-D00





Table of Contents

1. General Description	2
2. Specifications	3
2.1 Electrical	3
2.2 Physical	4
3. Installation.....	4
4. Operating Modes.....	6
5. Programming & Adjustments	7
6. Adjustment Procedure.....	18
7. Spare Parts	22
8. Prints	23
C11850 Cortex Inputs/Outputs	23
C11949 Cortex Block Diagram	24
D12007 Cortex Loadcell Tension Control Connection Diagram	25
D11926 Cortex Loadcell Tension Control Menu Structure.....	26
D12064 Cortex Panel Mount Interface Dimensions	28
Parameter Quick Reference Table	29



1 General Description

Model CORTEX-D00 is a microprocessor based loadcell tension controller. The unit is designed for use with a torque mode drive and loadcell tension feedback to provide constant tension or taper tension control of a center driven winder. Web tension is regulated by PID control of motor torque through varying levels of material roll diameter, line speed, and line acceleration. The unit also provides options for controlling parking tension, and even winder speed when in the WINDER JOG mode.

2.1 Electrical

A.C. Input

Internally fused at 0.3 Amps

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

Analog Inputs (4)

- Voltage inputs: 10 VDC max
- Current inputs: 20 mADC max
- Nominal +10VDC supply @ 5.0mA

Digital Inputs (6)

Sink Mode

- Vil=3.0 VDC max @ 2.7mA
- Vih=5.0 VDC min to 30.0 VDC max @ 2.5mA

Source Mode

- Vil=3.0 VDC max @ 0.7mA
- Vih=5.0 VDC min to 30.0 VDC max @ 1.0mA

Digital Input Reference

- Internal: Nominal +24 VDC supply @ 200mA
- External: 5.0 - 30.0 VDC

Frequency Inputs (2)

- Frequency: 32kHz max, zero crossing square wave
- Voltage: 12 VDC max
- Sinking current required: 1.5mA min
- Nominal +12VDC supply @ 300mA

Relay Outputs (4)

Form-C contact:

- 3 A @ 115 VAC
- 3 A @ 30 VDC

Analog Output

- 10 VDC max (voltage mode)
- 20 mADC max (current mode)
- External Voltage Reference -10.0 to +10.0 VDC

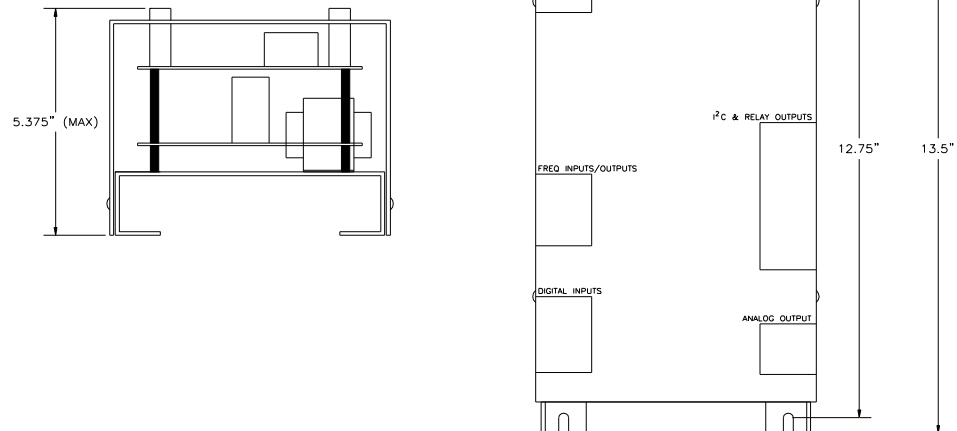
Frequency Output

- External Voltage Reference: 0 to 16.0 VDC
- Output Frequency: 2kHz max, zero crossing square wave
- Output current: 50mA max

I²C Expansion Bus

- Nominal +12 VDC supply @ 300mA

2.2 Physical



3

Installation

The Cortex should be installed in accordance with the National Electric Code and any applicable local or state codes.

WIRING PRECAUTIONS:

Use shielded cable for all analog, digital, and frequency inputs and outputs. Connect the shield to circuit common at the receiving end only. Please note that there are 6 different isolated sections on the Cortex. This allows unisolated drives, tachometers, etc... to be connected directly to the unit without the need for an isolation card. Each isolated common is designated on the included drawings with a unique number to distinguish one section from the others.

Any relays, contactors, motor starters, solenoids, etc. located in close proximity to or on the same A.C. line as the Cortex controller should have a transient suppression device in parallel with the coil to minimize interference with the unit.

TERMINAL CONNECTIONS:

TB1 (AC line input)

Terminals 1 and 4 are used for the AC line input. Either 115 or 230VAC input can be connected to these terminals. If 115VAC input is used, place a jumper between terminals 1 & 2 and also between terminals 3 & 4. If 230VAC input is used, place a jumper between terminals 2 & 3.

TB2 (Analog inputs)

There are 4 analog inputs on the Cortex, 2 voltage and 2 current. Terminals 1 and 6 provide the +10VDC supply and the common connection respectively. Terminals 2 and 4 are the voltage inputs and terminals 3 and 5 are the current inputs.

TB3 (Frequency output)

Terminal 2 is the frequency output signal and terminal 3 is the common. An external voltage up to 16 VDC must be supplied at terminal 1.

TB4 (Frequency inputs)

Terminal 2 is the frequency #1 input, and terminal 3 is the frequency #2 input. Terminals 1 and 4 provide a nominal +12VDC supply and the common connection respectively.

TB5 (Digital inputs)

Terminals 1 through 6 provide the six digital inputs, and terminal 7 provides the common connection. When configured with the INTERNAL reference, terminal 8 provides a nominal +24VDC level to be used with the digital inputs. If desired, an external signal up to +30 VDC can be used by selecting EXTERNAL reference. Terminal 8 then becomes an input for the external voltage signal.

TB6 (I²C Bus)

This expansion port can be used to supplement the Cortex with additional inputs and outputs along with other interface options. Terminal 1 is the SDA or signal data line and terminal 4 is the SCL or signal clock line. Terminals 2 and 3 provide a +12VDC signal and circuit common respectively.

TB7 (Relay Contacts)

Relay #1 contacts:	Normally closed	Terminal 1
	Normally open.....	Terminal 2
	Wiper.....	Terminal 3
Relay #2 contacts:	Normally closed	Terminal 4
	Normally open.....	Terminal 5
	Wiper.....	Terminal 6
Relay #3 contacts:	Normally closed	Terminal 7
	Normally open.....	Terminal 8
	Wiper.....	Terminal 9
Relay #4 contacts:	Normally closed	Terminal 10
	Normally open.....	Terminal 11
	Wiper.....	Terminal 12

TB8 (Analog Output)

Terminal 3 is the analog output signal. When configured as a voltage output, the common connection should be connected to terminal 4. When configured as a current output, the current return signal should be connected to terminal 5. If desired, an external voltage signal can be applied to trim the analog output. This is achieved by applying the signal to terminal 1 and configuring the output reference to EXTERNAL. Terminal 2 provides an extra common connection.

Tension/Torque Control

The main function of the Cortex Loadcell Tension Control is to provide rotational torque at a level that will keep the material tension level constant through ever changing conditions of winder loading. The source of torque in this case, a DC motor, will produce torque output that is directly proportional to its armature current level. The strength of the field, which also affects torque, is held constant by a fixed voltage supply for shunt wound motors or by use of a permanent magnet motor.

Diameter Compensation

Normally the greatest change in required torque is caused by the increase in roll diameter as material is wound. For constant tension, the torque must increase in direct proportion to the diameter increase. The Cortex Loadcell Tension Control accomplishes this by one of three methods. (1) An analog diameter signal is provided to the Cortex. (2) A revolution pulse(s) are provided to the Cortex along with the material thickness. (3) The diameter is calculated by comparing the line speed to the winder speed, which decreases as roll diameter (and circumference) increases. To maintain speed based diameter levels during stops, the Cortex Loadcell Tension Control retains the diameter based torque level. This keeps a constant tension on the material at “stop” and helps accelerate larger rolls back up to speed on “start”.

PID Compensation

The Cortex Loadcell Tension Control also regulates the material tension by monitoring the loadcell feedback tension signal. The open-loop diameter compensation method described above approximates the major portion of the torque required for constant tension. The PID compensation portion adds a smaller fine tuned level. When combined, these two compensation methods provide accurate torque levels to obtain the desired tension.

Taper Control

In some cases, a decreasing tension or taper tension is desirable to prevent telescoping and/or wrinkling of inner layers of material. The Cortex Loadcell Tension Control unit can be programmed to provide taper tension up to 100% starting at any point in the roll.

Park Mode

When it is desirable to stop or “park” the winder for a period of time but maintain a light tension on the web, parking tension can be selected. In the park mode, a diameter based torque level is produced to keep a constant tension on the web. If desired, the PID function can be enabled or disabled in this mode.

Winder Jog Mode

A slow and steady speed is best when aligning and threading material on the winder. The Cortex Loadcell Tension Control supplies this in the winder jog mode by converting operation of the winder drive from torque control to velocity control. There are two different modes of jog available. The constant RPM mode jogs the winder at a desired RPM. In the constant line speed mode, the winder is jogged at a diameter based speed. This in effect, adjusts the jog speed of the

winder so the material is taken up at a constant rate regardless of the diameter. Note: The memory function must be active for the constant line speed mode to function properly.

Run Mode

This mode enables the diameter calculator and PID, and provides the torque signal to the winder drive. The run mode can override the park mode.

Fault Mode

The Cortex Loadcell Tension Control provides a digital fault input and a programmable fault relay. If at any time the fault input is activated, the Cortex will enter the fault mode and de-energize the fault relay.

Batch Function (Optional)

The Cortex Loadcell Tension Control can be programmed to wind a desired length or diameter roll. In the length mode, a pulse train generated by an external wheel riding on the web allows the Cortex to calculate the length of material on the roll. The diameter mode needs no external devices and simply builds a roll until the desired diameter is reached.

5

Programming & Adjustments

INTERFACE

The Cortex contains an RS232 communication port for serial communication to and from the unit. This communication port is used in conjunction with a handheld programmer, panel mount programmer, or a personal computer to configure the Cortex's operating parameters. A standard 9 pin communication cable is required to connect the Cortex to a PC. When power is applied, the unit goes into an initialization process and then displays the first monitoring screen. Please refer to drawing D11926 in Section 8 for visual representation of the menu structure.

MENU

After the initial power up, the display will show the monitoring screen containing the line speed, winder speed, diameter, and operating mode. The user can scroll through the monitoring screens and the QUICK MENU by using the 'D' and 'E' keys. The 'D' key will take you to the previous screen and the 'E' key will take you to the next screen. Pressing the 'E' key will change the display to the next monitoring screen showing the batch, torque, and tension readings. If the PASSWORD ENABLE parameter is set to 'yes', pressing the 'E' key again will take you back to the first monitoring screen. If the password enable is not on, the QUICK MENU will be displayed. The QUICK MENU contains parameters that may require changing frequently. The softkeys are used to navigate through the menu and set values. When the NEXT softkey is pressed at the last QUICK MENU screen (jog speed), the display will return to the first monitoring screen. To gain access to the QUICK MENU when the password protection is on, press the 'ENTER' key while at one of the monitoring screens. Enter the QUICK MENU password when prompted. The following contains a description of each menu screen and the function of each parameter.

The MAIN MENU is accessed by pressing the 'ENTER' key. If the PASSWORD ENABLE selection is set to 'yes', the menu password has to be entered to gain access. Otherwise, the MAIN MENU screen is displayed and 8 options are given allowing the inputs, outputs, and functionality of the Cortex to be defined. Once an option is chosen, the appropriate menu screen is displayed. When in the menu, the top 5 keys (A,B,C,D, and E) act as 'soft keys'. The function of each soft key is indicated by the text immediately above each key in the bottom row of the display. The softkeys are used to navigate through the menu and set options. Note: As a safety precaution, many of the parameters in the I/O section can only be modified when the Cortex is in the DISABLE mode.

MAIN MENU

1-I/O	Configures the inputs and outputs.
2-MOTOR.....	Enter motor and drive data.
3-OPTIONS	Set Operating, jog, batch, & fault parameters.
4-TENSION	Enter tension settings for RUN and PARK modes.
5-DISPLAY	Set monitoring preferences.
6-SYSTEM	Set security passwords.
7-FILE	Load and Save user configurations.
8-EXIT	Return to the monitoring screens.

1. I/O (INPUTS/OUTPUTS)

CONFIGURE I/O

The analog, digital, and frequency inputs can be configured by pressing the INPUTS softkey. Likewise, the analog, frequency, and relay outputs are configured by pressing the OUTPUTS softkey. The MAIN softkey will take you back to the MAIN menu.

INPUTS

The digital inputs can be configured by pressing the DIGITAL softkey and the analog and frequency inputs are configured by pressing the ANALOG/FREQ softkey. The PREV softkey will take you back to the I/O menu.

DIGITAL INPUT VOLTAGE

Selects the source of voltage used on the digital input section. An internal unregulated NOMINAL voltage of +24 VDC is the factory preset and is accessed at TB5 terminal 8. If desired, an external voltage can be used by selecting external and applying the voltage at TB5 terminal 8.

DIGITAL INPUT LOGIC

Selects the type of logic for the external devices used on the digital inputs. The factory preset is SOURCE which sets the digital inputs low and the external input device must SOURCE or drive high the input when activated. An example of this is simply a switch connected to a digital input and the voltage source at TB5 terminal 8. The SINK selection sets the digital inputs at a high state and the external input device must SINK or pull down the input when activated. An example of this is simply a switch connected to a digital input and the common terminal at TB5 terminal 7.

DIGITAL INPUT n TYPE (n = 1 - 6)

Each digital input may be configured to be on (active) when the external device or switch is in the open (high) or closed (low) position. Normally open switches should be configured as 'CLOSED=ON' and normally closed switches should be set as 'OPEN=ON'. The factory preset is 'CLOSED=ON'.

VOLTAGE 1 INPUT, CURRENT 1 INPUT, VOLTAGE 2 INPUT, CURRENT 2 INPUT, FREQUENCY 1 INPUT, FREQUENCY 2 INPUT

Each of the 4 analog inputs (2 voltage, 2 current) and 2 frequency inputs can be configured to provide certain functions. The FUNC softkey scrolls through a list of available functions. Please note that if an input function is not displayed as you scroll through the list, it is already assigned to a different input. The function must be first unassigned before it can be reassigned to a new input.

After a function has been chosen, the CAL softkey allows the Cortex to calibrate the input. The Cortex can automatically measure the minimum and maximum levels by choosing AUTO. The Cortex will prompt you to input the minimum signal level and then press OK. It will then prompt you to input the maximum signal level. Again when this is done, press OK. Note: The calibration routine can only be run when the unit is in the STOP mode.

The Cortex also allows the user to manually set or adjust these minimum and maximum signal levels by pressing the MAN softkey. The levels are displayed and can be modified by pressing the SET softkey. Note that the 4 analog input levels have a resolution of 12 bits. The values can range from 0 to 4095 and correspond to an analog level of 0 to 10VDC or 0 to 20mADC. The frequency input levels are in Hertz and can range from 0 to 32,000 Hz.

Furthermore, the AVG softkey allows adjustment of the windowed or sliding average routine that is performed on the incoming signal. The size of the window is adjustable from 1 (no averaging) up to 255.

The AVG softkey allows the averaging of each input to be individually set. The averaging of an input can be used to suppress disturbances and ripples in the input signal.

The following input functions are available as analog or frequency:

Off

The input has no function.

Line Speed

The line speed input is used to provide a scaling input to the Loadcell Tension Control function. This allows the input to ratio or scale the output.

Winder Speed

The winder speed input can be used along with the line speed signal to calculate the diameter of the roll. This feedback signal is required if no diameter or

revolution signals are supplied or the Winder Jog function is used.

Tension Setpoint

The tension setpoint input function is used to set the desired level of tension on the web. The external tension input is optional and can also be configured to be an internal setting if desired. (See OPTIONS).

Diameter

An external diameter signal can be supplied to the Cortex. This signal can be obtained from a lay on roll, sonic measuring device, etc...

Taper

If desired, an external signal may be used to set the percentage of taper tension from 0 to 100%.

Loadcell

A buffered and scaled loadcell tension feedback signal is used by the PID algorithm to maintain the desired tension level on the material.

The following input functions are available only on frequency input 2. Please also note that the calibration function is disabled when either of these functions are selected since they are simply counting pulses.

Revolution

As described above, a diameter signal can be provided to the Cortex. Another option is to provide a pulse per revolution input signal. The Cortex, when provided with the pulses per revolution and material thickness data can compute the diameter. Note that the diameter signal has precedence over the revolution input if both signals are functioning simultaneously.

Batch

The optional batch function can be used to allow the Cortex to run a desired length of material. A pulse train generated by an external wheel riding of the web allows the Cortex to calculate the length.

OUTPUTS

The analog output can be configured by pressing the ANALOG softkey. Likewise, the relay and frequency outputs are configured by pressing the RELAY/FREQ softkey. The PREV softkey will take you back to the I/O menu.

ANALOG REFERENCE

Selects the reference source of voltage for the digital to analog converter. The factory preset is INTERNAL and selects a DC voltage level that allows an output up to 10VDC or 20mADC. If desired, an external voltage can be used to trim the output by selecting EXTERNAL. The external voltage should be applied to TB8 terminal 1.

ANALOG OUTPUT BIAS

This menu screen is used to set a bias level for the analog output. The '+' and '-'

softkeys are used to adjust the level up and down. The RES softkey will toggle the resolution between a coarse and fine adjustment. The factory preset is 0%.

ANALOG OUTPUT GAIN

This menu screen is used to set the gain level for the analog output. The '+' and '-' softkeys are used to adjust the level up and down. The RES softkey will toggle the resolution between a coarse and fine adjustment. The factory preset is 100%.

ANALOG OUTPUT

Selects whether the analog output is voltage or current. The output is at TB8 terminal 3 regardless of the selection. However, the common or return connection should be made to terminal 4 for voltage and terminal 5 for current. The factory preset is VOLTAGE.

FACTORY OFFSET

This parameter is used to zero the internal amplifier connected to the digital to analog output. This parameter is set at the factory and should not require re-adjusting.

FACTORY GAIN

This parameter is used to set the gain of the digital to analog signal to 10 VDC or 20 mADC. This parameter is set at the factory and should not require re-adjusting.

FACTORY BIAS

This parameter is used to bias the analog output to zero. This parameter is set at the factory and should not require re-adjusting.

RELAY #n FUNCTION (n = 1 - 4)

Each relay output may be configured to provide various functions. Below is a description of each function:

Off

The relay is de-energized.

On

The relay is energized.

Run

This function can be used to control the winder drive. The relay is energized when in the RUN, WINDER JOG, and PARK modes.

Fault

This function can be used to indicate a FAULT condition. The output is normally in an energized state and will de-energize in a FAULT condition.

Batch Slowdown

This function energizes the relay when the batch length has reached the BATCH SLOWDOWN percentage. The relay output can be used to switch to a slow line speed near the end of a batch run, in order to achieve precise batch lengths.

Batch Complete

This function energizes the relay when the batch run is complete.

Taper

This function energizes the relay when the taper function is active.

Zero Speed

This function monitors the line speed input and is energized when the speed is below the ZERO SPEED SETPOINT. This setpoint is adjustable. Refer to the operating parameters section under the OPTIONS menu.

Low Tension

If the tension feedback signal drops below an adjustable threshold level, this relay output function can be used to alert or shutdown the system. Thus this function can be used to detect web breaks. The relay is normally energized and de-energizes in a low tension condition.

FREQUENCY OUTPUT

This menu allows the user to select the function of the frequency output and to set the level of the 100% output. Pressing the FUNC key scrolls through a list of functions that are described below. The SET softkey allows the 100% frequency output level to be defined in Hertz. The frequency output range is 0 to 2000 Hz.

Off

The frequency output is disabled.

Tension

The frequency output will be proportional to the material tension.

Torque

The frequency output will be proportional to the torque output signal of the Cortex.

Line Speed

The frequency output will be proportional to the line speed input signal.

Winder Speed

The frequency output will be proportional to the winder speed input signal.

2. MOTOR DATA

MOTOR RATED HP (Horse Power)

The nameplate horsepower of the winder drive is entered here. This value is used along with the base speed and gear ratio to determine the maximum rated torque of the motor in use.

MOTOR BASE SPEED

The nameplate base speed of the winder drive is entered here in RPMs.

GEAR RATIO

The gear ratio of the winder core to the motor is entered here.

3. OPTIONS

- 1-OPERATING PARAMSConfigure operating parameters.
- 2-JOGConfigure the jog parameters.
- 3-BATCH/REV.....Configure batch & revolution params.
- 4-FAULT Configure fault parameter options.
- 5-PID Configure the PID options.
- 6-MAIN..... Return to the MAIN MENU.

1. OPERATING PARAMETERS

CORE DIAMETER

The diameter of the core roll is entered here. Press the UNITS key to scroll through a list of predefined units.

MAX DIAMETER

The maximum diameter of the roll is entered here. Press the UNITS key to scroll through a list of predefined units.

PERCENT TAPER

If desired, the Cortex can perform the taper tension function. This parameter sets the amount of taper. If no taper is desired, set to 0. The factory preset is 0.

TAPER DIAMETER

If the taper function is desired, this parameter sets the starting diameter of the taper function.

MATERIAL THICKNESS

The thickness of material is entered here. Please note that this is only required if a revolution pulse input is used to compute the roll diameter. Press the UNITS softkey to scroll to the desired units.

AUTO MEMORY RESET

The diameter calculations are held in memory when in the unit is disabled. In order to reset these values, a manual reset can be activated by a digital input, or the unit can automatically reset these values when the unit re-enters the run mode.

ZERO SPEED SETPOINT

This parameter sets the level of line speed or jog speed at which the run and zero speed relays energize and de-energize. The factory preset is 5%.

2. JOG PARAMETERS

JOG SPEED

This parameter sets the speed at which the unit will jog the winder. The percentage setting corresponds to the speed used in the calibration routines.

JOG ACCEL TIME

This parameter sets the acceleration time in seconds that the output takes to go from minimum to maximum.

JOG DECEL TIME

This parameter sets the deceleration time in seconds that the output takes to go from maximum to minimum.

JOG SPEED MODE

The Winder Jog function can be configured to operate in one of two modes. In the constant RPM mode, the winder is jogged at a constant speed regardless of the roll diameter. In the constant line speed mode, the winder jog speed is adjusted by the diameter. This jogs the winder at slower speeds as the diameter increases to maintain a constant line speed. Note that the memory reset must be active for this mode to function properly.

JOG PROPORTIONAL

This parameter sets the proportional response when in the Jog mode. Increasing this value increases the gain (increases the response rate). The factory preset is 31.4%.

JOG INTEGRAL

This parameter sets the integral response when in the Jog mode. Increasing this value increases the time (decreases the response rate). The factory preset is 14.5%.

3. BATCH/REVOLUTION PARAMETERS

BATCH MODE

The batch function can be configured to operate in a length mode or in a diameter mode. When in the length mode, frequency input #2 is used along with a web wheel to calculate the batch length. The diameter mode allows the user to wind a roll to a certain diameter. The BATCH LENGTH/DIAMETER setting is used to set the length or diameter, depending on the mode selected.

BATCH WHEEL CIR. (Circumference)

If the batch function is used (length mode), this parameter sets the circumference of the wheel that rides on the surface of the web.

BATCH/REVOLUTION PPR (Pulses Per Revolution)

If the batch (length mode) or revolution function is used, this parameter sets the number of pulses per revolution produced.

BATCH LENGTH/DIAMETER

This parameter sets the desired length of the batch run or the desired diameter. When this length has been reached, the batch complete relay is energized.

BATCH SLOWDOWN

When running the batch function, precise lengths can be obtained by switching to a lower line speed reference near the end of the batch run. This parameter sets the point, in a percentage of the batch length or diameter, at which the batch slowdown relay is energized.

4. FAULT PARAMETERS

LOW TENSION THRESHOLD

If desired, the Cortex can be configured to monitor and de-energize a relay if the tension level drops below a threshold (web break detection). This level is adjustable from 0 to 100%.

LOW TENSION TIMER

The Cortex can be configured to de-energize the low tension relay output if the tension level drops below the threshold for an adjustable time period. This allows the Cortex to ignore momentary tension errors that may occur in rapid speed changes. The time period is adjustable from 0 to 10 seconds.

EXTERNAL FAULT TIMER

An external fault can be activated by one of the digital inputs. If desired, the Cortex can be configured to only generate a fault condition if this input has been activated for an adjustable time period. The time period is adjustable from 0 to 10 seconds.

5. PID

PROPORTIONAL GAIN

This parameter sets the proportional response. Increasing this value increases the gain (increases the response rate). The factory preset is 20%. The RES softkey toggles the resolution of the + and - keys from coarse to fine.

INTEGRAL TIME

This parameter sets the integral response. Increasing this value increases the time (decreases the response rate). The factory preset is 20%. The RES softkey toggles the resolution of the + and - keys from coarse to fine.

DERIVATIVE RESPONSE

This parameter sets the rate at which the derivative responds. The factory preset is 0%.

DERIVATIVE LEVEL

This parameter sets the level of the derivative response. Increasing this value increases the effect on the output. The factory preset is 0%.

DEADBAND

This parameter sets a window in the response loop where the output is not affected by small changes in the loadcell. Increasing this value increases the window. The factory preset is 50%.

PID TRIM RANGE

This parameter determines the sensitivity of the PID portion of the control loop.

PARK MODE PID ENABLE

This selection determines if the PID algorithm is functional in the PARK mode.

DERIVATIVE SOURCE

This parameter selects the signal source for the derivative function block. Normally the TENSION ERROR is selected and a full closed loop PID is implemented. The LINE SPEED selection isolates the derivative portion from the control loop so only that a PI loop is implemented. The derivative portion then becomes an inertia compensation signal that can be used to provide accelerating torque.

4. TENSION SETTINGS

TENSION SETPOINT

If no external input is defined as a tension input, this internal parameter is used to set the level the tension. Press the UNITS key to scroll through a list of predefined units.

PARKING SETPOINT

This parameter sets the amount of web tension in the PARK mode. Press the UNITS key to scroll through a list of predefined units.

TENSION TRIM RANGE

This parameter determines the sensitivity of the diameter based portion of the control loop.

PULSE TORQUE LEVEL

In some systems where the mechanics are oversized to produce the desired tension, additional torque is required to start the winder, but then is no longer needed. In these cases, the pulse torque function can be used to momentarily provide additional starting torque to the system. This parameter controls the amplitude of the pulse torque.

PULSE TORQUE TIME

The amount of time the pulse torque level is applied to the output is controlled by this parameter. It is adjustable from 0 to 2000 milliseconds. The pulse torque is applied to the output when the line speed accelerates from stop.

5. DISPLAY SETTINGS

MAX LINE SPEED

The Cortex monitors the line speed and can display it as a percentage or in other useful units such as Feet/Min, Yards/Min, etc.. In order to display properly, the unit must first be calibrated with the 100% line speed value. Press the UNITS key to scroll through a list of predefined units and then enter the maximum line speed.

MAX WINDER SPEED

The Cortex monitors the winder speed and can display it as a percentage or in RPM. In order to display properly, the unit must first be calibrated with the 100% RPM value. Enter the maximum winder speed in RPM.

TORQUE UNITS

This parameter allows the user to select the torque units shown in the display screen. Available units are %, In-Lbs, Ft-Lbs, & N-m.

6. SYSTEM

CORTEX-D00

This menu screen displays the model number and the software versions.

PASSWORD ENABLE

This option allows the user to turn the password protection on or off. When turned on, the user must enter a password before access is given to either the main menu or the quick menu. The menu that is displayed depends on which password was entered.

MENU PASSWORD

The user can set the menu password at this screen.

QUICK MENU PASSWORD

The user can set the quick menu password at this screen.

TIME IN USE

The Cortex provides a real-time clock to keep track of how long a unit has been powered up.

FORCE A REINITIALIZATION

Choosing this option reinitializes the Cortex and loads the factory presets into all of the user parameter sets. Warning! Any custom configuration data contained in the current or user sets will be lost.

ANALOG INPUT STATUS

This status screen displays the level of the two voltage inputs and the two current inputs in volts and milliamps.

FREQ INPUT STATUS

This status screen displays the level of the two frequency inputs in Hertz. If frequency input #2 is configured for a revolution or batch counter, the screen will display the number of pulses counted.

DIGITAL INPUT STATUS

This screen displays the internal status of the six digital inputs as on or off. The state takes into account the configuration of the digital input (closed=on or open=on).

RELAY OUTPUT STATUS

This screen displays the status of the four relay outputs as on or off. A relay is energized when in the 'on' state and is de-energized when in the 'off' state.

SIGNAL OUTPUT STATUS

This status screen displays the level of the analog output in percentage and the frequency output in Hertz.

7. FILE

FILE MENU

The Cortex allows the user to save up to 10 different configurations. This menu screen allows you to either load or save a configuration. The MAIN key returns you to the MAIN MENU.

LOAD USER SETUP

To load a previously saved configuration or the factory presets, press the CHANGE key until the desired set is displayed. Pressing the OK key will load the selected configuration into memory. The CANCEL key returns you to the previous menu.

SAVE USER SETUP

To save the current setup to a user configuration location, press the CHANGE key until the desired location is displayed and then press OK. The CANCEL key returns you to the previous menu.

6

Adjustment Procedure

WARNING!

The Cortex has 6 sections that are electrically isolated from each other. Any section that is connected to an un-isolated device (such as an un-isolated DC drive) can have high voltage

potentials between earth ground and any point in the circuit and between other sections. All test instruments should be isolated from earth ground to prevent damage to the instrument or the control. Any instrument connected to the circuit is floating at potentials that approach the AC line voltage and should be handled with care.

STEP 1 I/O SETUP

Enter the MAIN MENU and select I/O and then INPUTS. Under the DIGITAL section, configure each digital input per the type of switch or signal used. Next, under the ANALOG/FREQ section, assign the line speed, loadcell, and any other optional inputs to the desired voltage, current, or frequency input.

After a function has been assigned to an input, use the CAL softkey to calibrate the input. Initial calibration should be performed in the AUTO mode. When calibrating the line speed, the Cortex will prompt you to input the signal corresponding to 0% line speed and then press OK. Next, run the line up to 100% speed and again press OK. Make a note of the surface speed before stopping the line.

If calibrating the winder speed input, it is necessary to run the winder drive in the velocity mode. This is accomplished by temporarily converting the motor control to velocity mode. The analog output of the Cortex or a speed pot must be used to control the winder drive. The Cortex will prompt you to input the signal corresponding to 0% winder speed and then press OK. Next, use the '+' and '-' keys or the speed pot to adjust the core surface speed until it equals the maximum line speed. Make a note of the winder RPM before pressing OK. Disable the winder drive and convert it back to torque mode control by the Cortex Loadcell Tension Control.

If used, the external tension setpoint, external taper, and/or the external diameter input signals should also be calibrated at this time. When calibrating the external diameter input, the minimum signal should correspond to core and the maximum signal should correspond to the maximum diameter. Also note that the revolution and batch functions on the frequency 2 input do not need calibrating.

Return to the I/O menu and select OUTPUTS. Under the ANALOG section, configure the analog output's reference and type. Under the RELAY/FREQ section, configure the 4 relay outputs per the desired function. Also, set the desired function and 100% output level of the frequency output.

STEP 2. ENTER MOTOR DATA

Return to the MAIN MENU and enter the MOTOR section. Enter the horsepower, base speed, and gear ratio.

STEP 3. CONFIGURE OPTIONS

At the MAIN MENU, enter the OPTIONS section. Under the OPERATING PARAMS section, enter the CORE and MAX DIAMETER. If a revolution counter is used to measure the diameter, also enter the MATERIAL THICKNESS.

If the jog function is desired, enter the JOG section and enter the appropriate speed and accel-decel settings.

STEP 4. TENSION SETTINGS

Material should now be loaded in the “line” and winder. Adjust the tension setpoint to the desired level, enable the Cortex and start the line. Adjustment of the PID parameters may be necessary to provide the optimum performance.

Due to the drastic differences in dynamics when accelerating compared to running on some machines, inertia compensation may be necessary to remove slackening of the material when accelerating. This can be achieved by switching the DERIVATIVE SOURCE from 'tension error' to 'line speed'. Adjustment of the DERIVATIVE RESPONSE and DERIVATIVE LEVEL parameters can now be used to produce an inertia compensating signal.

Furthermore, if the mechanics of the system are oversized, the static friction of the system may need to be overcome momentarily by extra torque. The PULSE TORQUE LEVEL and PULSE TORQUE TIME parameters allow extra torque to be supplied at an adjustable level and time period. The pulse torque is applied to the output whenever the line speed increases from zero.

STEP 5. TAPER TENSION (OPTIONAL)

In many winder applications, the best rolls are “built” when tension is highest at the core and mid-diameter and falls or tapers off during the remaining diameter increase. The TAPER DIAMETER sets the diameter where taper tension begins. This condition can be indicated by a programmable relay output. The amount of tapering torque is set by the PERCENT TAPER parameter or external taper input.

These settings are usually adjusted by winding material far enough to get a “feel” for the proper tension at small diameters and the point at which constant tension problems begin to occur. Most likely, any problem noticed at a particular diameter actually started earlier in the roll. After determining the approximate problem area, make adjustments as follows.

Set the TAPER DIAMETER to the diameter at which tapering is required. Start a new roll of material and wind until taper is required. As material is wound further, adjust the PERCENT TAPER parameter to control the level of taper.

STEP 6. DIAMETER MEMORY (OPTIONAL)

The diameter memory function has been disabled during the adjustment procedure to this point. In many applications, the memory function is not required and the jumper can remain in place. However, in the case where restarting partially completed rolls is a problem, the memory should be left functional. **THIS DOES REQUIRE RESETTING THE MEMORY BEFORE STARTING A NEW ROLL.** The Cortex can also be configured to automatically reset the memory when the unit enters the RUN mode by setting the AUTO MEMORY RESET parameter.

STEP 7. PARKING TENSION (OPTIONAL)

The park mode is intended to maintain tension on the web when the line has been stopped or ‘parked’. The constant tension mode works in a similar manner to the RUN mode and provides a constant tension on the web regardless of the size of the diameter. As the roll diameter increases, the Cortex provides more torque to keep the tension constant. Note that the diameter memory must be active for the function to work properly in this mode. Under most circumstances, the internal PID controller is disabled in the PARK mode and the desired tension is obtained from

the open loop diameter based controller. If desired, the PARK MODE PID ENABLE parameter can be set to ON to enable the PID controller in the PARK mode and obtain closed loop tension control.

STEP 8. LOW TENSION INDICATION (OPTIONAL)

As mentioned previously, the Cortex can monitor and detect when the loadcell tension feedback signal drops below an adjustable threshold level for a set time period. The combination of an adjustable threshold and timer allows the unit to ignore momentary tension errors that may occur on accelerating or decelerating of the line. If false indications are generated during normal operation, increasing the threshold and/or the timer are necessary. By wiring the external FAULT digital input through the LOW TENSION relay, the unit could then detect a web break and shut the system down.

STEP 9. BATCH FUNCTION (OPTIONAL)

The batch function is provided to allow a certain length or diameter of material to be built. When the BATCH MODE parameter is set to length, an external wheel riding on the web produces a pulse train into the frequency #2 input. To obtain precise lengths, a programmable relay output (BATCH SLOWDOWN) can be used to indicate when the roll is approaching the desired length. This relay can be used to switch the line drive to a slower line speed. When the desired length is finally obtained, another programmable relay (BATCH COMPLETE) signals that the batch is complete. Set the BATCH WHEEL CIRCUMFERENCE and BATCH WHEEL PPR parameters to match the type wheel being used. Enter the desired length or diameter at the BATCH LENGTH/DIAMETER menu. Set the BATCH SLOWDOWN parameter to adjust the slowdown point. The batch reset input is used to reset the batch length to zero when a new roll is loaded.

STEP 10. DISPLAY (OPTIONAL)

The Cortex monitors the line speed and winder speed inputs to perform internal calculations to provide constant tension. Moreover, the Cortex can display the line and winder speeds in useful units such as Feet/Min, RPMs, etc... In order to display the correct speed, the 100% speeds need to be entered into the MAX LINE SPEED and MAX WINDER SPEED menus. Press the UNITS key to scroll through the desired display units. Enter the maximum values that were measured during the calibration routines earlier.

STEP 11. PASSWORD (OPTIONAL)

The password option prevents unauthorized access to the MAIN MENU and QUICK MENU screens. The option is controlled by the PASSWORD ENABLE screen. The MENU PASSWORD and QUICK MENU PASSWORD screens allow a custom password to be entered.

STEP 12. FILE (OPTIONAL)

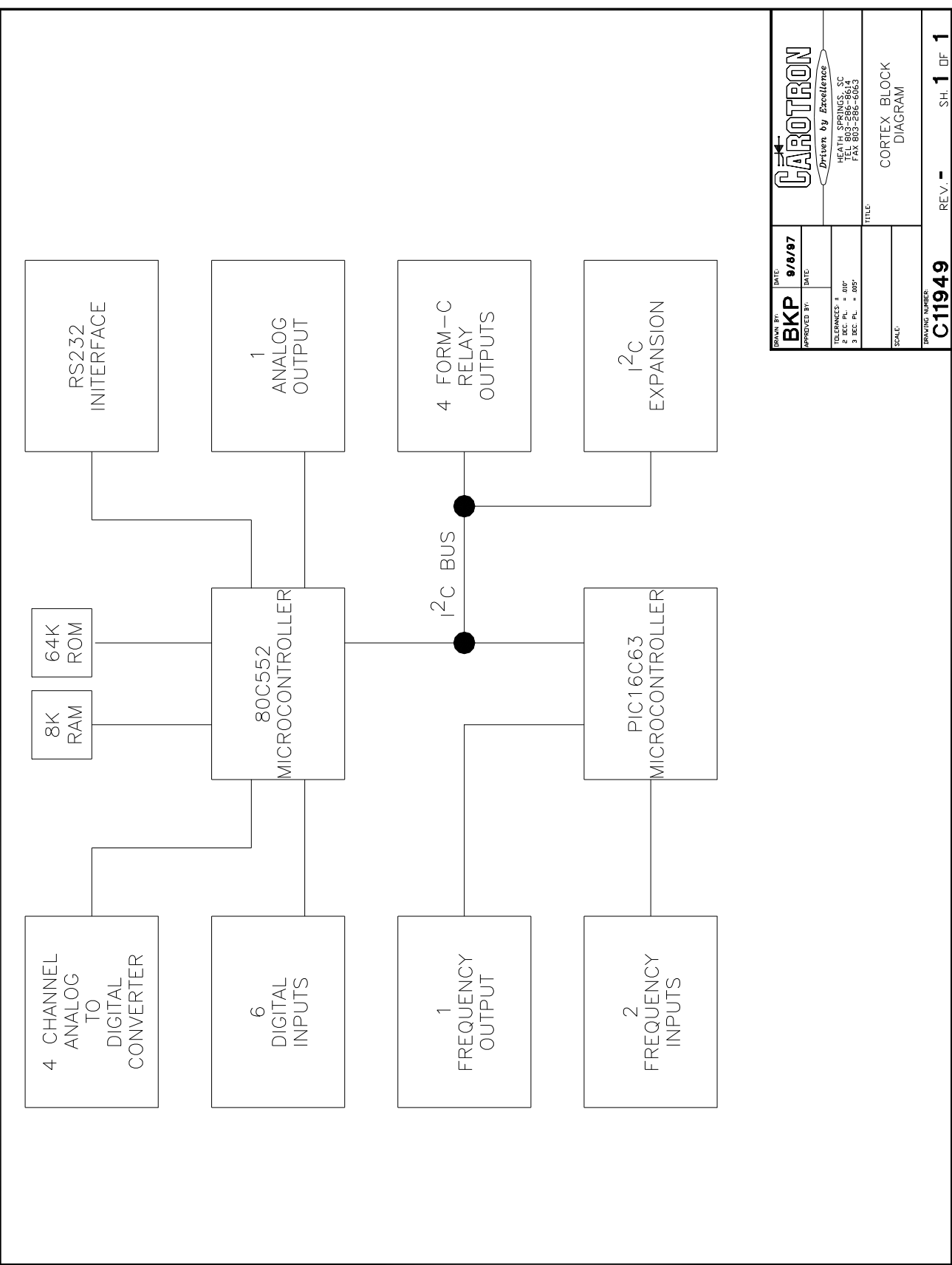
The Cortex allows up to 10 different configurations to be stored in memory for later recall. The SAVE option allows you to choose a location (0-9) to store the current configuration. Once saved, the configuration can be recalled by using the LOAD option. The LOAD option also will allow you to load the factory presets.

7

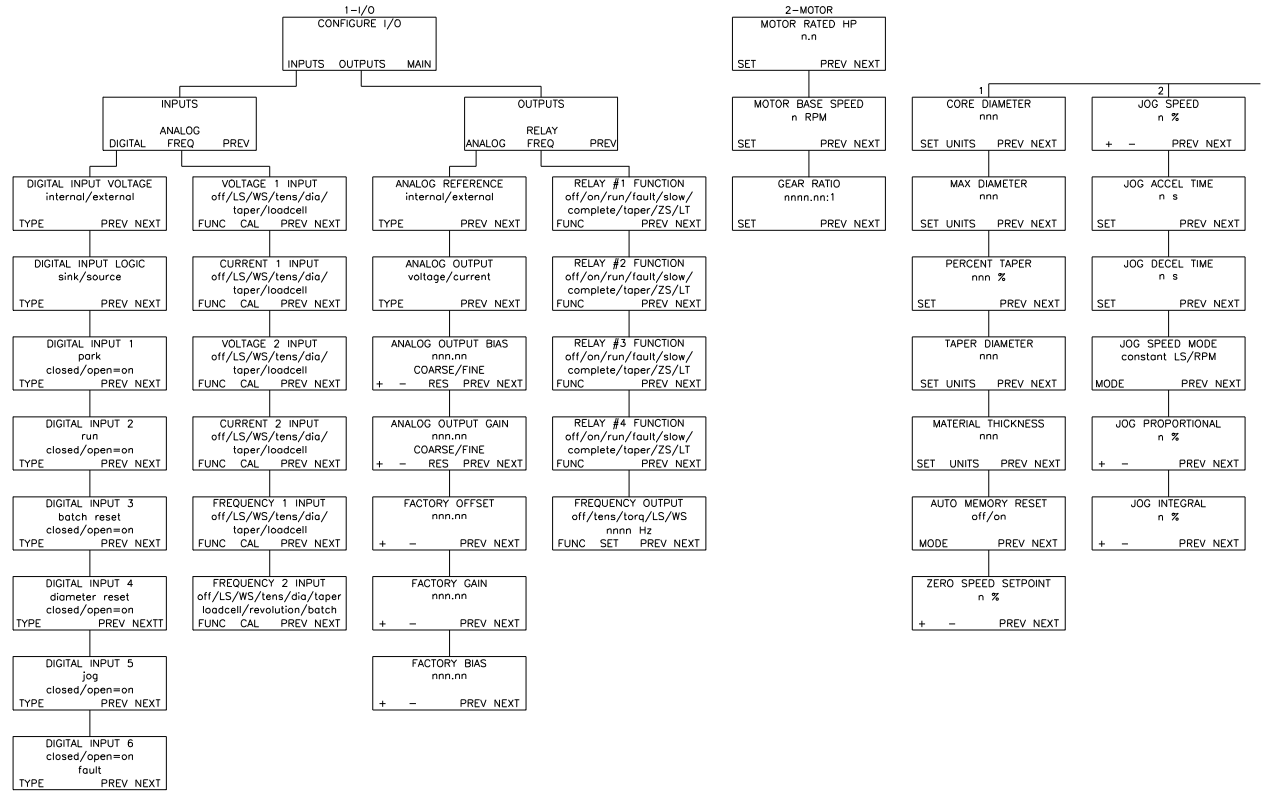
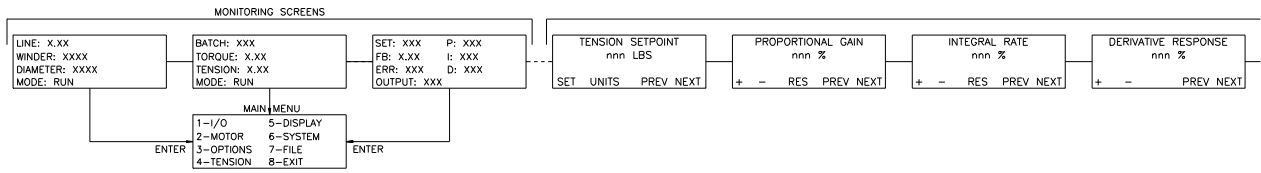
Spare Parts

Fuses: FU1 & FU2: 0.3 ampere, 250VAC, time-delay

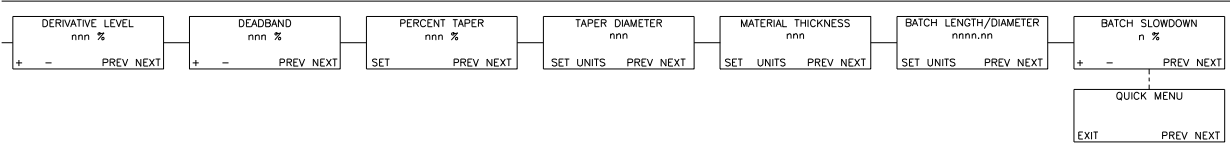
Carotron	FUS1006-01
Bussmann.....	MDL 3/10 A
Littelfuse	313.300



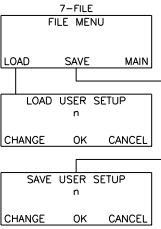
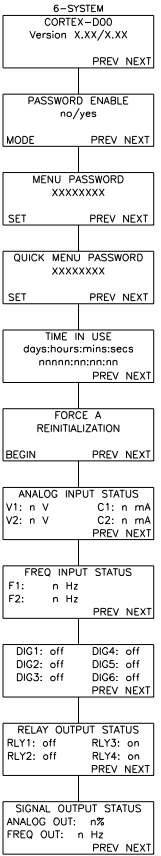
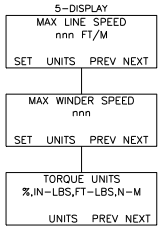
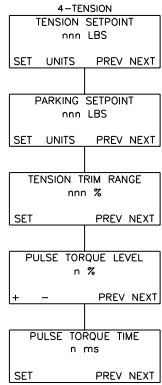
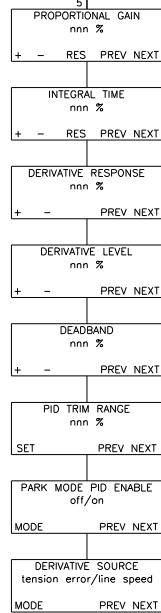
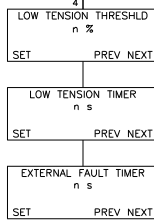
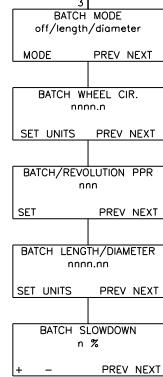
DRAWN BY: BKP	DATE: 9/8/97	APPROVED BY:	DATE:
CAROTRON <i>Driven by Excellence</i>			
HEATH SPRINGS, SC TEL: 803-286-8614 FAX: 803-286-6063			
TOLERANCES: 1		TITLE:	
2 DEC PL. = .010		CORTEX BLOCK DIAGRAM	
3 DEC PL. = .005		SCALE:	
DRAWING NUMBER: C11949 REV. - SH. 1 OF 1			



QUICK MENU



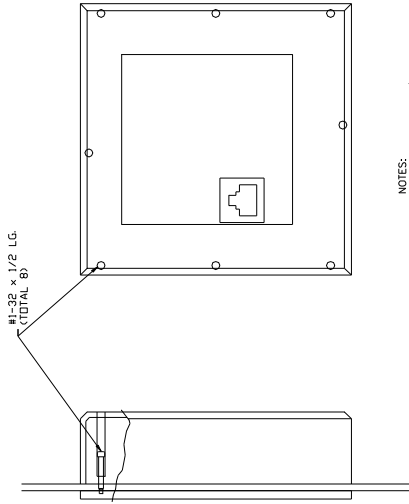
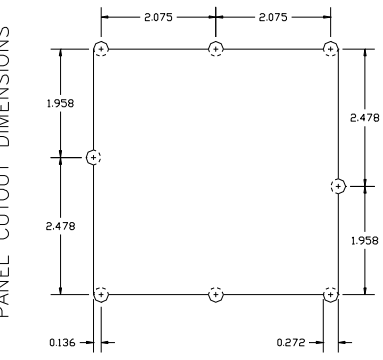
3-OPTIONS
1-OPERATING PARAMS
2-JOG
3-BATCH/REV 5-PID
4-FAULT 6-MAIN



REV. B, VERSION 2.03 UPDATES, 9-3-99
REV. A, VERSION 2.02 UPDATES, 5-18-98

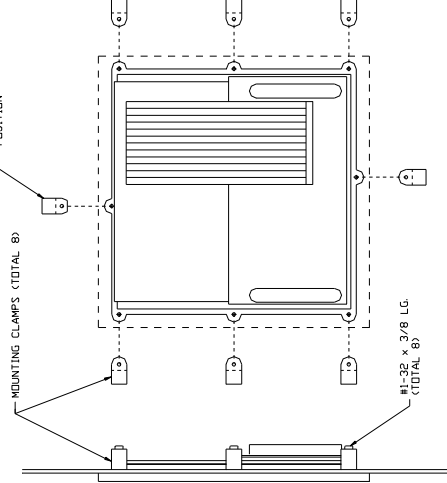
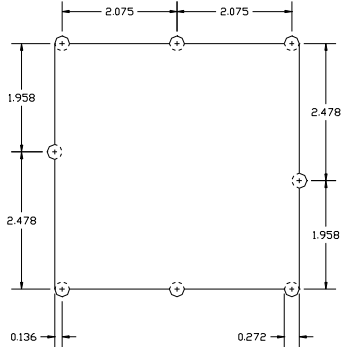
DRAWN BY: BKP	DATE: 3/25/98	
APPROVED BY:	DATE:	
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"		HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE:		TITLE: CORTEX-DOO LOADCELL TENSION CONTROL MENU STRUCTURE
DRAWING NUMBER: D11926		REV. B SH. 1 OF 1

PANEL CUTOUT DIMENSIONS



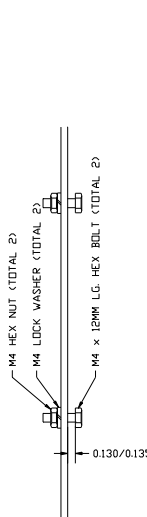
NOTES:
1. FLUSH MOUNT/CLOSED BACK MOUNTING CONFIGURATION
2. RECOMMENDED PANEL THICKNESS: 0.0625" - 0.125"

PANEL CUTOUT DIMENSIONS

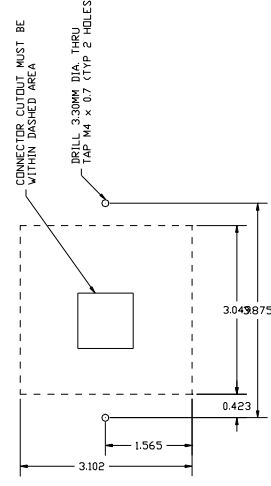


NOTES:
1. FLUSH MOUNT/OPEN BACK MOUNTING CONFIGURATION
2. RECOMMENDED PANEL THICKNESS: 0.0625" ONLY.

DATE	1-8-88
DESIGNED BY	DATE
DRIVEN BY	DATE
TESTED BY	DATE
APPROVED BY	DATE
LAROTRON Driven by Associates	
THE BELL SYSTEM CORP. CORTEX PANEL MOUNT KEYPAD/DISPLAY VERSION 2 INSTALLATION INFO	
FIGURE NUMBER	D12064
REV.	SH. 1 OF 1

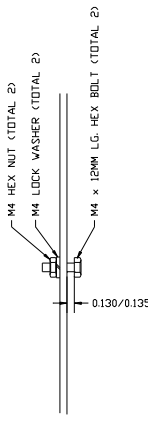
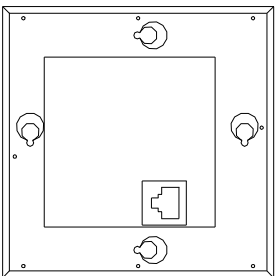


PANEL CUTOUT DIMENSIONS

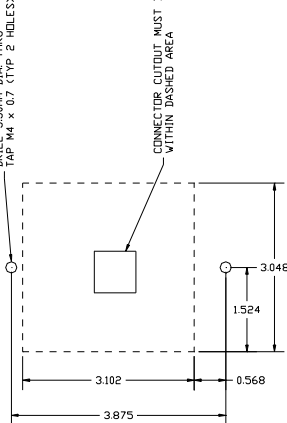


NOTES:
1. VERTICAL DETACHABLE MOUNTING CONFIGURATION.
2. RECOMMENDED PANEL THICKNESS: 0.0625" - 0.125"

SLIDE UNIT UP WHEN DETACHING

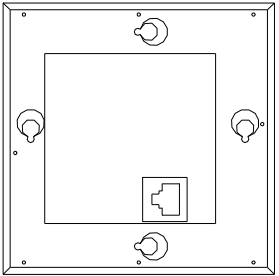


PANEL CUTOUT DIMENSIONS



NOTES:
1. HORIZONTAL DETACHABLE MOUNTING CONFIGURATION
2. RECOMMENDED PANEL THICKNESS: 0.0625" - 0.125"

SLIDE UNIT TO THE RIGHT WHEN DETACHING



Parameter Quick Reference Table		
Parameter	Factory Preset	Customer Setting
Analog Output Bias	0%	
Analog Output Gain	100%	
Analog Output	voltage	
Analog Reference	Internal	
Auto Memory Reset	Off	
Batch Diameter	1 inch	
Batch Length	0 feet	
Batch Mode	off	
Batch Slowdown	90%	
Batch Wheel Cir.	0"	
Batch/Rev PPR	300	
Core Diameter	1"	
Current 1 Input Averaging	16	
Current 1 Input Func	off	
Current 1 Input Max	4095	
Current 1 Input Min	0	
Current 2 Input Averaging	16	
Current 2 Input Func	off	
Current 2 Input Max	4095	
Current 2 Input Min	0	
Deadband	50%	
Derivative Level	0%	

Parameter	Factory Preset	Customer Setting
Derivative Response	0%	
Derivative Source	tension error	
Digital Input 1 Type	closed=on	
Digital Input 2 Type	closed=on	
Digital Input 3 Type	closed=on	
Digital Input 4 Type	closed=on	
Digital Input 5 Type	closed=on	
Digital Input 6 Type	closed=on	
Digital Input Logic	source	
Digital input Voltage	internal	
Ext. Fault Timer	0 ms	
Factory Bias	49.80% *	
Factory Gain	94.90% *	
Factory Offset	49.80% *	
Freq 1 Input Averaging	16	
Freq 1 Input Func	winder speed	
Freq 1 Input Max	32,000 Hz	
Freq 1 Input Min	0 Hz	
Freq 2 Input Averaging	16	
Freq 2 Input Func	off	
Freq 2 Input Max	32,000 Hz	
Freq 2 Input Min	0 Hz	
Freq Output Function	off	
Freq Output Level	2000 Hz	
Gear Ratio	1:1	

Parameter	Factory Preset	Customer Setting
Integral Rate	20%	
Jog Accel Time	2 s	
Jog Decel Time	2 s	
Jog Proportional	31.4%	
Jog Integral	14.5%	
Jog Speed	10%	
Jog Speed Mode	const. line speed	
Low Tension Threshld	5%	
Low Tension Timer	1s	
Material Thickness	0"	
Max Diameter	10"	
Max Line Speed	100 Ft/Min	
Max Winder Speed	1750 RPM	
Motor Base Speed	1750 RPM	
Motor Rated HP	0.25	
Park Mode PID Enable	off	
Parking Setpoint	20%	
Password Enable	off	
PID Trim Range	10%	
Percent Taper	0%	
Proportional Gain	20%	
Pulse Torque Level	0%	
Pulse Torque Time	0 ms	
Relay 1 Func	run	
Relay 2 Func	fault	

Parameter	Factory Preset	Customer Setting
Relay 3 Func	zero speed	
Relay 4 Func	off	
Taper Diameter	0"	
Tension Setpoint	20%	
Tension Trim Range	100%	
Torque Units	%	
Voltage 1 Input Averaging	16	
Voltage 1 Input Func	line speed	
Voltage 1 Input Max	4095	
Voltage 1 Input Min	0 bits	
Voltage 2 Input Averaging	16	
Voltage 2 Input Func	loadcell	
Voltage 2 Input Max	4095	
Voltage 2 Input Min	0	
Zero Speed Setpoint	5%	

*The factory settings for the offset, bias, and gain parameters are unique for each individual Cortex unit. The actual values may differ slightly from the nominal values listed in the table.



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MAN1033-2D
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