SYSTEMS
Engineering Associates, Inc.

HSL/HSK-CD4
Rutherford Decorator
High Speed Front End
Installation And Setup

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WARNING

To ensure the equipment described by this User Manual, as well as the equipment connected to and used with it, operates satisfactorily and safely, all applicable local and national codes that apply to installing and operating the equipment must be followed. This includes the National Electric Code in the USA and other applicable legislation, regulations, and codes in practice elsewhere. Since codes can vary geographically and can change with time, it is the user's responsibility to determine which standards and codes apply, and to comply with them.

FAILURE TO COMPLY WITH APPLICABLE CODES AND STANDARDS CAN RESULT IN DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY TO PERSONNEL.

Persons supervising and performing installation or maintenance must be suitably qualified and competent in these duties, and should carefully study the User Manual and any other manuals referred to by it prior to installation and/or operation of the equipment.

The contents of this document are believed to be correct at the time of printing; however, no responsibility is assumed for inaccuracies. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or it's performance or the contents of this document without notice.

Hardware Included:

The standard HSL-CD4 includes the hardware kit of the HSK-CD4, mounted and pre-wired to a 17”x17” sub-panel, provided for installation inside the existing control cabinet:

The HSK-CD4 is only the hardware kit for the HSL-CD4 and includes the following:

1ea. M4500 - PLC/PLS Module with 4 I/O slots and associated I/O boards:
- 1ea. S4563 – 16 point digital DC input board (10-30VDC sourcing)
- 1ea. S4568 – 8-in/8-out digital DC input/output board (10-30VDC sourcing)
- 1ea. S4573 – 16 point digital DC output board (10-30VDC sourcing)

1ea. M4500 Power Supply - P4500
1ea. Keypad/Display - D4591, with cable, for mounting on the exterior of control cabinet door
1ea. Program Disk with User Manuals

Options (Purchased Separately):

1ea. RSV34-MS1 Resolver
1ea. RSV-RSCBLE-XX Resolver Cable
1ea. HSL-QCSTA - Remote Select-A-Can PB station
1ea. S4516 - Data Communications Board (MODBUS and DF1 protocols)

Power Required:

The HSL/HSK-CD4 is powered from 115VAC/230VAC 50/60HZ and +24VDC power supply.

The 115VAC/230VAC is used to power the M4500 module while the +24VDC is used to power the +24VDC I/O (sensors, trip and blow-off solenoids).

Note: +24VDC solenoids must be used for all trip and blow-off solenoids. The +24VDC current required is no more than that of the existing system therefore the existing +24VDC power supply should be adequate.

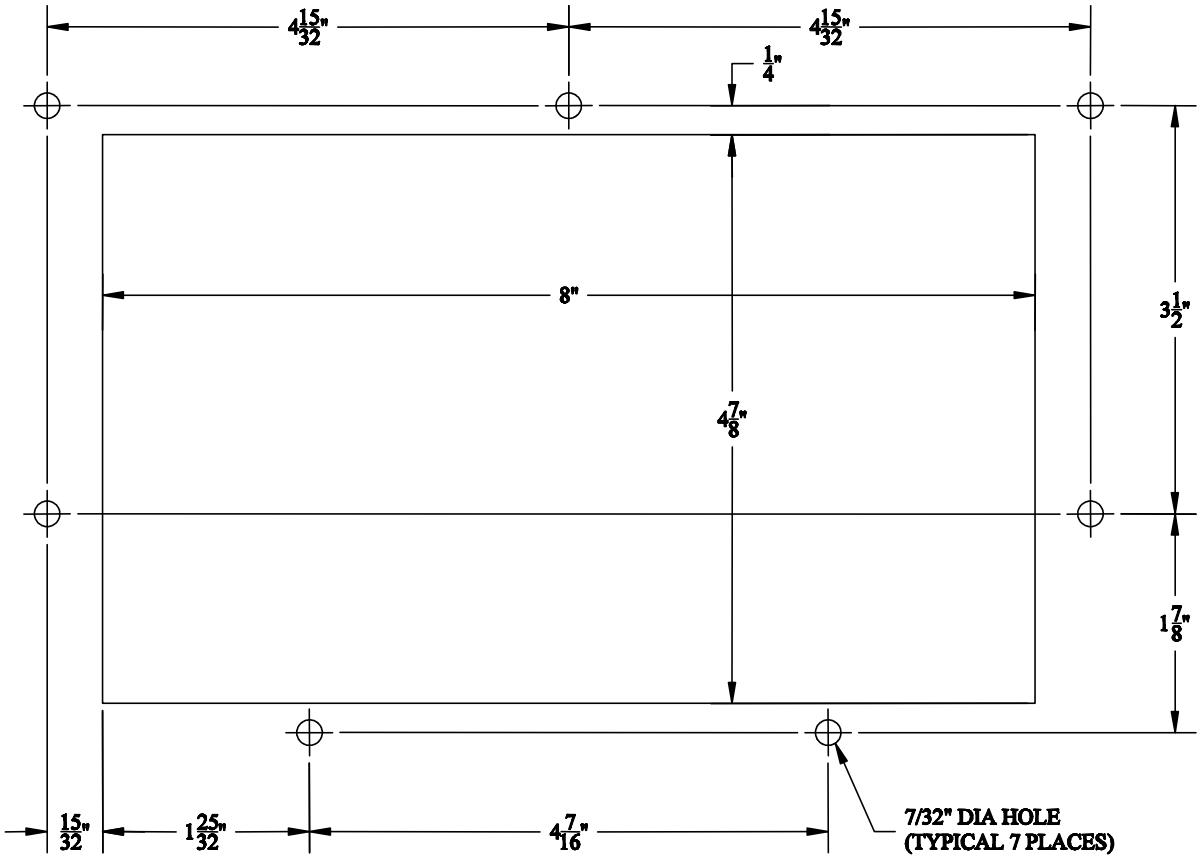
Mounting the HSL/HSK-CD4:

The HSL-CD4 17”x17” sub-panel is mounted inside the existing control cabinet.

The HSK-CD4 requires a minimum area of 11”x11” to mount the P4500 and M4500 hardware. The case of the M4500 chassis and P4500 power supply are required to be positively grounded to the mounting surface. Use a star lock washer to penetrate the painted surface, making a positive connection with the mounting screw, case and mounting surface. It may also be necessary to remove some paint from the area on the case in order to make a solid connection.

A cut-out in the existing control cabinet door is created to mount the D4591 Keypad/Display, refer to the figure below.

Note: The D4591 must be located within 6 feet of the M4500 module to avoid EMI pick-up on the display ribbon cable. Connect the ribbon cable from the M4500 module to the D4591 Keypad/Display.



D4591 Recommended Panel Door Cut-out

Mounting the RSV34-MS1 Resolver (if required):

If not already equipped with a resolver, then one will have to be mounted. If the optional RSV34-MS1 resolver (and required RSV-RSCBLE cable) was purchased with the system then refer to the associated data sheet for details on mounting the resolver. The HSL/HSK-CD4 is designed to interface to a resolver (not encoder) for machine timing. The resolver must make one revolution for each spindle (24 revolutions per spindle wheel revolution).

Note: Route the resolver cable in a separate conduit, away from all other high voltage and control wiring. Wire the cable directly to the 8-pin resolver connector on the M4500 as shown on the electrical schematics.

Spindle #1 I.D. Sensor (not provided):

A non-discriminating 10-30VDC proximity sensor can be mounted anywhere around the periphery of the spindle wheel. The spindle #1 I.D. sensor must see a target once every revolution of the spindle wheel (once every 24 spindles) and is used to determine which spindle is #1 for both the QC select-a-can blow-off and the trips per spindle count.

Mounting the HSL-QCSTA (if required):

The HSL-QCSTA is used to blow-off a Can printed on a selected spindle (or blanket) from the pin chain for quality verification. If the optional HSL-QCSTA remote select-a-can PB station was purchased, mount it in a convenient location, in the vicinity of the pin chain blow-off and wire it to the HSL/HSK-CD4, referring to the electrical control schematic.

Wiring:

Referring to the HSL-CD4 electrical control schematic, wire the system as follows:

Note: Keep all +24VDC wiring, resolver cable, and sensor cable wiring away from high voltage wiring and wire the machine mounted resolver directly to the 8-pin resolver input, connector on the M4500.

1) Incoming Power: 115VAC-230VAC to FU1, neutral to 900 and ground to GND. +24VDC to 501 and common to 500.

2) Interlocks from existing control system: 11 inputs to terminals I10 through I19 and I23.

3) Interlocks to existing control system: 5 outputs from terminals O22 through O25 and FLT – module fault interlock(+24VDC sinking output).

4) Carriage Trip, Varnish Unit Trip, Damaged Can Blow-off, Pin Chain Blow-off and Can Feed solenoids (terminals O10 through O21).

5) Can/No Can Sensor, Spindle No.1 I.D. Sensor and No Transfer Sensor (terminals I08, I09, I21) using three conductor shielded cables. The shields of the sensor cables should be tied to earth ground at a terminal inside the existing control cabinet and left floating at the sensors.

6) Set-Up Enable key switch (recommended) to allow entry to set-up variables through Keypad/Display.

7) Resolver cable from resolver (or existing PLS) to 8-pin resolver input connector on the M4500 using a three pair (six conductor) shielded cable. The shield of the resolver cable should be tied to the “SHLD” terminal of the M4500 resolver input connector. The resolver cable shield is left floating at the resolver.

Modify Existing PLC Program:

PLC program will need to be modified to interface with the HSL/HSK-CD4 by incorporating the following into the existing PLC ladder logic:

1) The damaged Can blow-off, print carriage trip, varnish unit trip, and pin chain blow-off solenoids will be controlled by the HSL/HSK-CD4. This logic can be removed or defeated from the existing host PLC logic.

2) Add the “Infeed Track Jam” and “Can On Mandrel” (no transfer) alarms as inputs to the host PLC. These should stop the machine anytime either of these alarms are “ON”.

3) Add the “Module Fault Interlock” as an input to the host PLC. This signal will be “ON” if the M4500 controller has faulted. This should immediately stop the machine if this input is “ON” as M4500 is no longer executing the program.

4) Add the “Carriage Auto Mode” and “Carriage Manual In” outputs into the PLC logic. When both are “Off” the carriage will be retracted. When the “Manual In” is “ON”, the carriage will be extended (print position). When the “Auto Mode” is “ON”, the carriage is controlled by the Can/No Can sensor.

5) Add the “Varnish Auto Mode” and “Vanish Manual In” outputs into the PLC logic. When both are “Off” the varnish unit will be retracted. When the “Manual In” is “ON”, the varnish will be extended (varnish position). When the “Auto Mode” is “ON”, the varnish unit is controlled by the “Can/No Can” sensor.

6) Add the “Damaged Can Auto Mode” and “Damaged Can Manual On” outputs into the PLC logic. When both are “Off” the damaged Can blow-off is disabled. When the “Manual On” is “ON”, the damaged Can blow-off is “ON”. When the “Auto Mode” is “ON”, the damaged Can blow-off is controlled by the “Can/No Can” sensor and “Infeed Open” input.

7) Add the “Pin Chain Manual Blow-off” output to the PLC logic. When “ON”, the bad Can pin chain blow-off is “ON”. When “Off”, the pin chain blow-off functions normally, blowing off detected bad Cans, restart Cans, etc.

8) Add the “Can Feed Open” output to the PLC logic. When turned “ON” while running, the infeed is timed “Open” with the Can feed timing signal. When turned “Off” while running, the infeed is timed “Closed” with the Can feed timing signal. When the machine is stopped, turning this input “ON” and “Off” will respectively “Open” and “Close” the Can stop.

9) Add the “Main Drive On” output to the PLC logic. This should be “ON” when the drive is enabled (running) and should be “Off” when the drive is disabled (this includes auto stop conditions). This is also true for jog mode.

10) Add the “Alarm Reset” output. This signal should be “ON” as long as the system reset push-button is depressed.

11) Add the “End of Shift” output to the PLC logic. The “Current Shift” data is transferred to the “Last Shift” data when the end of shift input transfers from a “0” to a “1”.

Default Set-Up Variables:

As shipped, the user variables for the M4500 are set to the following defaults:

Print Carriage and Varnish Unit:
- Print Carriage retract response time (msec) _____: 45
- Print Carriage extend response time (msec) _____: 45
- Varnish Unit retract response time (msec) _____: 60
- Varnish Unit extend response time (msec) _____: 60
- Number of Shifts to Varnish Unit _____: 5

Bad Can (pin chain) Blow-off:
- # of Cans to blow-off from infeed open _____: 6
- # of Cans to blow-off from print at restart _____: 4
- # of Cans to blow-off from varnish at restart _____: 4
- # of Cans to blow-off for each misload _____: 3
- # of pins to pin chain blow-off port _____: 50
- # of Cans from infeed to Can PRX _____: 6
- Blow-off solenoid “on” response time (msec) _____: 15
- Blow-off solenoid “off” response time (msec) _____: 20

QC Can (select-a-can) Blow-off:
- Blow-off solenoid “on” response time (msec) _____: 15
- Blow-off solenoid “off” response time (msec) _____: 20
- QC Can blow-off port shift offset _____: 1
- Blanket wheel segments _____: 8

- Spindle Trip Offset _____: 0

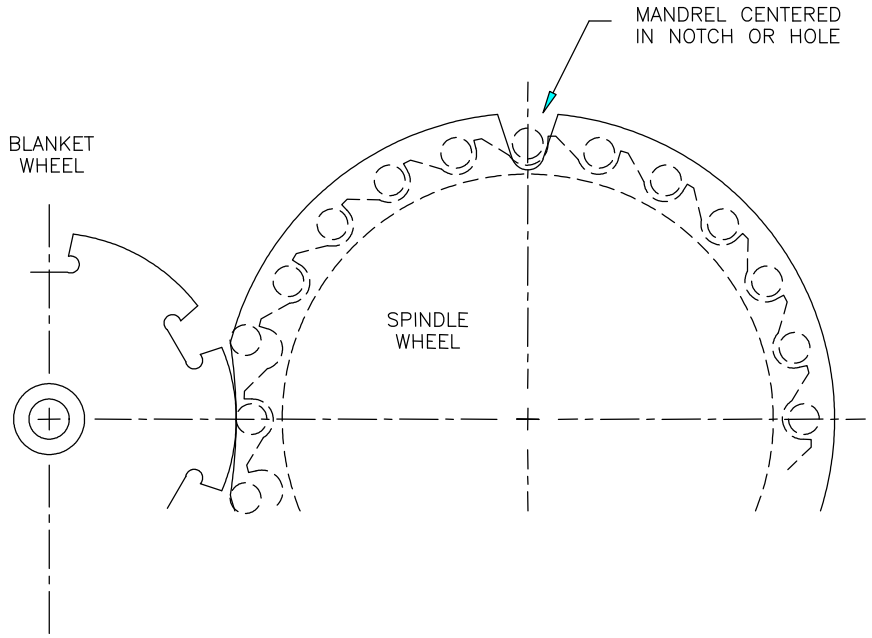
As shipped, the timing set-points are set per the following:

CHAN	ON	-	OFF	DESCRIPTION
CH00:	020	-	060	Carriage trip timing
CH01:	010	-	050	Varnish trip timing
CH02:	180	-	000	Can/No Can clock
CH03:	060	-	250	Damaged Can Blow-off (Low speed)
CH04:	030	-	200	Damaged Can Blow-off (High speed)
CH05:	250	-	290	Pin Chain Blow-off (bad can) timing
CH06:	255	-	295	Select-A-Can (QC) Blow-off timing
CH07:	000	-	140	Can Gate Timing
CH10:	000	-	180	PLC Clock Timing
CH11:	___	-	___	
CH12:	___	-	___	
CH13:	___	-	___	
CH14:	___	-	___	
CH15:	___	-	___	
CH16:	___	-	___	
CH17:	___	-	___	

Machine Zero:

Perform the following to set the resolver offset using the Keypad/Display:

1) Press the “Set-Up” key.
2) Press the #5 key – Zero Machine (set resolver offset).
3) Enter “0” to zero the resolver and set the offset. The timing channel set-up menu will be displayed, showing the position, “POS:” at zero.

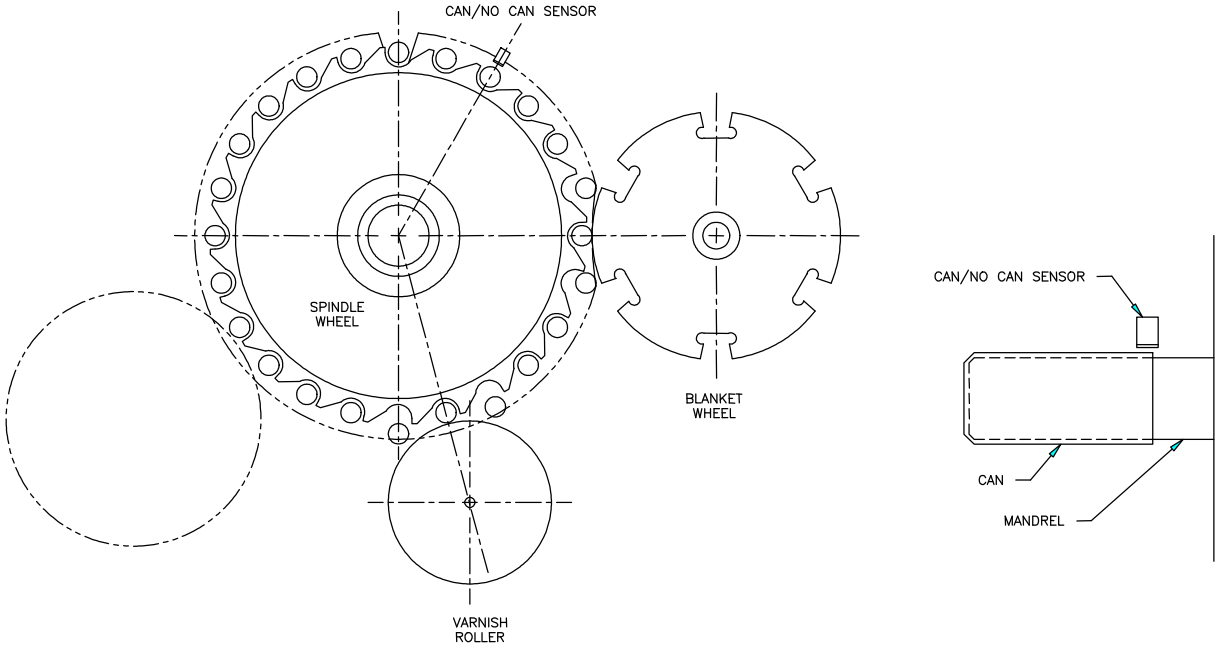


Machine Zero Position
(as seen from back of machine)

Location of "Can/No Can" Sensor:

With the machine at the "Zero" location, the "Can/No Can" sensor is centered over the 2nd spindle from 12 o'clock. See figure below.

The sensor should first see the Can at between 300 and 0 degrees. The Can/No Can sensor "ON" position can be viewed by selecting option #6 – View Critical Input Positions, from the primary setup menu using the Keypad/Display. Placing a Can on a spindle and slowly jog it past the sensor will update this "ON" position display. The sensor should be moved to within the 300 to 0 degree range if the Can/No Can sensor does not first see the Can within this range.



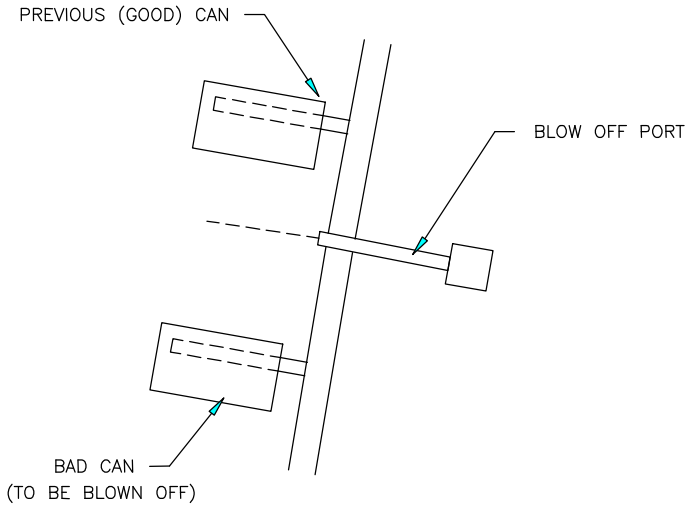
Location of Can/No Can Sensor

Pin Chain Blow-Off Timing:

The bad Can (pin chain) blow-off timing (CH05 or CH06) is set such that the timing signal turns "ON" when the pin chain blow-off port is centered between Cans on the pin chain.

From the primary setup menu of the Keypad/Display, select option #3 – Set Machine Timing (set-points, etc.) and perform the following:

1) Select timing channel CH05 – Pin Chain Blow-off.
2) Clear the channel (press the "CLEAR CHAN" key).
3) Enter a new set-point (press the "ENTER SET-POINT" key). The "ON" SETPOINT should be the current position of the resolver (press the "ENTER" key). The "OFF" SETPOINT should be set 40 degrees after the "ON" set-point (press the "ENTER" key).
4) Search the channel to confirm only one set-point (one on setting and one off setting).



Location of Blow-off Timing "ON" Position
(channel 05 or 06)

Setting the Number of Pins to Pin Chain Blow-Off Port:

The chain take-up must be after the pin chain blow-off port for reliable blow-off operation. If the take-up is before the port, the relative position of the port to the blow-off timing will vary as the take-up moves, causing partial blow-offs to occur.

1) Count the number of pins from the spindle wheel to disc transfer location to the bad Can pin chain blow-off port

2) From the primary setup menu using the Keypad/Display, select option #2 – Set Pin Chain/QC Blow-off Parameters. Press the "NEXT" key until "# PINS TO PIN CHAIN BLOW-OFF PORT:" is displayed.

3) The number entered is the number counted minus 2 (this is still just an approximation).

4) Set the "# CANS TO BLOW-OFF FOR EACH MISLOAD" (press the "PREV" key) equal to five.

5) Run the machine at low speed. Open the infeed and allow Cans to load and be printed. After Cans have passed the pin chain blow-off port, close the infeed and observe the number of Cans blown off.

   Note: Half prints or silver Cans may get through the line until this variable is properly set.

6) Adjust the number of pins to pin chain blow-off such that whenever the infeed is closed, one (half printed) Can is consistently blown off. Reduce the number of pins to pin chain blow-off if no Cans are blown off. This indicates that the number of pins to pin chain blow-off is too high (blow-off comes on too late). Increase the number of pins to pin chain blow-off if more than one Can is blown off. This indicates that the number of pins is too low (blow-off comes on too early).

7) Set the "# CANS TO BLOW-OFF FOR EACH MISLOAD" equal to 3. Run the machine at low speed with Cans and verify that for each miss-loaded Can, three bad Cans are blown off (miss-loaded silver Can blown off at damaged Can blow-off port, half print Cans ahead and behind miss-loaded Can blown off at pin chain port). If not adjust "# of pins to pin chain blow-off port" accordingly until they are.

   Note: Once this variable is set, set the "# of Cans to blow-off for each misload" equal to 4 or 5 until the print carriage and varnish unit response times are set. This is to verify the Cans following the miss-load for proper print.

Setting the Number of Cans from Infeed to Can PRX:

This parameter is used to adjust the number of stations from the Can gate solenoid to "Can/No Can" sensor. Default value is set to 6. Decorators that utilize an infeed star wheel will add an additional 6 (total 12) stations from infeed to Can PRX.

1) From the primary setup menu using the Keypad/Display, select option #2 – Set Pin Chain/QC Blow-off Parameters. Press the "NEXT" key until "# OF CANS FROM INFEED TO CAN PRX:" is displayed and initially set this value to 6. If an infeed star wheel is used, set this value to 12.

2) Run the machine at low speed. Open the infeed and allow Cans to be printed.

3) From the default display of the Keypad/Display, observe the "BLOWOFFS" field. When the Can feed is first opened, this number should increment up by the number of Cans to blow-off at infeed open.

4) If the number of Cans blown off was less than the number counted, increase this number by the difference. If the number of Cans blown off was more than the number counted, decrease the number by the difference.

5) Continue to adjust this parameter until the actual number of Cans blown off at infeed open is equal to the desired.

Setting the Number of Shifts to Varnish Unit:

This is the number of spindles from the Can Sensor to the varnish unit minus 2. In general, this is set such that the varnish unit retracts out on the Can ahead of the misloaded spindle.

From the primary setup menu using the Keypad/Display, select option #4 – Set Number of Shifts to Varnish Unit. The default value is set to 5. For Rutherford Decorators that have been fitted with the reverse roll gravure over varnish unit, this is set to 4.

Setting Print Carriage and Varnish Unit "Retract"/"Extend" Response Times:

The retract and extend response time is the amount of time the system will lead the trip point to compensate for the mechanical response of the machine. Run the machine at high speed, induce miss-loads and observe the Cans blown off at the pin chain blow-off to verify the trip control.

Note: Pressing the "Blank Key" on the Keypad/Display while the default display is shown will electronically induce a misload into the system.

The miss-loaded Can should be completely silver. The Can ahead of the miss-load (carriage retract) should be 1/4 to 1/2 printed. The Can behind the miss-load (carriage extend) should be 1/2 to 3/4 printed. Any additional Cans blown off should be fully printed and of good quality print.

From the primary setup menu using the Keypad/Display, select option #1 – Set Carriage/Varnish Response Times.

If the Can ahead of the miss-load (carriage retract) is more than half printed, the "Print Carriage retract (out) response time" is too short. Increase the response time by 5 milliseconds and try again. Continue increasing this time until this Can is 1/4 to 1/2 printed. If this Can is less than 1/4 printed, the retract (out) response time is too long. Decrease the response time by 5 milliseconds and try again. Continue decreasing this time until this Can is 1/4 to 1/2 printed.

If the Can behind the miss-load (carriage extend) is less than 1/2 printed, the extend (in) response time is too short. Increase the extend (in) response time by 5 milliseconds and try again. Continue increasing this time until this Can is 1/2 to 3/4 printed. If this Can is more than 3/4 printed, the extend (in) response time is too long. Decrease the extend (in) response time by 5 milliseconds and try again. Continue decreasing this time until this Can is 1/2 to 3/4 printed.

Note: The "extend (in)" is a function of the "retract (out)". Therefore the "retract (out)" time should always be set before setting the "extend (in)" time.

Prior to setting the varnish unit retract/extend response times, set the number of shifts to the varnish unit. This is set such that the varnish unit retracts out on the Can ahead of the misloaded spindle. The default value is "5". This is set to "4" for machines fitted with the reverse roll gravure over varnish unit.

The varnish unit extend and retract response times are set in the same fashion as was done for the print carriage. In general, the miss-loaded Can should have no varnish on it, the Can ahead and behind should be approximately 2/3 varnished.

Setting the Spindle Trip Shift Offset:

1) From the primary setup menu of the Keypad/Display, select option #2 – Set Pin Chain/QC Blow-off Parameters. Press the "NEXT" key until "SPINDLE TRIP SHIFT OFFSET (0-23):" is displayed (last setup parameter in this menu) and initially set this value to zero.

2) Wrap a piece of tape around spindle #1 such that Cans do not load on this spindle. With the machine running slowly open the Can gate and verify that Cans do not load on spindle #1 and that the print carriage is tripped for that spindle.

3) Observe the "Trips per Spindle" data and determine which spindle number is being incremented. The spindle number that should be incrementing is spindle #1. If it is not, subtract 1 from the spindle number that is being incremented and enter this value as the "Spindle Trip Shift Offset".

4) Verify that the spindle #1 count is incremented every time the carriage trips for spindle #1. If it still increments another spindle number, continue adjusting the "Spindle Trip Shift Offset" until it does. Stop the machine and remove the tape from spindle #1.

Setting the QC Blow-Off Shift Offset:

If the QC Can (select-a-can) feature is used, set the "QC Can blow-off port shift offset" as follows:

Note: This variable must be a number between 1 and 24 as there is always a Can printed on spindle #1 every 24 Cans.

1) Initially position the machine with the "Spindle No. 1 I.D." sensor located over the target.

2) Count the number of stations from the "Q.C. Can Blow-off" port to spindle No. 1. Divide this number by 24. The remainder of the division, + 1, will be the initial value for the shift offset.

3) From the primary setup menu of the Keypad/Display, select option #2 – Set Pin Chain/QC Blow-off Parameters. Press the "NEXT" key until "# QC BLOW-OFF SHIFT OFFSET (1-24):" is displayed. Enter in the initial value for the shift offset.

4) Set the thumbwheel switch for the Select-A-Can blow-off to 1.

5) With the machine running slowly, mark Cans printed on spindle #1 so they can be identified while on the pin chain and press the Select-A-Can pushbutton. This function can also be performed from the Keypad/Display utilizing the "QC BLOW-OFF" key and entering "1".

6) Compare the Can that was actually blown off with the location of the marked Can.

7) From the primary setup menu using the Keypad/Display, select option #2 – Set Pin Chain/QC Blow-off Parameters. Press the "NEXT" key until "# QC BLOW-OFF SHIFT OFFSET (1-24):" is displayed. Add the difference between the Can actually blown off and the marked Can on spindle #1 to the QC blow-off shift offset and enter this as the new offset number.

8) Continue to adjust the offset number until a Can marked on spindle #1 is blown off.