



Orbit Indrafold Manual

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Operating Manual

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2 General Safety Notes

2.1 Using the Safety Instructions and Passing them on to Others

Do not attempt to install or commission this device without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with the device. If you do not have the user documentation for the device, contact Orbit Motion Technologies, Inc. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the device.

If the device is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the device in the official language of the user's country.

2.2 How to Employ the Safety Instructions

Read these instructions before initial commissioning of the equipment in order to eliminate the risk of bodily harm and/or material damage. Follow these safety instructions at all times.

- Orbit Motion Technologies is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before commissioning the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of this device.
- Only assign trained and qualified persons to work with electrical installations:
 - Only persons who are trained and qualified for the use and operation

of the device may work on this device or within its proximity. The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the product, as well as an understanding of all warnings and precautionary measures noted in these instructions.

– Furthermore, they must be trained, instructed and qualified to switch electrical circuits and devices on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.

- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The devices have been designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Only use safety-relevant applications that are clearly and explicitly approved. If this is not the case, they are excluded. Safety-relevant are all such applications which can cause danger to persons and material damage.
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturer must

– make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,

– make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.

- Commissioning of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
- The machine or installation manufacturer is responsible for compliance

with the limiting values as prescribed in the national regulations.

- Technical data, connection and installation conditions are specified in the product documentation and must be followed at all times.

National regulations which the user must take into account

- European countries: according to European EN standards
- United States of America (USA):
 - National Electrical Code (NEC)
 - National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
 - regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
 - International Organization for Standardization (ISO)
 - International Electrotechnical Commission (IEC)

3 System Overview

3.1 Touchscreen

The touchscreens that are being used are:

Bosch Rexroth: VCP11.2DWN-003-NN-NN-PW

These screens have unique software and must be programmed before use. If damaged, contact Orbit Motion to order a replacement.

3.2 Drives

The Orbit Indrafold System uses 2 Bosch servo drives, with advanced control sections

Bosch Rexroth: Drive: HCS02.1E-W0054N-A-03-NNNN
Control: CSH01.2C-NN-ENS-EN2-CCD-NN-S-NN-FW

These units also contain specialized software. To order a replacement contact Orbit Motion.

4 Operation

4.1 Using the Touchscreen

The Orbit Indrafold System primarily uses the touchscreen to accomplish any task. From the screen you can set your folding parameters, view system diagnostics, view batch and box counts, and many other functions.

Values that are user changeable can be done so by simply tapping the value you would like to change. When you tap a certain variable a numeric pop-up window will appear where you can type in your new value.

When any changes are made to the system it is important that you save your values, that there is no motor torque, and that you are in Edit mode (more detail will be presented on this later).

4 Operation

4.2 Theory of Operation

Each complete fold cycle of the flipper MUST be completed in one belt feed cam cycle, therefore it is critical to pick the proper belt cycle cam size to match the type of blanks you intend to fold. As an example: If the belt feed cam is set at 12" then no box/gap total of less than 12" can be folded. There is no upper or lower limit to the blank size. As an example, with a 12" master cam (belt cam) folding a 4" blank will require a minimum of an 8" gap or folds will be missed. ($12'' - 4'' = 8''$ gap). One might set the master cam at 6" with the idea of covering all blank sizes with the minimum gap length however is not the optimal solution. The smaller the master cam the more violent the folding motion. That is because the fold motion must be completed within one master cam cycle. When folding longer blanks you will actually limit line speed due to power limitations of the servo. A good starting point for master cam size is 18". This will fold most blanks at an acceptable throughput.

Set the number of fingers that you intend to fold with and set the homing routine so that the fingertip ends up JUST below the paper line. This is your ZERO point.

4.3.1 Setting Folding Motion Values

Each axis has a corresponding touch screen associated with it. From these touch screens, you are able to fully implement all operator controls and input an application specific parameter set. The following section will show just how to do this.

Main Menu Screen

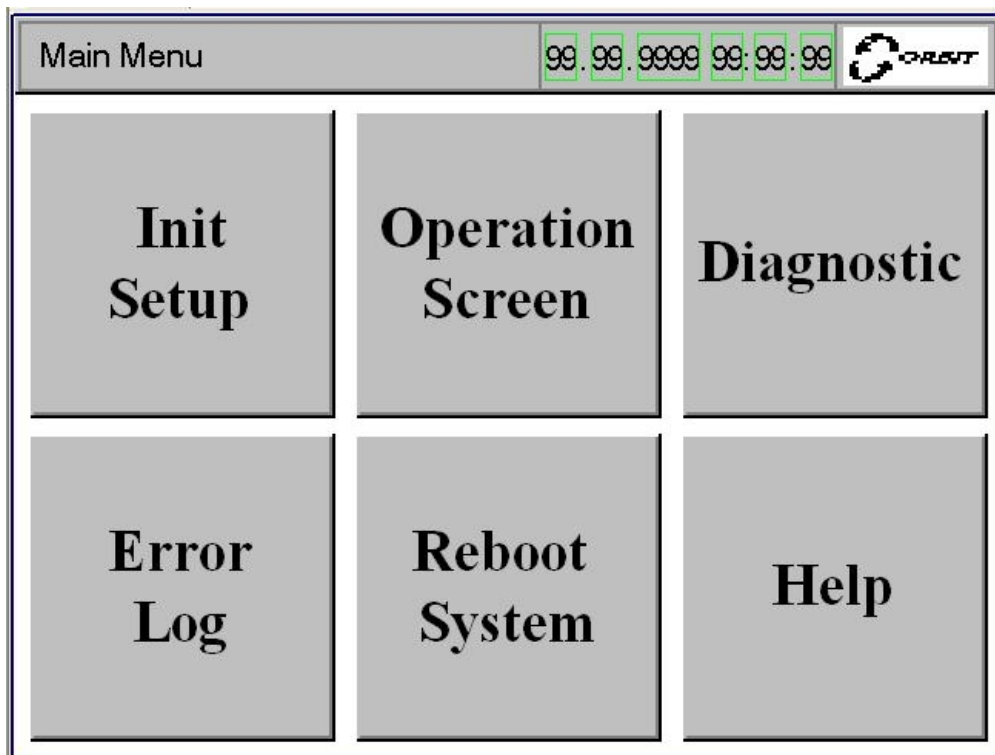
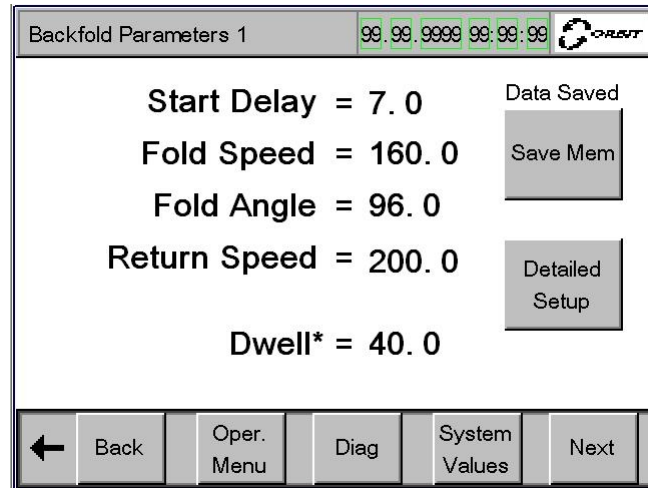


Figure 1 - Main Menu

The root of the Indrafold system begins from the main menu screen. Here you can perform many actions. You can alter the motion of the fold, keep track of batch counts, view diagnostic information, and many other functions.

Touching the “Init Setup” button will allow the end user to set the folding parameters of the system. On this screen you can control the start delay of the finger movement, the folding speed, the folding angle and the return to home speed.

Backfolding Parameters 1*Figure 3: Backfolding Parameters 1*

- Start Delay:** The first box setting to set is the fold delay. This is the delay in belt feed travel from when the trailing edge of the box is detected and the finger begins to move. Trial and error will determine the proper impact distance.
- Fold Speed:** This setting determines how fast the finger makes the fold. Too fast and the box breaks, too slow and the fold doesn't get made in time. Note: This value is inverted. *Reducing it increases the folding speed.*
- Fold Angle:** This is the distance in degrees that the finger moves in the folding motion. Too little and the flap will not run under the shoe. Too much and the box will be marked or even smashed. Once again, trial and error are the only way to determine the proper setting.
- Return Speed:** This is the speed in which the finger returns to the zero position. It is important to remember that the DWELL TIME or the time that the finger waits for the box to get out of the way before it starts back to the zero, is determined by the return speed. The slower the return speed the shorter the dwell time. As you remember this is because the fold cycle must be completed within one belt feed master cycle. Setting the return speed too high will result in an unnecessary use of servo power, which ultimately means slower belt speeds. Remember that DWELL TIME is NOT settable. It is a result of FOLD SPEED and RETURN SPEED at a given master cam cycle. Remember that you may NEVER have a zero or negative dwell time, as this will cause the servo motion to fault out. Increasing the fold speed or return speed will increase the dwell time.

Dwell: The time after the fold is completed until the time the finger returns home. This value is not directly changeable!

$$Dwell = Return\ Speed - Fold\ Speed$$

All values must be > 0

Tapping the “Detailed Setup” button will bring you to a basic folding parameter tutorial.

4.3.2 Detailed Folding Setup

Start Delay Screen

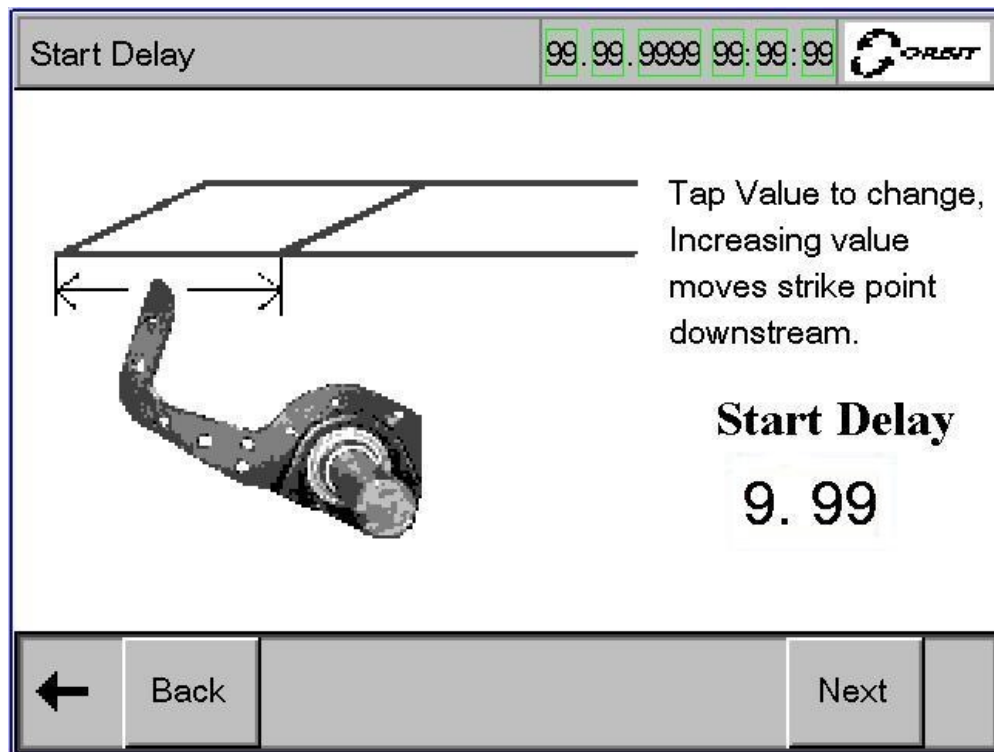
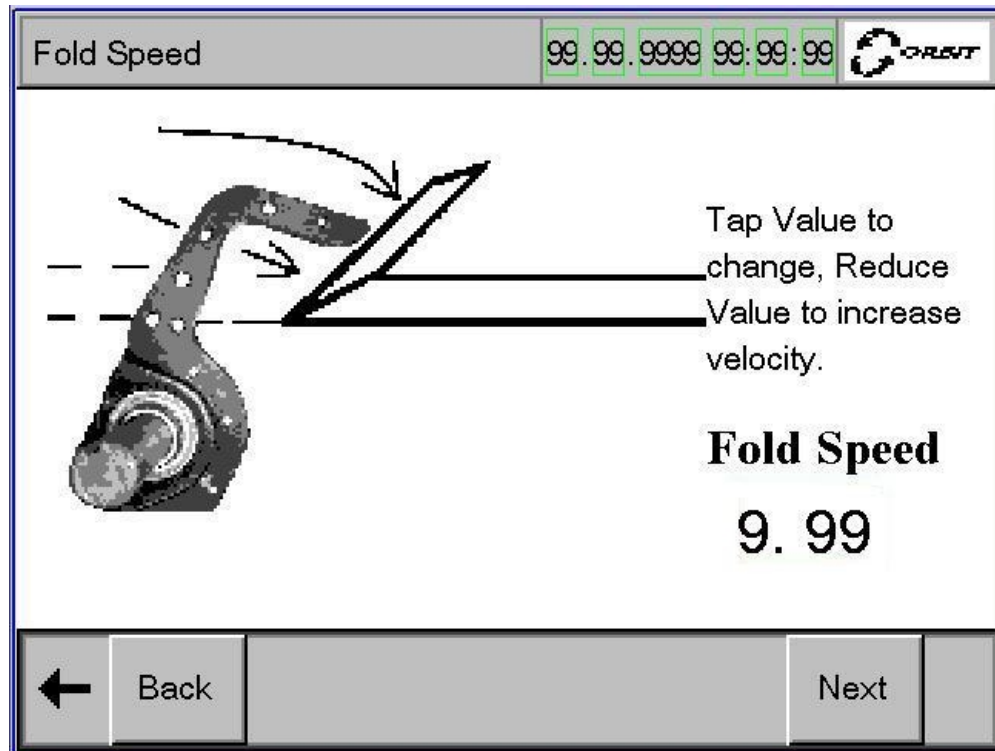


Figure 4: Start Delay

This screen is the first Cam value you can alter. It allows you to adjust the point where the finger strikes the flap of the box. Increasing this value moves the strike point downstream, while decreasing the value moves the strike point upstream.

*Note: To change value touch the current value and a keypad will allow you to enter your new value

Touching the “Next” button will bring us to the fold speed screen, shown in figure 3.

Fold Speed Screen*Figure 5: Fold Speed*

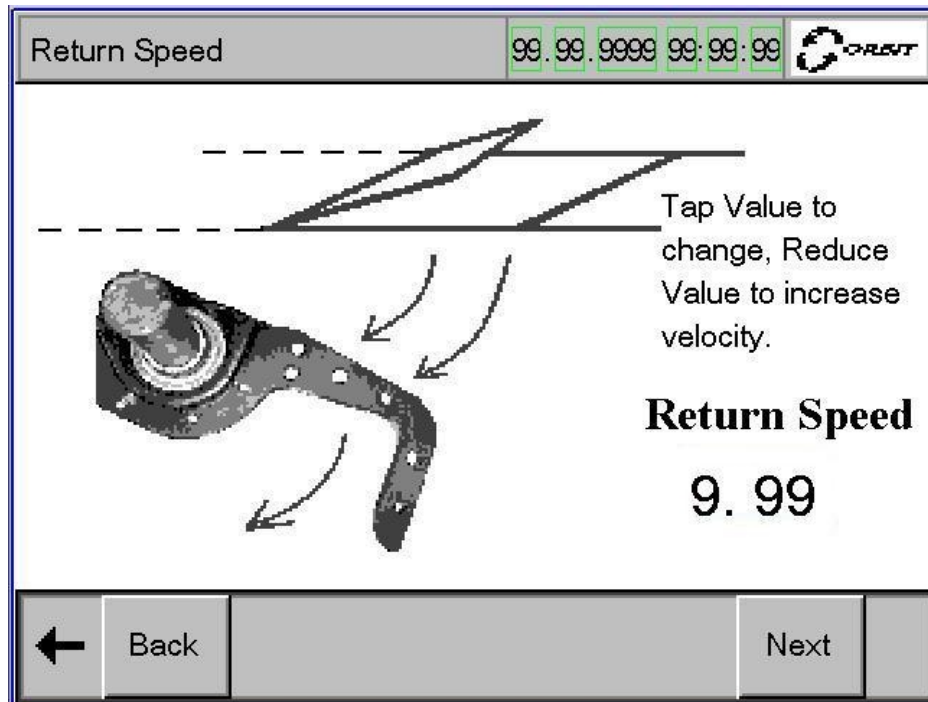
This screen allows you to adjust the folding speed of the finger. Reducing the value increases finger speed, and increasing the value will slow the folding speed down. If the finger velocity is set too high then damage to the box may occur. It is advised when you are setting your cam values to make small changes, as big changes may generate a motion error.

*The relation:

$$Dwell = Return Speed - Fold Speed$$

must always be kept in mind.

Press the “Next” to continue setting cam values.

Return Speed Screen*Figure 6: Return Speed*

On this screen you can adjust the speed that the finger returns back to the initial home position. To increase this velocity you increase the current value.

*As previously, the relation:

$$Dwell = Return\ Speed - Fold\ Speed$$

must always be kept in mind.

Press the “Next” button to continue on to the final cam setting, “Fold Distance”.

Fold Distance Screen

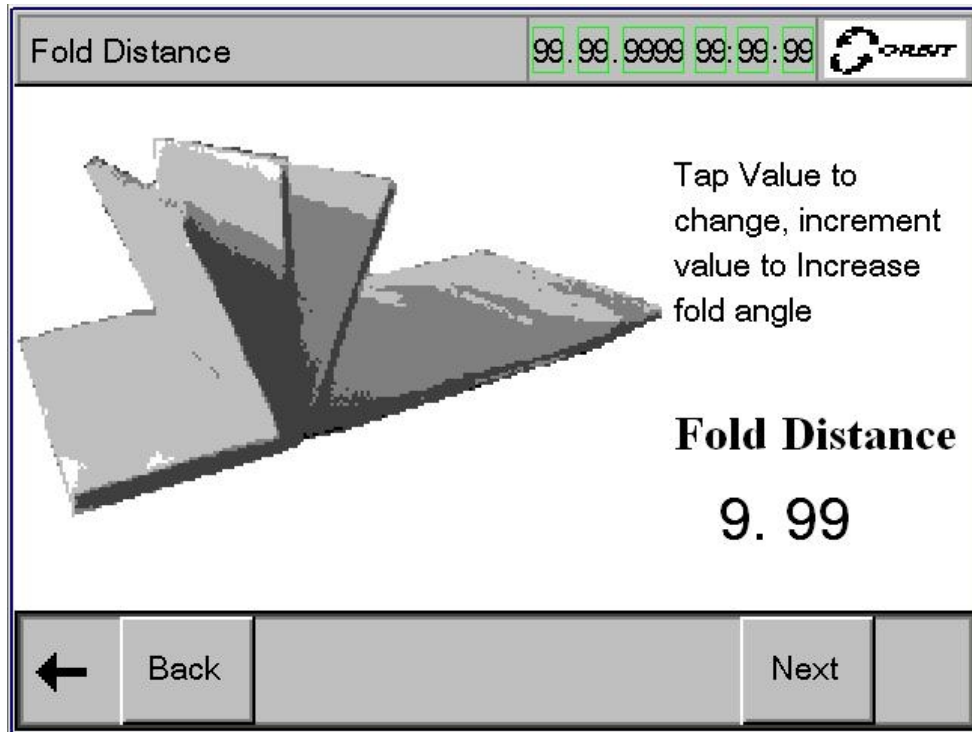


Figure 7: Fold Distance

On this screen you can change the angle of the fold. Tap the existing value on the screen to change, increasing the value increases the angle the box flap is folded.

The final cam setting is done, click “Next” to continue on to more system parameters.

4.3.3 Setting System Parameters

Under the category of system parameters includes the number of folding fingers, homing velocities, homing offsets, motor direction, encoder directions, encoder gear ratios, the main pulley pitch diameter, and the box plus gap distance (which will be discussed in detail later in this manual).

However, in order to set these parameters the system needs to have no motor torque and the drive must be in Edit mode, i.e. the system needs to be nonoperational.

The screen below allows you to enter into this Edit state.

Enter Parameter Settings

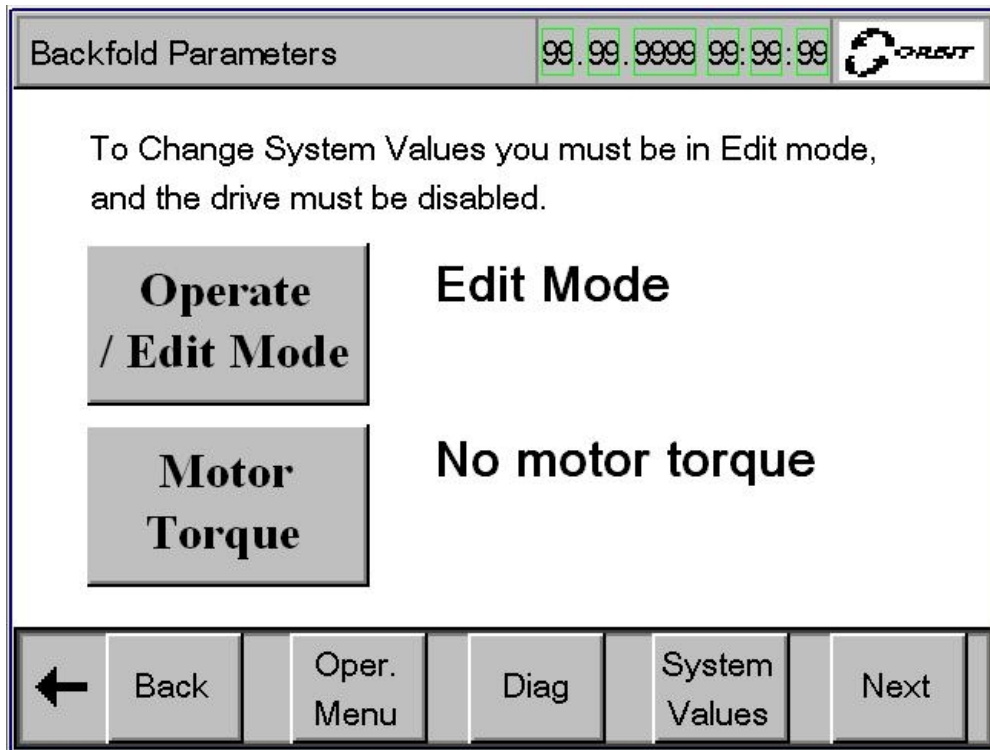


Figure 2: Entering Parameter Settings

When you are in Edit Mode and the drive is disabled (no torque on axis), you can now move on by tapping the next button.

*You must first remove the motor torque to toggle into Edit Mode.

Note: You can be in Operate Mode and still view the current parameter settings.

On this next screen you can set two or three finger mode, home offsets, and home velocity.

Finger Select Screen

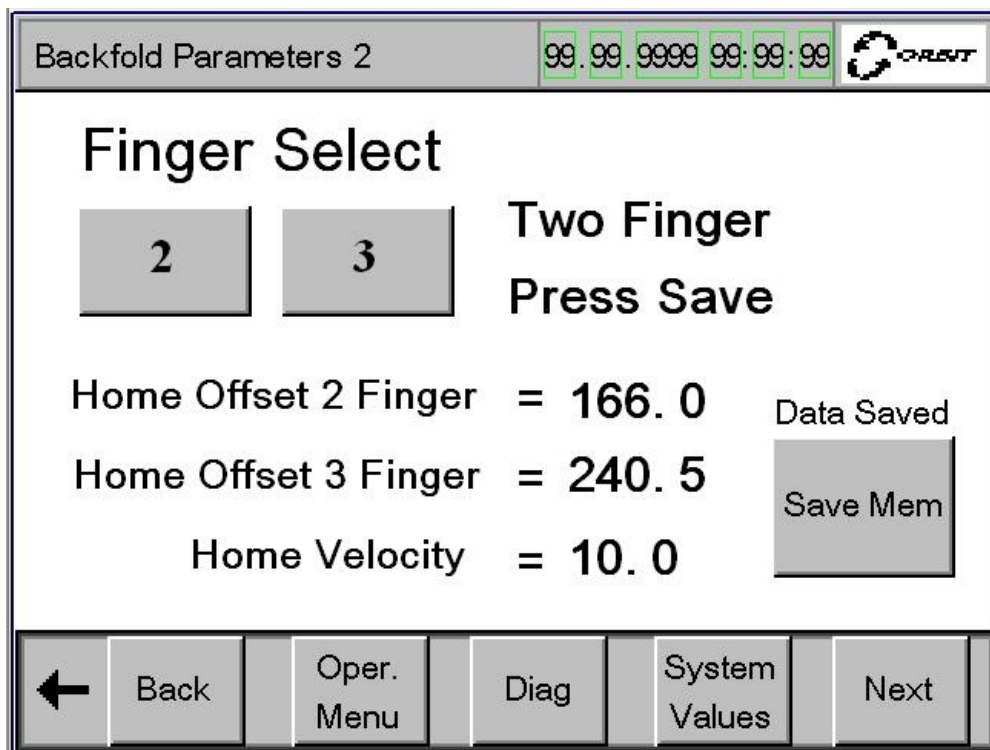


Figure 8: Backfold Parameters 2

When your parameters are set make sure to press the “Save Mem” button to retain the values that have been set.

On this next parameter screen you can set encoder gear in/out, encoder direction, motor direction, the main pitch diameter of the main pulley (in inches), and the box plus gap distance.

System Parameters 1


System Parameters 1		99.99.9999 99:99:99	
Enc. Gear In =	1		
Enc. Gear Out =	1		Data Saved
Motor Direction =	1		Save Mem
Enc. Direction =	1		
Main Pitch Dia. =	3.8197		
Box+Gap (inch) =	18.000		
← Back		Oper. Menu	Diag
		System Values	Next

Figure 9: System Parameters 1

Encoder Gear In: Encoder side gearing
 Encoder Gear Out: Load side gearing

Motor Direction: 0 – Clockwise Motion (reference to shaft)
 1 – Counter Clockwise

Encoder Direction: 0 – Clockwise Motion (reference to shaft)
 1 – Counter Clockwise

Main Pitch Diameter: This value must be as accurate as possible, as (in inches) there are many other variables dependent upon this value (the master folding cycle “Box+Gap”, and Belt Speed).

Box+Gap: This value is essentially the most important system (in inches) parameter. Here you can set the master folding distance, i.e the distance the folding motion is done in. This is particularly useful when changing job types.

For example: Doing a large corrugated job may call for a Box+Gap distance of 24” inches, while a small carton job may call for a distance of 12” inches.

System Parameters 2

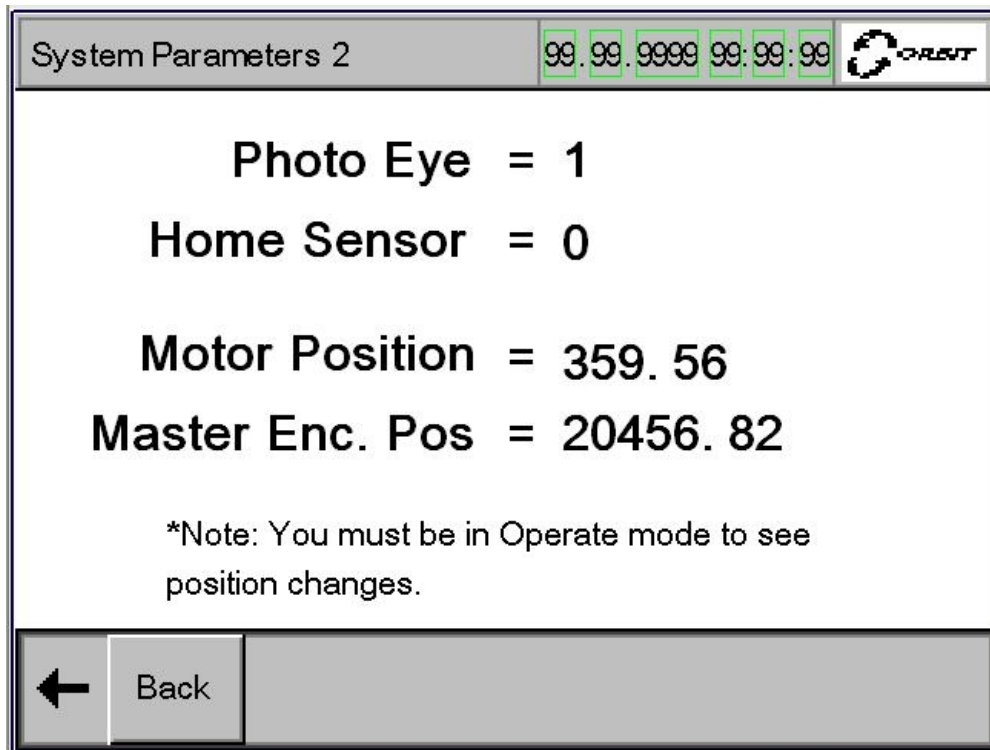


Figure 10: System Parameters 2

This screen allows the user to view several real-time parameters for diagnostic support. Here you can determine if your sensors are set up properly. The sensors are PNP, and will toggle between a 0 and 1.

Photoeye: 0 – No product
 1 – Product under photoeye

Home Sensor: 0 – Not in notch on stepper disc
 1 – Axis in notch on stepper disc

Also, the “Motor Position” value will show what the angle of the axis is within 360 degrees.

The “Master Enc. Pos” will show the encoder data, this number should always be increasing when the main belt is running.

Exiting System Parameters

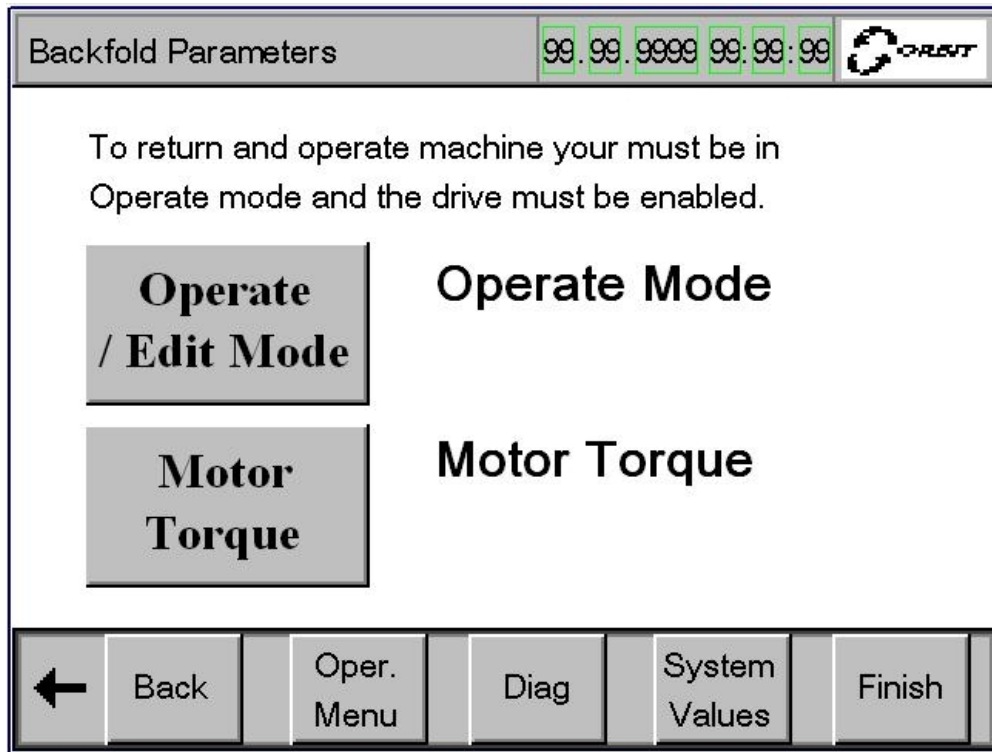


Figure 11: Exiting Backfold Parameters

To exit the Backfold Parameters you must enter Operate Mode and then apply torque to the motor.

*The Mode must be set before torque is enabled.

5 Diagnostics

5.1 Touchscreen Error Codes

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows:

Communication Error
 Code XXXXXX
 Subcode XXXXXX
 Retries XXXXXX

Code	Subcode	Description	Possible Cause
40		Illegal System Variable	The system variable is not supported by this operating device.
50	03	Framing error on serial interface	
	06	Parity error on serial interface	
	10	Poll area error	No poll area defined
	12	Poll area error	Poll area defined more than once
	16	Memory overrun	
	50	Memory allocation not possible	No memory allocated
51		SPC3 hardware defect	
	1	Wrong initialization	Inputs/outputs not correctly initialized
	2	Wrong initialization	
	4	Wrong initialization	Memory not correctly initialized
	16	No hardware / No SPC3	Interface hardware missing or defective
52		SPC3 not configured properly	
	1	Physical connection error	Cable defective or not connected
	2	Logical connection error	Wrong participant number
	3	Wrong input length	

5.1 Error Codes Con't

Code	Subcode	Description	Possible Cause
52	4	Wrong output length	
	5	Invalid configuration	
54		SPC3 disconnects from the bus	
55		Internal SPC3 error	
56		Waiting time in SPC3 exceeded; no more telegrams received from master	
60	40	Wrong checksum	
	60	Waiting time exceeded; No response	Cable interruption, connection cutoff, wrong baud rate
	70	Transmission buffer too small	
80		Field bus error PROFIBUS	
	10	Ready bit in status byte of master not set	
80		Field bus error ETHERNET	
	10	Response telegram error	Wrong start token in data module
	11	Error while establishing the Ethernet connection to a server	
	12	Error sending a telegram	
	13	Timeout, no response from control	
90		Response with length 0 received...	
	21	...while reading the error number	
91-1 10	1	Error in response telegram	
	2	Error in response telegram	
120	1	Telegram contains errors	
	2	Variable does not exist	
	3	Illegal process	
	4	User not logged in	

5.1 Error Codes Con't

Code	Subcode	Description	Possible Cause
120	5	Value can not be converted as required by variable type	
	6	Handle was expected	
	7	No memory	

5.2 Drive Error Codes

If an error occurs consult the following list. The list contains the error code and a brief description of what caused the error to be generated.

If more information is needed on the generated error, consult the following link:

<http://www.boschrexroth.com/>

Error Diagnostic Messages F

- F207 Switching to uninitialized operating mode
- F208 Motor Type Has Changed
- F219 Motor Overtemperature Shutdown
- F221 Error Motor Temperature Control
- F222 Error Drive Overtemperature Watch Defekt
- F226 Undervoltage Error
- F228 Excessive Deviation
- F229 Motor Encoder Failure: Quadrant Error
- F233 External Power Supply Error
- F234 Emergency Stop
- F237 Excessive Position Command Value Difference
- F242 External Encoder Failure: Signals Too Small
- F245 External Encoder Failure: Quadrant Error
- F248 Low Battery Voltage
- F267 Incorrect Internal Hardware Synchronization
- F268 Brake Error
- F276 Absolute Encoder Error, Deviation > P-0-0097
- F280 Earth connection
- F281 Mains Fault
- F282 Phase Fault
- F283 Net Overvoltage
- F284 Main Contactor nc - Low Voltage
- F316 Power supply module softstart error
- F318 Power supply module heatsink overtemperature
- F320 Bleeder overload
- F324 Power supply unit additional component error
- F360 Power supply unit over voltage
- F369 +24V / ±15V / +5V Power supply unit error
- F380 Power supply unit ground short
- F381 Power failure
- F382 Phase error
- F383 Mains voltage error

F384 Power supply unit connection error
F385 Mains frequency error
F394 Checksum error - power supply unit
F401 Double MST Error Shutdown
F402 Double MDT Error Shutdown
F403 Invalid Communications Phase Shutdown.
F404 Error During Phase Progression
F405 Error During Phase Regression
F406 Phase Switching Without Ready Signal
F629 Positive Travel Limit Value Is Exceeded
F630 Negative Travel Limit Value Is Exceeded
F643 Positive Travel Limit Switch Detected
F644 Negative Travel Limit Switch Detected
F818 Drive Overtemperature Shutdown
F819 Drive Overtemperature Watch Defect
F820 Bleeder Overload
F822 Motor Encoder Failure: Signals Too Small
F827 Drive Interlock While Drive Activated
F860 Overcurrent: Short in Powerstage
F861 Overcurrent: Short to Ground
F869 +/- 15 Volt Error
F870 + 24 Volt Error
F871 + 10 Volt Error
F878 Velocity Control Loop Error
F879 Crossing Velocity Limit (S-0-0091) Value
F889 Regenerating Overcurrent
F890 Regenerating Electronic Watchdog
F891 Power Supply Fault
F892 Wrong Code of the Current Measuring Unit
F893 No Regenerating Current to Net
F894 Checksum Error

Warning Diagnostic Messages E

E201 No Mains
E202 Not Ready for Power On.
E219 Warning Drive Temperature Watch Defekt
E221 Warning Motor Temperature Control
E249 Positioning Velocity (S-0259) Greater S-0-0091
E250 Drive Overtemperature Warning
E251 Motor Overtemperature Warning
E253 Target Position Out of Range
E255 Feedrate Override (S-0-0108) = 0
E257 Continuous Current Limiting Active
E259 Command Velocity Limitation Active
E261 Continuous Current Limiting Prewarning
E263 Velocity Command Value S-0-0036 Greater Than Bipolar Limit

E325 Power supply unit regeneration overload
E326 Power supply module feed overload
E350 Power supply unit warning - heatsink overtemperature
E352 Power supply module bleeder overload warning
E353 Power supply unit diagnosis faulty
E387 Power supply unit control voltage failure
E410 Slave Not Scanned or Address 0
E825 Overvoltage Error
E829 Positive Position Limit Value Exceeded
E830 Negative Position Limit Value Exceeded
E843 Positive Travel Zone Limit Switch Activated
E844 Negative Travel Zone Limit Switch Activated

Command Diagnostic Messages C

C100 Communications Phase 3 Transition Check
C101 Invalid Communications Parameter (S-0-0021)
C104 Config. IDN for MDT not configurable
C105 Configured Length > Max. Length for MDT
C106 Config. IDN for AT Not Configurable
C107 Configured Length > Max. Length for AT
C108 Time Slot Parameter > Sercos Cycle Time
C109 Position of Data Record in MDT (S-0-0009) Even
C110 Length of MDT (S-0-0010) Odd.
C111 ID9 + Record Length - 1 > Length of MDT (S-0-0010)
C112 TNcyc (S-0-0001) or TScyc (S-0-0002) Error
C113 Relation of TNcyc (S-0-0001) to TScyc (S-0-0002) incorrect
C114 T4 > TScyc (S-0-0002) - T4min (S-0-0005)
C115 T2 Too Small
C200 Communications Phase 4 Transition Check
C201 Invalid Parameter (-> S-0-0022)
C202 Limit Error Parameter (-> S-0-0022)
C203 Parameter Calculation Error (-> S-0-0022)
C204 Motor Type (P-0-4014) Incorrect
C210 External Feedback Required (-> S-0-0022)
C211 Invalid feedback data (-> S-0-0022)
C212 Invalid Amplifier Data (-> S-0-0022)
C213 Position Data Scaling Error
C214 Velocity Data Scaling Error
C215 Acceleration Data Scaling Error
C216 Torque/Force Data Scaling Error
C217 Motor Feedback Data Reading Error
C218 External Feedback Data Reading Error
C220 Mot. Feedback Initialization Error
C221 Ext. Feedback Initialization Error
C225 Coprocessor Not Ready For Initialization
C226 Coprocessor Acknowledge Failed

C227 Module Range Error
C228 Controller Type (S-0-0140) Incorrect
C300 Set Absolute Measuring
C302 Absolute Measuring System Not Installed
C500 Reset Class 1 Diagnostic (Error Reset)
C501 Error Delet Only in Parameter Mode
C600 Drive-Controlled Homing Procedure Command
C601 Homing Not Possible if Drive is Not Enabled
C602 Distance Homing Switch - Reference Mark Erroneous
C604 Homing of Absolute Encoder Not Possible
C700 Basic load
C701 Basic Load Not Possible If Drive Is Enabled
C702 Default Parameters Not Available
C703 Default Parameters Invalid
C704 Parameters Not Copyable
D400 Positive Stop drive procedure command
D401 ZKL1 Error at Command Start

Status Diagnostic Messages

A000 Communication Phase 0
A001 Communications Phase 1
A002 Communication Phase 2
A003 Communications Phase 3
A010 Halt Drive
A011 Drive Interlock Open
A012 Control and Power Sections Ready for Operation
A013 Ready for Power ON
A100 Drive in Torque Mode
A101 Drive in Velocity Mode
A102 Position Mode Encoder 1
A103 Position Mode Encoder 2
A104 Position Mode Encoder 1/Lagless Positioning
A105 Position Mode Encoder 2/Lagless Positioning
A106 Drive-Controlled Interpolation, Encoder 1
A107 Drive-Controlled Interpolation, Encoder 2
A108 Drive-Controlled Interpolation/Encoder 1 Lagless Positioning
A109 Drive-Controlled Interpolation/Encoder 2 Lagless Positioning

6 Maintenance

6.1 Servicing

For any Servicing needs contact Orbit Motion Technologies, Inc.

6.2 Repairs

For any Repair needs contact Orbit Motion Technologies, Inc.

6.3 Replacement Parts

For any Replacement Part needs contact Orbit Motion Technologies, Inc.

7 Appendix

Appendix A: Variable Table

Appendix B: Wiring Diagram

Appendix A: Variable Table

	Modes			Save Data	User Access (Y/N)
	Edit Mode	Operate Mode	Motor Torque		
Cam Values					
Start Delay	●	--	--	●	Y
Fold Speed	●	--	--	●	Y
Dwell	--	--	--	--	N
Return Speed	●	--	--	●	Y
Fold Distance	●	--	--	●	Y
Home Variables					
Home Velocity	●	--	--	●	Y
2 Fing. Offset	●	--	--	●	Y
3 Fing. Offset	●	--	--	●	Y
Jog Variables					
Jog Velocity	●	--	--	●	Y
Jog Accel.	--	--	--	--	N
Jog Decel.	--	--	--	--	N
System Variables					
Error Quit(Button)	●	●	●	--	Y
Run(Button)	--	●	●	--	Y
Jog(Button)	--	●	●	--	Y
Finger Select	●	--	--	●	Y
Probe Input	--	--	--	--	N
Home Prox	--	--	--	--	N
Enc Gear In	●	--	--	●	Y
Enc Gear Out	●	--	--	●	Y
Encoder Dir.	●	--	--	●	Y
Motor Dir.	●	--	--	●	Y
Box+Gap(inch)	●	--	--	●	Y
Batch Size	●	●	●	--	Y

7 Appendix

Appendix B: Wiring Diagram