EMP SERIES 1100
SERVO REGISTRATION SYSTEM
(PANEL VIEW PLUS TOUCH SCREEN)

Operating Manual

v2014.1

1. **General**

» **Introduction**

The EMP Series 1100 Servo System is designed to provide a reliable and economical solution to your machine's registration control needs. With an independent servo motor, timing and web placement no longer rely on gears, PIVs or the precise diameter of rollers. In addition, change over durations are quicker and easier than ever, thanks to the intuitive touch screen software.

Based on information provided, EMP has preprogrammed your equipment for your specific application. The program and equipment have been selected based on your machine and web speed.

» **Description of Operation**

Once a length is entered and the Servo System is in the "Run" mode, the draw rollers are ready to follow the movement of the encoder. As the machine starts, the encoder will begin rotating, the servo motor will follow it with the correct ratio to pull the desired sheet length.

When you press **Set**, the **Scanner** will begin relaying the location of each Registration Mark to the Servo. The system determines if it is ahead or behind where it should be, and the servo motor makes a correction.

Once running in Register, the Set Position can still be adjusted on the fly by using the **Print Advance and Retard** buttons.

An important concept in Registration Control is the Active Area. The Active Area is basically a window that is used to ignore all the print between Registration Marks.
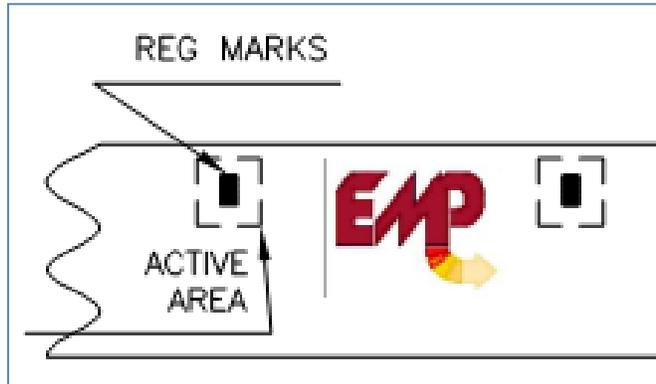
2. **Installation**

» **Preparing/Unpacking**

Although every precaution is taken to ensure the equipment is delivered in good condition, a careful inspection should be made upon receipt of the system. EMP makes every effort to individually box and label each component for easy identification of the shipment. Please report any shortage immediately.

A **standard** system will have all of the following components:
- (1) Touch Screen
    - (2) Cables (Power and Signal)
- (1) Scanner
    - (1) Cable
    - Bracket
- (1) Servo Motor
    - (2) Cables (Power and Feedback)
    - Bracket
    - Coupling
- (1) Encoder
    - (1) Cable
    - Bracket
    - Coupling
- (1) Electrical Enclosure
    - (1) Servo Drive and other various Breakers, Contactors and Misc. Parts
    - (1) Power Cable for Main Electrical Power (Use ½" Liquatite Conduit)

If anything is missing or was damaged in transit, please notify EMP immediately so we can send a replacement.

NOTE: If your system was custom or modified, some of the above parts may be different.

» **Power Drop & Cables**
Be sure to check with EMP what the required power drop and phase is before proceeding.

EMP recommends using conduit to protect all cabling. For signal cables, use a non-metallic version. For power cabling, use a metallic type.

» Mounting Instructions

Check that you have been provided with all necessary EMP brackets. Before mounting any parts, measure to make sure that your wires will be long enough to reach the cabinet.

Cabinet – Be sure to mount the electrical housing on a sturdy platform that will not vibrate. When using conduit, be careful to avoid mounting the conduit to conveyors as it can transmit vibration back to the housing. If unavoidable, use a flexible-type conduit (such as Liquatite) in and out of the housing.

Servo Motor – EMP recommends using ½″ Liquatite conduit (at minimum) to protect the cable and prevent any electrical noise issues. Also, keep in mind that any degree of misalignment can impact performance and lead to degradation of the coupling, gearhead, and motor.

Encoder – The Encoder is ideally mounted on a draw roller (direct or belted) that runs 1:1 with the knife. If this is not possible, consult with EMP for other options. As with the Servo Motor, it is extremely critical that misalignment be minimized when mounting the Encoder.

Touch Screen – The Touch Screen should be mounted in a sturdy location with minimal vibrations. Be sure it is within reach and visible to all operators.

Scanner – The Scanner lens will need to be located 3/8″ away from the web. Be sure it is placed in a spot that is adjustable and suits all your Registration Mark locations.

3. Initial Setup Procedure

» **Motor Settings**

Start with the Motor Settings, which are in the Setup Screen:

Step 1: <u>Push the Green Button</u> **on the touch screen to turn Power On to the unit.**

Step 2: <u>Press the Length Button</u> **and enter your product length (inches or millimeters).**

Step 3: <u>Press the Login Button</u> **to enable access to the Setup screen.** <u>Enter the user name (tech or eng) and then password (12345 or 54321)</u> **into the keypad.**

Note: While the initial password is 12345 or 54321, the password may be changed by the user.
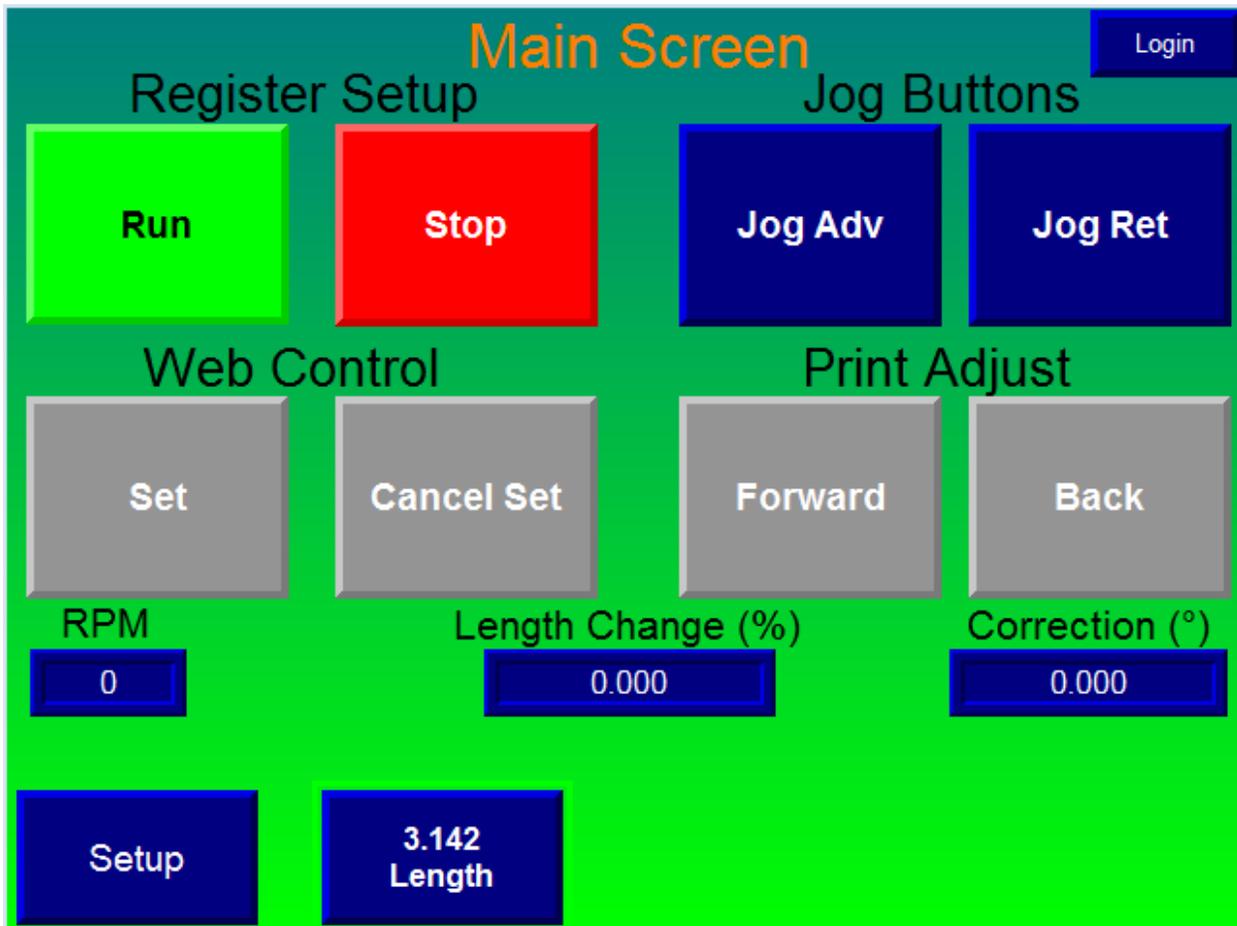
Step 4: <u>Configure Hardware Settings.</u>

Before running, enter in the hardware settings for your system.

20.00 Width of Active Area	1 Sequence	4096 Encoder Resolution	Run Off Set Off
0.100 Length Factor	1.00 Print Adjust Rate	10000 Motor Resolution	Normal Jog
0.700 Correction Factor	6 Alarm Count	1.000 Draw Roll Diameter	Normal Print Adjust
5.00 Width of Alarm Area	5.00 Jog Speed	1.0000 Reducer Ratio	3.000 Correction Limit
Main Screen		Maintenance Screen	
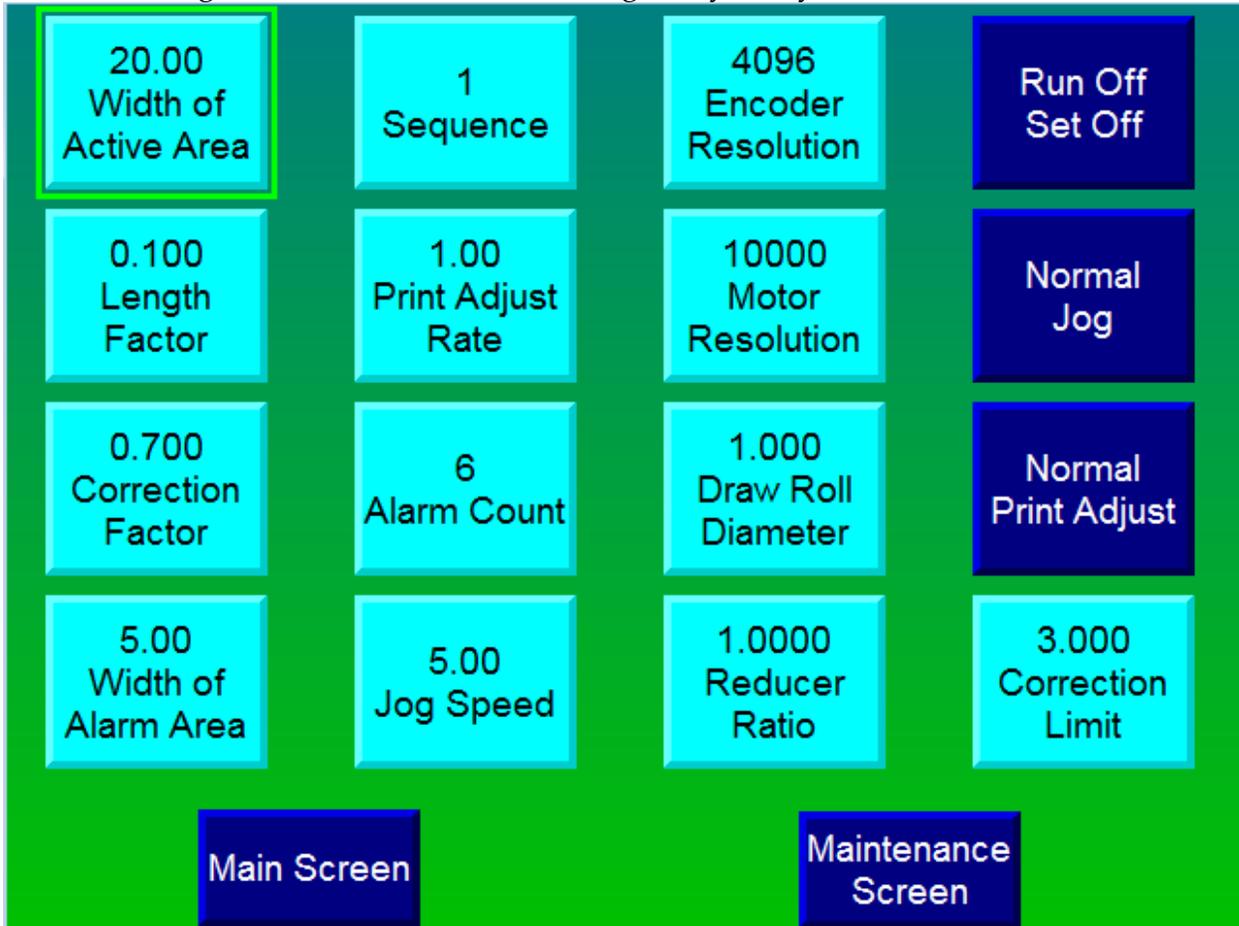
For initial setup, be sure your **Draw Roller Diameter (aka Metering Roller)** and **Reducer Ratio (gearhead)** settings are entered correctly.

A detailed explanation of every setting is given in the Setup menu section. These are all factory default settings, and can be adjusted if necessary.

» Phase the Encoder

Start with encoder, then phase the motor.

Step 1: <u>Enter the Maintenance Screen (from Setup screen).</u>
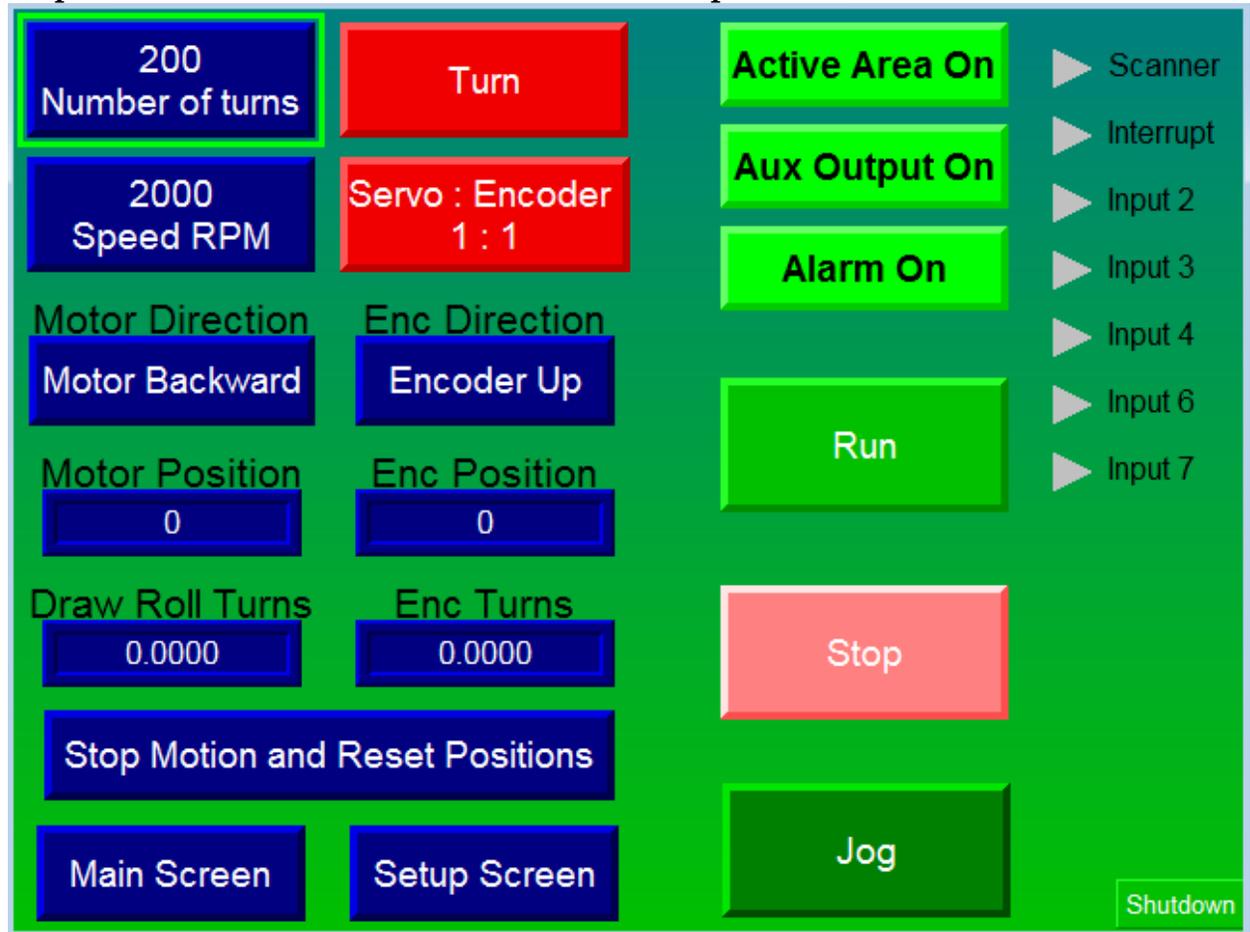
Step 2: <u>Press the Stop Motion and Reset Positions button.</u> This will zero out the position values.

Step 3: <u>Remain on the Maintenance Screen, and jog the machine forward.</u> (non-EMP controls) so that the EMP Encoder is rotating.

Step 4: <u>Inspect Encoder Position:</u>
If the Encoder Position value decreases, stop and press the Encoder Direction button once.
If the Encoder Position value increases, the Encoder is phased properly and you don't have to press anything.
NOTE: IT IS VERY IMPORTANT THAT THE ENCODER VALUE BE INCREASING. IF IT IS LEFT RUNNING IN NEGATIVE DIRECTION, YOU WILL NOT RECEIVE ACTIVE AREAS AND THE SYSTEM WILL NOT MAKE CORRECTIONS.

» **Phase the Servo Motor**

   Step 1: <u>Press the Jog button.</u>
   Step 2: <u>If motor is going backwards, press the Motor Direction button.</u>

If motor is in correct direction, you can exit the Setup screen.

» **Setup the Scanner**

First, make sure it's properly mounted and approximately 3/8" away from the paper.

1. Press & Hold Set until the LED under the Lock symbol turns on.
2. Put the Register Mark under the scanner and press & hold Set until the Green LED turns off.
3. Put the Background under the scanner, and press once (don't hold) Set.

At this point the system is setup and ready to run register. To begin running product, continue to the next section, Operating Instructions, for the steps to run registered and blank web.

4. **Operating**

» **Power On**

To turn power on, press the Green button on the Touch Screen.

» **Touch Screen Front Panel**

- **Green Push Button** - Turns power on for everything, including electrical cabinet.
- **Red Push Button** - Turns power off.
- **Red LED** - Active Area. Blinks when the encoder is in its active area, meaning it is expecting a register mark.
- **Green LED** – Scanner pulse. Will flash when the scanner sees the register mark or any other print similar to what it has been trained to see. If these other scanner pulses occur outside of the Active Area they will not generate corrections.

» **Main Screen**

- **Run** - Puts system into Run mode. When you jog the machine, the EMP Encoder will turn and the servo motor will then follow it.

- **Stop** -The servo motor will not follow the encoder.

- **Jog Adv/Ret** - Moves the servo motor independently.

- **Set/Cancel Set** – When in Set mode (blue), the system will make corrections to maintain register. When in Cancel Set (grey), the system will feed the Length and not make corrections.

NOTE: After you press Set, the Set button will flash until the scanner picks up the register mark.

- **Print Forward/Back -** Used to make small corrections to the register, while running.

- **Length** - Brings up the Length keypad. To change, must be in Stop mode.

- **Length Change %** - the difference between the Actual running length and the Length entered.

- **Correction –** Shows the current correction (measured in degrees) being made to keep the print in registration.

- **RPM** is the current speed of the machine (seen by our encoder).

Login: Password entry to Setup and Maintenance Screen.

» **Changing the Length**

To change the length, press the blue LENGTH button at the bottom of the Main Screen.

A keypad will pop up and you will be able to enter in your new length (in inches or in millimeters).

» **Running Pre-Printed Material**

1. Move the Web to the correct location/cutoff point.

    Before pressing the Set button, be sure that the next print seen by the scanner is going to be the register mark. For a more detailed explanation, see the next section "When to Press Set".

2. Press the **Set** Button, it will now appear as below:
    NOTE: The Set button will flash until the scanner picks up the mark.
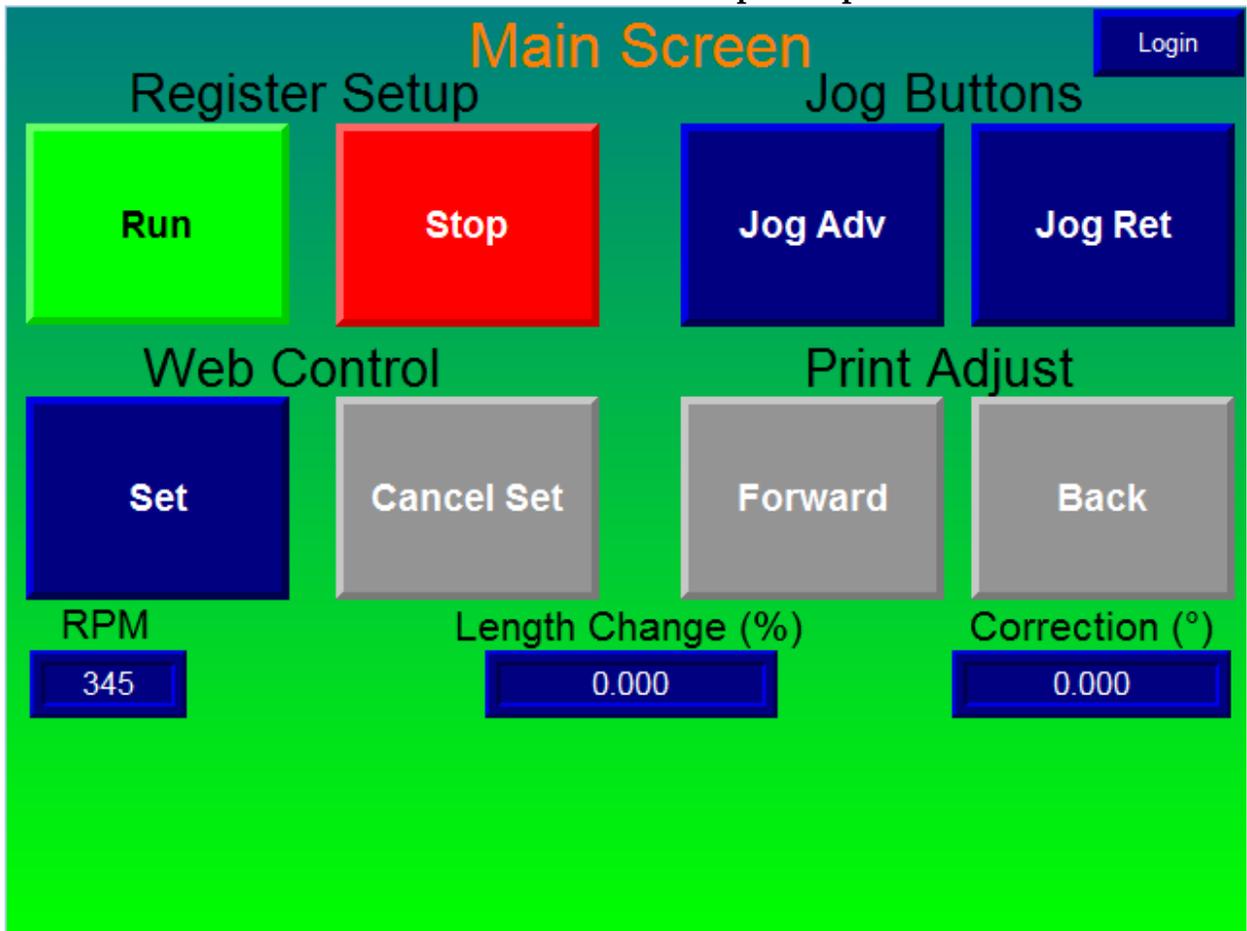
3. Run the Machine. Once the web starts moving, the scanner will detect the Register Mark and the screen will change again, now adding a Print Advance and Retard button.

4. Use the **Print Adjust buttons (Forward and Back)** to fine-tune the Registration. Note that the Print Adjust buttons are now blue, meaning they are enabled.
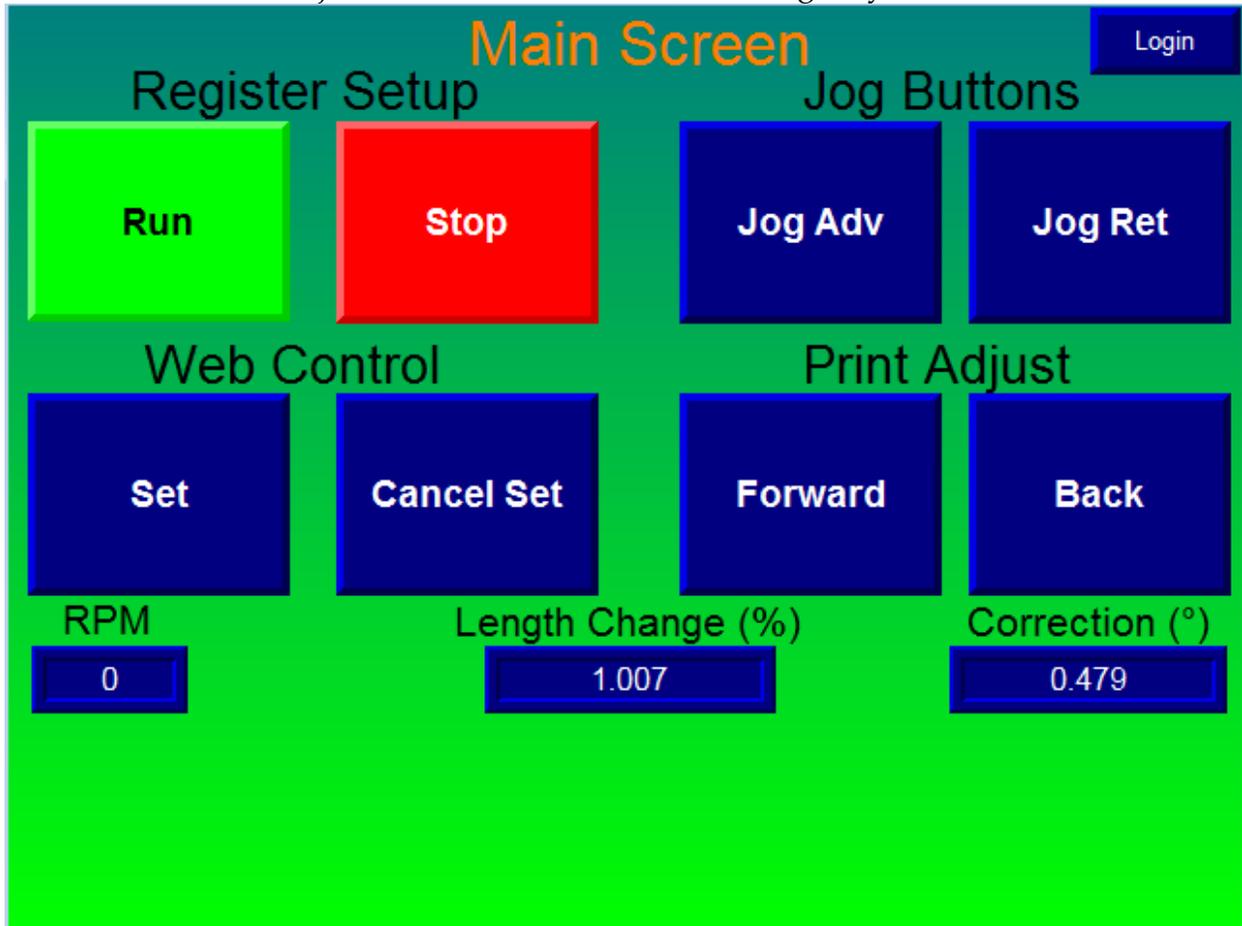
Once running, note the % Length Change and Correction Values (measured in degrees). These indicators are useful to see how much the system is correcting for inaccuracies in print and tension issues. Ideally, the Correction Value will remain small (<1.5) and bounce between negative and positive values. If all the corrections are large and either negative or positive, the system was not setup properly or there is an issue.

The Print is now in time and the control will use the register marks to maintain register. The EMP Series 1100 will now accommodate for changes in tension and inaccuracies in print.

NOTES:
- The **Cancel Set button** allows the system to return to non-registered mode at any time.

- **The Scanner assumes that the first mark it sees is the Register Mark. If the Scanner picks up a different mark or print, it will cause problems.**
- The Jog Advance and Retard buttons do nothing while the machine is in Run mode.
- If you want to enter the Setup Menu, change the Length or the Sequence, you must hit Stop first.

» **When to Press Set**
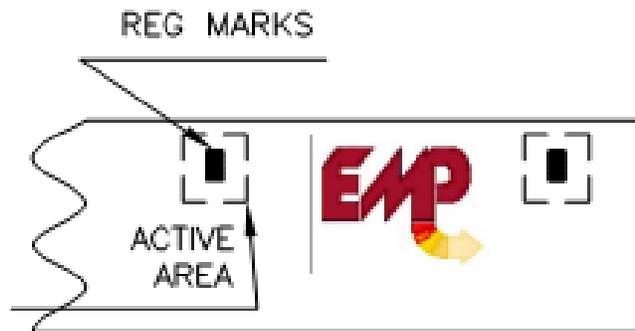
Your setup procedure may vary slightly depending upon your application/web. If it does, there are several important things to remember:

1. **After pressing Set, the FIRST mark/print seen by the Scanner has to be the Register Mark.**
   a. This is especially true for the Sample EMP web shown here. If you press Set at the wrong time, Registration will be based off the curved logo rather than the flat square of the Register Mark.
2. If there is a clear path between Register Marks, you can press Set at any time. (Since the scanner is only going to pick up the Register Mark)
3. If you use a Luminescent Scanner, you can press Set at any time. Again, because the scanner is only going to pick up the Register Mark.

» **Running Blank Material (Without Print)**
NOTE: Make sure proper Length is put in.

1. Press RUN to put system in Run mode.

That's it! If you are not running Registered web, the system needs to only know the Length and it has to be in Run Mode.

5. **Main Screen Overview**

- **Run** - Puts system into Run mode. When you jog the machine, the EMP Encoder will turn and the servo motor will then follow it.

- **Stop** -The servo motor will not follow the encoder.

- **Jog Adv/Ret** - Moves the servo motor independently.

- **Set/Cancel Set** – When in Set mode (blue), the system will make corrections to maintain register. When in Cancel Set (grey), the system will feed the Length and not make corrections.

NOTE: After you press Set, the Set button will flash until the scanner picks up the register mark.

- **Print Forward/Back -** Used to make small corrections to the register, while running.

- **Length** - Brings up the Length keypad. To change, must be in Stop mode.

- **Length Change %** - the difference between the Actual running length and the Length entered.

- **Correction –** Shows the current correction (measured in degrees) being made to keep the print in registration.

- **RPM** is the current speed of the machine (seen by our Encoder).

- **Login**: Password entry to Setup and Maintenance Screen.

6. **Setup Menu**

The Setup menu is primarily used by maintenance and adjusters, that's why it is password protected (5678). It is used to enter the critical parameters for running.
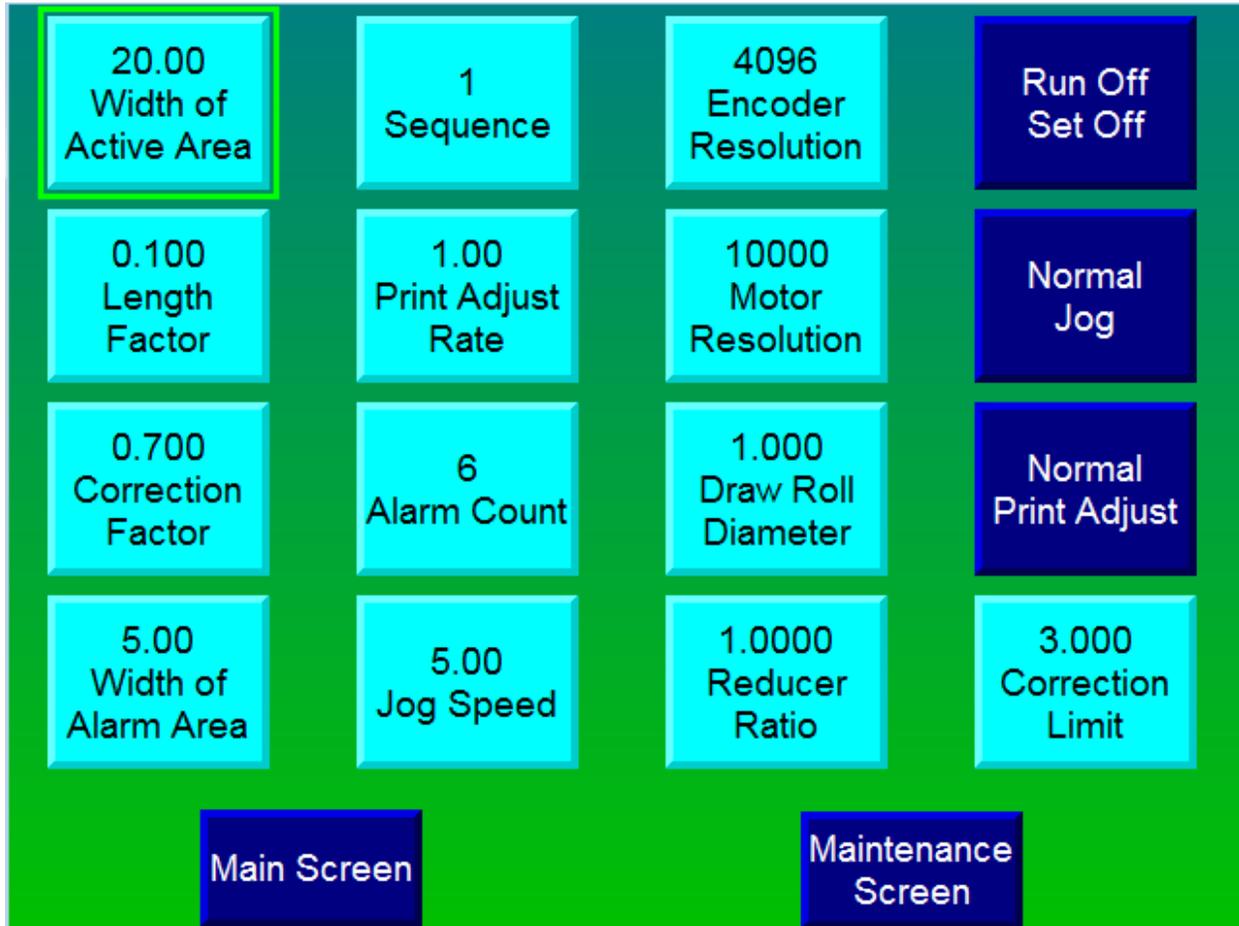
- **Width (Active Area)** - This determines the distance before the mark that the controller will actively seek a mark. For example, if the repeat Length is 12 inches and the width parameter is set to 30^0, then the controller will start actively looking for a mark 12x30/360 = 1 inch before it arrives. Any value between 5 and 90 degrees is allowed. If your print job has other ink within that 1 inch range, you will need to make the Active Area smaller in order to prevent the scanner from picking up this ink and thinking it is the register mark.

- **Length Factor** - During normal operation the ratio of encoder rotations to motor rotations will change to accommodate changes in tension, slippage at draw rollers, stretch in the web etc. This parameter changes the rate at which the ratio

changes. It can take any value between 0 and 1. Note: 0 turns off length correction.

- **Correction Factor -** When the Controller determines that the web is out of position a correction is applied to bring it back in to position. Because machinery has cyclic errors (due to run out etc.) it is not always desirable to move the web back into position. This factor determines how much correction is actually made. The amount of correction made = Measured Error x Correction Factor. For example, an error of 0.020 inches with a CF of 0.6 makes a correction of 0.012 inches [since .020x.6=.012] on the first pass leaving 0.008 inches. Then on the next pass it makes a correction of 0.0048 inches leaving 0.0032 inches and so on. The allowed values are between 0.2 and 1.

- **Alarm Area -** This sets up a tolerance for the marks. If the mark does not occur within this tolerance of where it is expected it is counted as an alarm event and enough alarm events will cause an **Out Of Tolerance** alarm. If the mark does not occur in the Active Area it will cause a **No Register Mark** alarm. The allowed values are between 5^0 and 10^0.

- **Sequence -** The sequence setting is used to primarily compensate for a bad print job. If you put a sequence of 2 in, the system will only make corrections for every 2 register marks, and so on. This is useful when a print cylinder is improperly placed, causing a repetitive error in the register marks.

- **Print Adjust Rate –** This setting can scale the amount of movement that the Print Advance/Retard (on the main screen) moves the web.

- **Alarm Count -** This sets up the Number of Alarm events required to cause an alarm. The Alarm events are no mark in the Alarm Area, and no mark in the Active area. The permitted values are between 4 and 20.

- **Jog Speed –** This is the speed at which the controller jogs the motor when commanded to do so (Jog Advance, Retard). It is calibrated in Draw Roller RPM. Values between 1 and 100 rpm are allowed.

- **Encoder Resolution -** This sets up the resolution of the auxiliary encoder. Note: For quadrature encoders, the resolution is equal to the line count x 4. So a 1024 line encoder has a resolution of 4096. This parameter is usually factory set for your particular encoder. Values between 1000 and 50000 are allowed. The resolution number, e.g. 4096, means one revolution of the encoder shaft equals 4096 pulses. Each pulse represents an incredibly small movement of the machine which is then relayed to the servo motor. So as the encoder is turned by the

machine's motor, the encoder pulses are relayed to the servo telling it to move the same distance.

- **Motor Resolution -** This sets up the resolution of the Servo Motor Feedback. This parameter is usually factory set for your particular motor. Values between 1000 and 50000 are allowed. Standard values are 4096 or 10,000.

- **Draw Roll Diameter** - This is the diameter of the roller that the EMP servo motor uses to advance the web, in **inches. It needs to be as accurate as possible, EMP recommends using calipers to measure.** The controller uses this information, the reducer ratio information, and the encoder position to determine the required position of the motor. Values between 1 and 30 inches are allowed.

- **Reducer Ratio** - This is the Ratio between the Servo Motor and the Draw Rollers. It should include the Gear Head Ratio as well as any other Belt/Pulley or Gearing Reductions. E.g. if the Gearhead has a 5:1 ratio, and it is attached to a 2:1 Pulley, enter in 10. (5*2). Any value between 1 and 50 is allowed.

- **Run Off Set Off** – This button toggles you through the various options for startup mode. Run off and Set off means the system will boot up with Run and Set modes disabled. By pressing this button, you toggle through choices. Run On, Set off (motor will follow machine, but no corrections made). Run On, Set On (motor will follow machine and begin automatically making corrections). Be careful starting up in Setup mode, as the system still needs to know where to correct to.

- **Normal Jog** – Refers to direction of the servo motor when jogged.

- **Normal Print Adjust** – Will reverse the direction of the corrections made by the Print Advance/Retard buttons.

- **Correction Limit** – Maximum amount of correction made at one time. Measured in degrees.

» **Maintenance Screen**
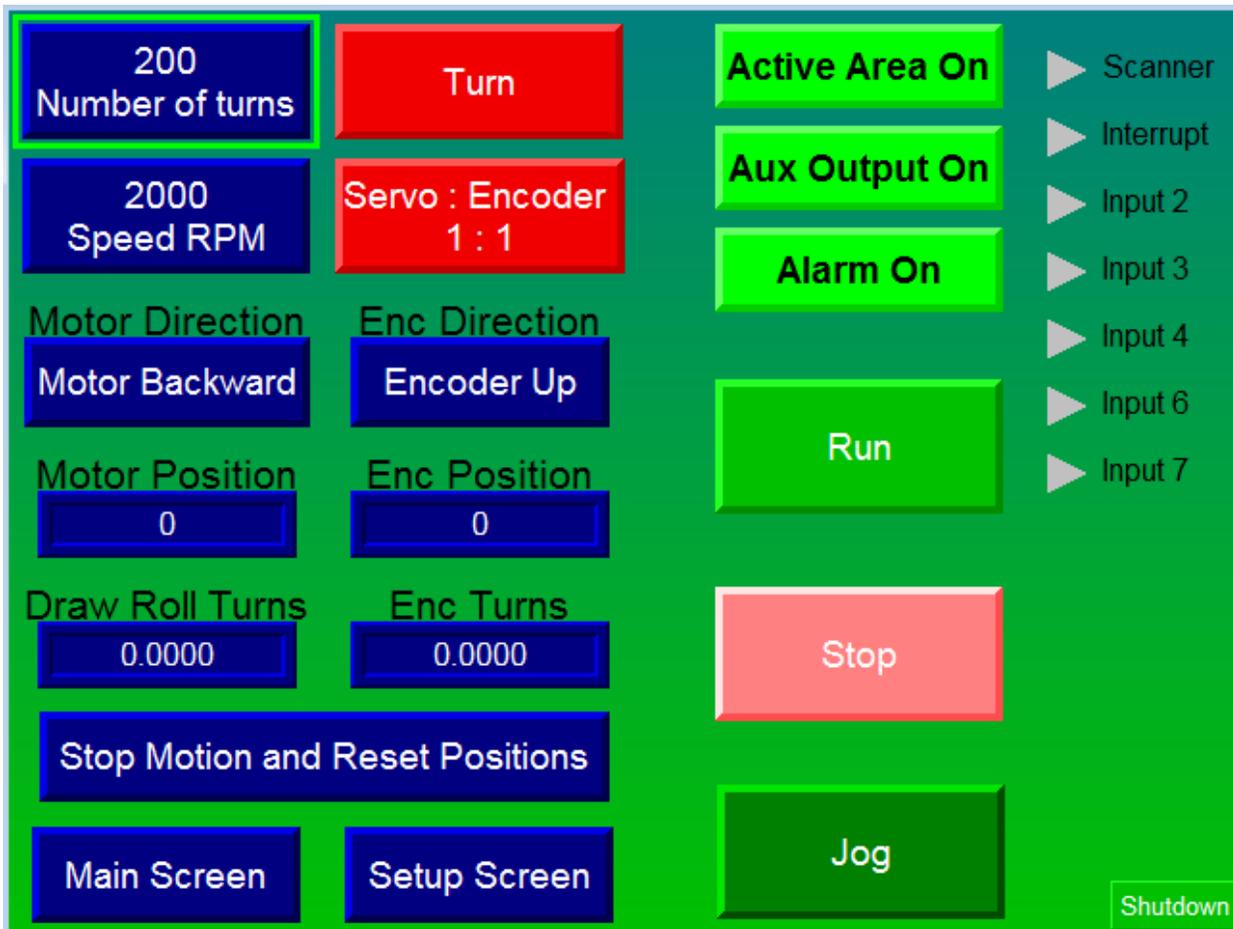
NOTE: Red buttons are used for testing/troubleshooting purposes only.

- **Turn Test:** When the red Turn button is pressed, the servo motor will turn a set number of turns (defined by button to the left of it).

- **1:1 Ratio Test –** When the red Servo : Encoder 1:1 button is pressed, the servo motor will begin to turn at a 1:1 ratio with the encoder at a set speed (defined by the button to the left of it).

- **Motor Direction:** Reverses the direction of the servo motor.

- **Encoder Count Direction:** Reverses the direction of the encoder count.

NOTE: It's important that for register to be held, must have the Encoder Position counting upwards in the positive direction.

- **Encoder Position:** Displays the current position of the encoder. If you jog machine, notice the position change.

- **Draw Roll Turns/Enc Turns:** Counts and displays number of turns for each component.

- **Stop Motion & Reset Positions:** Will zero out the displayed positions for the encoder and servo motor.

- **Main Screen:** Will return user to the Main Screen.

- **Active Area:** Will turn on or off the red Active Area LED on the front panel.

- **Aux Output:** Will turn on or off the Auxiliary output. (Optional)

- **Alarm:** Will turn on or off the Alarm relay.

- **Input/Output Table:** Shows the various inputs and outputs current state, including the Registration Scanner and the Interrupt input (optional). **Run Motor:** Motor will start turn independently.

- **Run:** Will run the servo motor independent of machine.

- **Stop Motor:** Will stop the servo motor.

- **Jog Motor:** Will jog the servo motor independently.

7. **Electrical Components**

Below are the major components in your electrical cabinet:
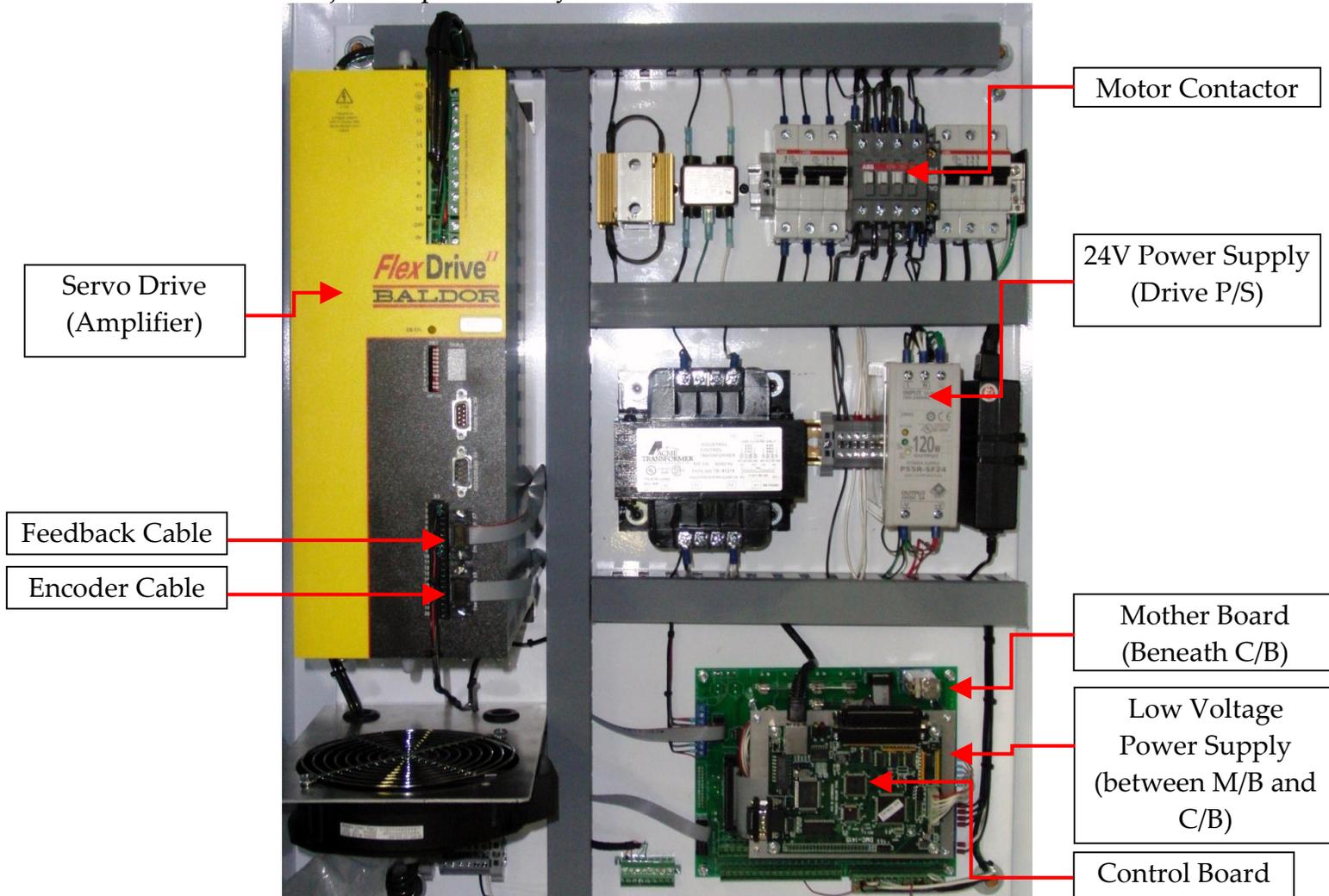
The **Servo Drive** amplifies the incoming voltage to the correct amount needed for your specific motor. The one shown above is a 27.5 Amp Drive. It contains a custom motor profile for your motor for optimal tuning. The Drive's **24V power supply,** as well as **Feedback and Encoder Cable** are critical to the operation of your system.
The **Control Board** is manufactured by Galil. It performs the calculations to determine the registration corrections made by the motor. It contains custom EMP software.

The **Mother Board** is located underneath the Control Board. It contains the power supply for the Control Board and several fuses that protect it. The **Motor Contactor** is a relay with a much higher current rating.

8. **Troubleshooting & Alarms**

If you are having issues, don't hesitate to call us at (631) 434-3700. Before you call, please have the Serial Number of your unit. Also, note any errors on the touch screen and servo drive LCD.

Verify the Low Voltage Power Supply (shown in previous section), is working as follows:

Wire Description	Correct Voltage
White with Red	+5V DC (± .2)
White with Green	Common
White with Black	-12V DC (± .5)
Red with Orange	+12V DC (± .5)

Startup screen stays on. Have to press Done to get to Main Screen – This means the communication between the Galil and the Touch Screen is not working.

Action:
- Check your signal cables.
- Check voltage at Touch Screen and Galil Controller.

Touch Screen Not Responsive - Press buttons on touch screen but nothing changes. No communication between Touch Screen and Galil.

Action:
- Replace Galil board.
- Check cabling.
- Replace Touch Screen.
- Re-calibrate touch screen.
  - Turn on while holding your finger in top left corner of touch screen, this will take you to Touch Screen diagnostics screen, and allow you to re-calibrate screen.

Following Error - The Controller system will shut down when a following error exists. This error occurs when the ratio between the Motor and the Encoder has changed unexpectedly. To avoid an unexpected Motor movement, a Following Error stops the machine. The Machine must be set up again.

Action:
- Check that the drive is enabled and does not have any faults.
- Use the **1:1 Ratio test** in the Maintenance screen.
- Use the **Turn test** in the Maintenance screen.
- Inspect motor feedback and power cables, make sure plugged in properly.
- Check encoder shaft is not loose.
- Check the encoder belt/pulley assembly. A faulty belt can cause a sudden change in speed of the encoder, which can cause a following error.
- Replace the servo motor (faulty feedback device).
- Remove the gearhead from the servo motor to see if error message disappears. (Faulty bearings in the gearhead can seize the motor position).
- Check that the tension is being maintained properly.
- Check that the motor's feedback cable and drive's feedback ribbon are both connected properly.
- Verify that the product length is correct.

Out of Tolerance Alarms – The web is not being cut accurately, but corrections are still being made. For some reason, the system is cutting the wrong length.

Action:
- Check that the tension is not too high or too low, and is steady rather than changing rapidly.
- Try a new roll of web.

No Register Mark Alarm – The scanner is not picking up the register mark within the active area. This can be caused by slippage on the draw roller or tension being off.

Action:
- Check that the tension is not too high or too low, and is steady rather than changing rapidly.
- Make sure that the draw roller is tight against its nip roller. Try and pull it through, you should not be able to move it easily.
- Check the Length value entered in the touch screen matches the actual length.
- Make sure the scanner lens is clean and setup properly.
- Run the **1:1 Ratio** and **Turn** test.

Command Error – Usually indicates a software problem, or possibly a damaged Galil board.

Action:
- Cycle the power.
- Check your settings.
- Make sure Sequence is not set at zero.
- If the error keeps coming up, replace the Galil board.

.

Position Errors – Placement of servo motor is incorrect.

Action:
- Replace servo motor.
- Run the **1:1 Ratio** and **Turn** tests.
- Make sure all electrical components are properly grounded.

9. **TL-U Scanner Operation**

Proper Position of Scanner

1. **The Scanner should be 3/8" (9mm) from the preprinted web.**
2. The beam direction may be changed by swapping the cap and lens.

Scanner Set-Up

1. Press & Hold Set until the LED under the Lock symbol turns on.
2. Put the Register Mark under the scanner and press & hold Set until the Green LED turns off.
3. Put the Background under the scanner, and press once (don't hold) Set.

10. **Emergency Telephone Number**

EMP maintains a file by serial number of each Servo System sold. The serial number will supply details on the:

1. Servo Program
2. Motor Amplifier
3. Style of Alarm Relay and Components Used
4. Motor Type
5. Reducer Ratio

Before contacting EMP, please obtain the serial number. The Serial Number can be obtained by checking the label on the door of the control panel.

Call us at **(631) 434-3700** during normal business hours for troubleshooting assistance.

After normal business hours, an emergency phone number, **212-365-0932 or 917-215-4639**, should be called.

The EMP web site www.empregister.com also provides trouble shooting assistance.