

## **Bus Master Controller Firmware Release 1.3, dated 21 February 1997**

### **Administration Update Manual**

#### **Introduction**

This is a major release of the Bus Master firmware. It provides major corrections and improvements from Initial Production Release 0.02, dated 28 Nov 1995; since no documentation has been released since that Initial Production Release, this document describes two releases: Interrim Release 1.2, 5 November 1996, which saw only limited distribution; and Release 1.3, 21 February 1997, which is the major, and current, release. There were other versions, but none of those were released to the public.

Interrim Release 1.2, 5 November 1996 gave two improvements you can see: 1) we made the press speed display a declining average, to smoothen the display. Also, the speed display is accurate on all Press Models. (But, press speed still displayed only in 3 digits); and 2) we changed the Linear Footage display to print accurately to 2,000,000,000 feet in 6 figures.

We also did a massive “state machine” clean-up to the internal programming, i.e. we ripped the guts out of the whole routine which signals the “Splice throw-off” to the print stations, because, frankly, the old routine just wasn’t very good.

You’ll find major changes in the current release, Release 1.3, 21 February 1997:

We further improved the “Splice throw-off” signalling routine on machine start and stop.

We expandend the number of Press Speed digits from three to four.

We put in programming to make the splice detection "insensitive" when the press is "stopped", except when there truly is a splice.

We Implemented five operator keys, so that you (the operator) can Cancel a splice in the machine, reset the display, Select displaying the linear Footage or the remaining Splice linear Footage, and Set Machine Model Number.

We put "splice in the press" indicators on the display.

## **Description of Specific Changes on the display:**

When we first released the bus master, its purpose was confined to signalling the Station Controllers whether and where a web splice might be in the Press, and to sending the Host computer the web travel speed and linear footage count. However, each Mark series Press that had a bus master also provided the bus master with a display; taking advantage of that, we rough programmed the Press speed on the first line, and a linear footage count (in five digits) on the second. However, we didn't use the keyboard at all, and most Mark series Presses were shipped without keyboards.

However, there were problems.

1. The Press speed was accurate only for the 16.5 inch repeat presses, and would, for example, read 4% low on the 27.5 inch repeat presses. Also, the speed number was not "well stabilized." It would follow the small, rapid speed changes that a press is always making too well, rendering it hard to read. As an annoyance, the speed display would show speeds greater than 999fmp without the leading 1000's digit.
2. The linear footage count would not display past 65,535 feet; at that footage it would seem to reset its count to zero before resuming the count. This odd behavior is a natural consequence of the "rough and

ready” displaying of 16 bit binary counters and has no affect on the actual count accuracy, but is likely to befuddle any person.

3. We needed to tell you (the Press operator) what the bus master is seeing and doing, primarily whether there is a splice in the press, and where the last splice in the Press is.

Release 1.2 and 1.3 addressed the problems with displaying the speed and linear footage. We added one digit to the speed, shifting the number one place to the right on the display, addressed the “jumpy” speed display using the declining averaging technique, and fixed the accuracy problem. For the linear footage, we now use the whole second line (six digits) for it; when the display reaches 999,999 feet, it will “wrap” to zero and repeat. It will do this over and over again, until it reaches a limit of some 2,147,500,000 feet --- which will take, at a continuous 1000fpm, 4.08 years to reach. (We think you will power down before then).

Release 1.3 dedicates the last (sixth -- far right hand side) character position on the first line to display splice symbols:

1. If there is no splice in the Press, the character position will be blank (empty).
2. If there is a single splice, then the display will show single "Corner Brackets", alternating about three times a second.
3. If there is more than one splice, then the display will show the "hard" 3-dashes over each other, the middle dash flashing about 1.5 times a second.

And as to where the last splice in the Press is, we added a “count down” splice remaining linear footage (see below for discussion), in minus sign and three digits. When you invoke seeing it, it replaces the linear footage, occupying the first four digits on the second line.

## Description of Keyboard Changes:

As noted, the original Bus Master release didn't "see" the keyboard at all. Beginning with Firmware Release 1.3 21 February 1997, however, it started to use the keyboard, which looks initially like this:

Ct11		Ct12	MODL
	CANCEL		
SerFoot	SplFoot		

Figure 1: The 1.3 keyboard.

We set up these keys to address these problems:

1. On rare occasions, the bus master display will "get funny", or go blank, so we needed some way for you (the operator) to reset the bus master display from the keyboard without resetting the bus master itself. (Re-powering the controller has been a popular option, but then the bus master loses track of what it was doing.)
2. Occasionally the bus master will get a false splice detected signal, so we needed a way for you (the operator) to cancel the bus master's notion that there is (are) a splice(s) in the machine.

3. You (the operator) would like to know where in the machine the bus master thinks the splice is. (Perhaps you want to go in search of???) So, we needed a way for you to select between displaying the linear Footage or the remaining Splice linear Footage.
4. Since these bus master controllers are used on a number of different COMCO Press models, we needed a way to set up the Press Model Number from the keyboard. Previously, the Press Model Number was programmed before the controller was shipped. This tended to logistical nightmare.

These are the key arrangements we made to address those problems:

The CANCEL key (formal name: Abandon Current Operation -- and sometimes called BANG key, because its symbol is “!” on the Station Controller Keyboard):

<i>Ctl1</i>		<i>Ctl2</i>	<i>MODL</i>
	<b>CANCEL</b>		
<i>SerFoot</i>	<i>SplFoot</i>		

Figure 2: The CANCEL key.

Push The CANCEL key to reset the Display, and whatever other

(keyboard) operation was going on. (Currently, the only keyboard operation to cancel is setting the Press Model Type).

Use the following two button combination to cancel the bus master's notion that there is (are) a splice(s) in the machine:

<b>Ctl1</b>		<i>Ctl2</i>	<i>MODL</i>
	<b>CANCEL</b>		
<i>SerFoot</i>	<i>SplFoot</i>		

Figure 3: The Splice CANCEL combo.

Since the bus master can “track” only one splice in the Press at a time, there are three modes of splice: 1)no splice in the Press, 2)one and only one splice somewhere in the Press, and 3)two or more splices in the Press. Naturally, if there is no splice in the Press, (and the Press is moving), then the Bus Master signals the Station Controllers that the “Press is Moving,” and that they should commence printing by pressing the Ink Rolls in contact with the Print Head, and the Print Head in contact with the paper.

If there is one and only one splice somewhere in the Press, then the Bus Master tracks that splice, informing all of the Print Stations of the

location of the splice. It does that by starting and maintaining a “pulse train” (one pulse = 6 inches) on the “press moving” Press Bus wire when the Splice Detector signals that a splice has entered the Press at the infeed end. It is then up to the individual Print Station controller to determine when the splice has arrived at its station, throw the head off, and return to print. When the splice has cleared the Press (at the expiration of a linear footage the Bus Master keeps), the Bus Master tells the Station controllers that all is well with splices.

If there are two or more splices in the Press, then the Bus Master tracks only the last splice detected (i.e. the one closest to the infeed end of the Press), and signals all of the Print Station Print Heads to flee to the non-printing “THROW-OFF” position until the last splice has cleared the Press. We do it this way because: 1)it’s not physically possible for the Bus Master to track more than a small number of splices (and one is a number we like), and 2)it’s not possible to tell the Station Controllers the positions of more than one simultaneous splice. When the last splice clears the press, the Bus Master signals the Station Controllers to resume print.

Now, pressing this button combination will: 1)do nothing, if there is no splice in the press; 2)cancel all notion of a splice in the Press if there is one and only one splice somewhere in the Press; or 3)make the Bus Master think that there is one and only one splice in the Press (it will be the last splice detected) if there are two or more splices in the Press. As you do these presses, the splice display symbols will reflect these changes, changing from the single splice symbol to no symbol, and from the double splice symbol to the single splice symbol.

Notice that you must press the cancel buttons twice to completely clear the “two or more” splice condition to no splice. It seemed best to do it this way, to allow you maximum flexibility. However, there is a problem. It is true that the Bus Master tracks the last splice into the Press.

But the Station Controllers don't, and can't know this, and presume to track the first splice in the series. So if the first splice is a "real" splice, and the following splice(s) are mistakes, then you can press the button combo once, and the Station Controllers should do a proper throw-off. On the other hand, if the splice detector first triggered by mistake, and there are real splices in the Press, you'd best not cancel any splices. If, of course, all the splice detects are phantoms, then you can cancel all of the splices.

Push one of the following buttons to select the linear footage you want to see on the second line of the display:

<i>Ctl1</i>		<i>Ctl2</i>	<i>MODL</i>
	<i>CANCEL</i>		
<b>SerFoot</b>	<b>SplFoot</b>		

Figure 4: The Footage Select keys.

The **SerFoot** button selects displaying the plain, old linear footage that the Press has travelled since the last time the Bus Master was powered up. Pushing the **SplFoot** button causes the Bus Master's notion of how many feet of web remain in the Press before all splices clear the Press. In either case nothing else happens, just a change in the display.



When you press the SplFoot button, you will notice that the display reads as a negative number. This is because, normally, the Bus Master is physically mounted at or near the outfeed end of the Press, and the value of “feet of web remaining in the Press” is the web distance from the Bus Master itself to the splice, which, being backwards, is negative. When, as is usually the case, there is no splice in the Press, this display will read zero.

So, to find the splice, count the web distance back from the Bus Master’s position.

You (the operator) would like to know where in the machine the bus master thinks the splice is. (Perhaps you want to go in search of???) So, we needed a way for you to select between displaying the linear Footage or the remaining Splice linear Footage.

Use the following two button combination to program the Press Model Number into the Bus Master:

<i>Ctl1</i>		<b>Ct12</b>	<b>MODL</b>
	<i>CANCEL</i>		
<i>SerFoot</i>	<i>SplFoot</i>		

Figure 5: The Set Press Model combo.

This key combination sets the Bus Master's basic operating parameters, and requires the use of the Operator Wheel, and **UNLESS IT IS WRONG, OR A NEW CONTROLLER, YOU DON'T EVER WANT TO MESS WITH IT.** At most, you will want to check it. See step 4 below.

However --- having said that and throwing caution to the winds --- if you have to, this is the way you do it:

1. Press the button combination. A decimal number representing the current COMCO Press Model will appear.
2. Change the COMCO Press Model number to the correct one as listed below using the Operator Wheel. Not to worry, only valid numbers will be displayed or used.
3. Press the same button combination again to set the Press Model number. The Bus Master will save the number into Read Mostly Memory, and remember its proper Model Number forever, and the display will revert to its normal configuration.
4. Now, if you're fussy, (I am -- actually a bit paranoid), you can use check the same key combination to check that the Press Model number is correct. Press the CANCEL (BANG) key to cancel re-programming the Press Model number and make the display return to its normal configuration when you've verified the Press Model is correct.

This is the Press Model Table:

1 === All Commander Series Presses.

4 === All Mark Series Presses with a 16.5 inch Basic Repeat.

5 === All Mark Series Presses with a 27.5 inch Basic Repeat.

## **Additional changes you should be aware of**

In Release 1.3 we put in programming to make the splice detection "insensitive" when the press is "stopped", except when there truly is a splice. (The press might be so slowly moving over a splice that we think that press is stopped.) To do this, we measure the splice by means of the encoder. If the splice detect is on continuously for 1-1/2 inches, then we say it's a splice.

However, there is a problem: if the Press rocks "backwards" at stop, then the Linear Footage counting routine goes "crazy," thinking that the Press is moving forward very fast indeed. So we Modified the linear footage counting routine to count backwards under these conditions. Also we modified the LF display routine to move with the LF Counting routine. Please watch to see that this is all accurate.

The speed display didn't seem to be smooth enough, so in Release 1.3 we radically damped the declining average pool. You may see the displayed press speed "lag" the actual press speed, particularly when the Press comes to a stop. We may need to fiddle with this a bit. Also, changed to display the speed in four digits, so we can see speeds exceeding 1000 feet per minute.

## **Additional changes you shouldn't be aware of**

We took out an unused counter (MSDebnc).

We made SetOpMds (set up operating modes) interrupt-protected.

We hanged the OTIMR (Our timer routine) encoder direction discriminator, to wait 256 10-ms time periods before changing the direction. However, we may want to base this on web distance, instead of time.

Put in programming to force a short Press Run de-assert to the Station Controllers under certain conditions.

Imported and used the improved stepdem key-in debounce routine. Now a bad key sense is treated as a no-key, instead of looking like ALL of the keyboard keys are pressed simultaneously.

## Program Change Comments

(As they appear in the program -- not for the faint-hearted)

MLR 050000November96 -- mlr -- v 1.2:

1. Massive state machine clean-up. Ripped the guts out of the whole bottom loop from just after the splice signal detect in, to the bottom of the loop.
2. Addition of ECnts27ms to more accurately make press speed on all models of Press. ECnts27ms is a declining average, to smoothen the display.
3. Changed the Linear Footage display to print accurately to 2gig feet in 6 figures.

MLR 210000February97 -- mlr -- v 1.3:

1. Took out MSDebnc, Machine Start Debounce counter.
2. Made SetOpMds (set up operating modes) interrupt-protected.
3. Changed the OTIMR (Our timer routine) encoder direction discriminator, to wait 256 10-ms time periods before changing the direction.
4. Put in programming to force a short Press Run de-assert under certain conditions. Two new flags added, WbSplSg and WbSplSgD  
Web Splice To Signal

-- need a short Press Run de-assert, and  
-- need a short Press Run de-assert, but deferred,  
respectively.

5. Put in programming to make the splice detection "insensitive" when the press is "stopped", except when there truly is a splice. (The press might be so slowly moving over a splice that we think that press is stopped.) To do this, we measure the splice by means of the encoder. If the splice detect is on continuously for 1-1/2 inches, then we say it's a splice.
6. Problem: if the Press rocks "backwards" at stop, then the Linear Footage counting routine goes "crazy," thinking that the Press is moving forward very fast indeed. So I Modified the linear footage counting routine to count backwards under these conditions. Also modified the LF display routine to move with the LF Counting routine.
7. The speed display didn't seem to be smooth enough, so I changed the declining number of encoder counts in 27.5ms so that each new value of encoder counts in 10ms only contributes 1/11 to the declining average. Also, changed to display the speed in four digits, so we can see speeds exceeding 1000 feet per minute.
8. We needed to know if there's a splice in the machine: So, I changed the program so that if there's a single splice, then display single "Corner Brackets", alternating with time. If there is more than one splice, then display the "hard" 3-dashes over each other.
9. Imported and used the improved stepdem key-in debounce routine. Now a bad key sense is treated as a no-key, instead of an ffff key (failed debounce looks like ALL of the keyboard keys are pressed simultaneously.)
10. Implemented five operator keys:

KyCanSp to Cancel a splice,  
KyESC to ESCAPE (abandon current operation),  
KyBgLF to Select BIG LF linear Footage,  
KySpLF to Select Splice linear Footage, and  
KySet\_M to Set Machine Model Number.

11. Implemented the two select buttons so that the operator can display either the serial LF, or the Splice Linear Footage, which is normally the distance (negative) from the bus\_mstr to the splice.
12. Implemented Set Special Op Key for Set Machine Model Number, so that the operator can set up a new press model from the keyboard: we no longer have to program the model number here.
13. Implemented splice cancel. Press KyCanSp, and either single splice in Press or double splice in Press is cancelled. Hit it again, and remaining splice is cancelled.
14. Implemented Cancel. Press KyCan, and (for now, solely,) the display is re-initialized.

## Revision History

New -- no history

## Future Enhancements

The following notions are under serious consideration, or are maybe's, or are pipe-dreams. You are invited to comment on them, expand or expound on them, or to add to the list. (This list was compiled before Release 1.3, so you'll find some things already done).

### Keyboard Stuff:

1. Reset (or Escape, Reset Display). (Done in Release 1.3).
2. Set Machine Model. (Done in Release 1.3).
3. Set Learn Mode (No longer have an external switch: pressing this key will assert the Learn Line, and keep it asserted, until the operator returns to the Bus Master keyboard, and hits (any?) key, setting the presslength of web value automatically.
4. Set and/or adjust the presslength of web value manually.
5. Reset the Splice in Machine condition. (Done in Release 1.3).
6. Set Simulate a Splice Detected. Useful for testing, for manual set-up in learn mode, or to substitute for a missing or broken splice detector.
7. Disable Splice Detection; Thro-off and press stop work normally.
8. Disable all Bus Master Throw-off processing: the Bus Master passes the Press Run Signal on to the Station Controllers exactly as it receives it.
9. Set the Double Splice in machine condition: All stations immediately go to throw-off and remain there until presslength of web has moved though the press.
10. Reset the Double Splice in machine condition. (Should it be the same key sequence as Reset the Splice in Machine condition? Double or multiple key presses until all Splices are cleared?) (Done in Release 1.3).
11. Set emergency throw-off: All stations immediately go to throw-off and remain there until reset.

12. Disable Press Run: This is somewhat the same as Set emergency throw-off: if the press were running, all stations would immediately go to throw-off, and six seconds later, switch over from the press driving the analog rolls to the motors; no good. So the Bus Master would first check to see if the Press Run Sig from the PLC is negated; if so, block asserting Press Run and remain there until reset. Otherwise, the Bus Master will function normally(?) until the press halts; then it will block Press Run, and remain there until reset.
13. Keep several Linear Footage Counters. Amongst them:
- (a) A serialized Linear Footage Counter that can't be set or reset. (Existing).
  - (b) A serialized Linear Footage Counter that the operator can't set or reset, but is reset on each outfeed roll turn-up.
  - (c) A serialized Linear Footage Counter that the operator can't set or reset, but is reset on the start of each infeed roll.
  - (d) Using a technique similar to the "learn" distance, we can measure the distance from the infeed roll to the outfeed roll. Therefore, we can calculate where the infeed splice is in the outfeed roll, and also keep some sort of Linear Footage Counter(s) based on the infeed.
  - (e) Some number of Linear Footage Counters that the operator has control of: set to some value, reset to zero, make run backwards, count in meters, or some conversion factor to pounds or kg, etc, etc.
14. Reset a Linear Footage Counter value to zero.
15. Set a Linear Footage Counter to some value.



16. Change the units of display to, e.g. English, Metric, etc.
17. Do we have to have the Repeat Length? If so, set the Repeat Length.
18. Set Force Phasing.
19. Set Show Splice Linear Footage as a count-up progression through the press to presslength of web, or
20. Set Show Splice Linear Footage as a count-down from presslength of web to zero, (Done in Release 1.3), or
21. Set Show Splice in the press as a symbol only.

Add following to display:

1. Splice in press symbol. (Done in Release 1.3).
2. Double Splice in press symbol. (Done in Release 1.3).
3. "In Learn Mode" symbol, count up to presslength of web value.
4. "Press Stopping" Flashing symbol.
5. Press Run input signal symbol.