CBPC-3590
Clutch-Brake Positioning Controller

P-291-1
819-0526

Service & Installation Instructions

Warner Electric

An Altra Industrial Motion Company

Contents

⚠ WARNING **Failure to follow these instructions may result in product damage, equipment damage, and serious or fatal injury to personnel.**

⚠ WARNING **Only Authorized Personnel to set up and maintain this unit.**

Introduction

The CBPC-3590 Clutch Brake Positioning Control is a dedicated control incorporating a counter system, control logic, and clutch brake power supply for closed loop control operation. The controller uses an incremental encoder input with marker pulse to register position for single revolution operation.

The one board design eliminates interconnection between numerous boards and controls and improves reliability by removing unnecessary interconnecting cables. With everything located on one board, replacement of the control board is simplified.

An external start input signal is used to provide the start input to the controller which applies power to the clutch. The encoder registers the position to the controller and when the preset count is reached turns power on to the brake. An internal averaging circuit takes the actual stop position from the required stop position and compensates so the controller provides the stop

at the precise position. In this method, compensation is maintained in the stop position from cycle to cycle.

The control has front panel indicators to tell when the clutch is on, brake is on, a fault has occurred and a home pulse indicator. In addition, a front panel run-jog switch allows the user to operate the control in normal running mode or in jog mode for set up and troubleshooting purposes. When in the jog mode, the jog push-button allows the clutch to be activated at a preset level below the maximum set output level. The clutch will be engaged as long as the push-button is held in and brake is actuated as soon as it is released.

This control will directly replace the older style CBC1500-AHFC controller. Connectors are provided on the housing of the control for hook-up to existing cables where the CBC1500-AHFC is used. If existing cables are non-existent, optional cable accessories are available.

Set up has been simplified to minimize the number of steps necessary to commission the unit. All functions are accessed internally in the controller via the keypad and display. Once the unit is set up and closed, the operator does not have access to any of the functions without going into the controller. Remote indicators on the faceplate show the status of the controller.

Theory of Operation

The CBPC-3590 operation is simple and straight forward. The unit is typically setting with the brake output engaged. A "start input" signal is received by the control from the external signal source. The controller disengages the brake and applies power to the clutch. The output level to the clutch is adjustable via the programming mode to obtain the proper engagement of the clutch. With the clutch engaged, the drive mechanism starts to rotate generating a signal to the controller from the encoder. The controller counts the encoder pulses and the display (internal) counts in an up direction. If the count is in the reverse direction,

then the encoder signals "A" and "B" are improperly connected and need to be reversed for correct operation. Additionally a marker pulse is generated by the encoder to the controller which looks at this pulse and internally in the processor matches the system count with the encoder count. When the system count is equal to the preset count (600 minus the braking distance) a brake output signal is generated and the controller applies the brake. Brake torque is adjustable to obtain optimum stop conditions.

The controller internally compares the actual stop point with the desired stop point based on the preset distance, the braking distance, and any over or undershoot that might occur. This braking distance is averaged on a continuous basis to provide a stopping point as close to the preset point as possible.

The controller also can handle multiple start signal inputs so that the controller can make numerous moves and yet still return to the correct stop point. This is accomplished through the integrated control logic of the processor on the board.

A batch counter is also incorporated into the controller to keep track of the number of operation cycles the unit operates. This can be useful in both troubleshooting as well as scheduling preventative maintenance on the machine.

During normal operation if any one of a number of faults would occur; the controller will provide a visual indication via the front panel "LED" marked fault as well as tripping an internal relay which can be wired to external alarms or sensors for detection purposes. Additionally, the display will provide a reference as to which fault possibly occurred.

Specifications

Input Power: 120 VAC, +/- 10%, 50-60 Hz, Single Phase, 300 VA maximum

Fusing: 1.6 Amp, 250 V fast acting (5x20mm)

Output: Adjustable 0 – 90 VDC pulse width modulated full wave rectified DC via keypad. 1 Amp per channel maximum

Output Frequency: Adjustable from 60 to 400 Hz via keypad

Start Input: 120 VAC, 50-60Hz signal. Minimum on time of 0.02 seconds (20 milliseconds), maximum on time 0.100 seconds (100 milliseconds)

Front Panel Switches

Power: On-Off power switch with internal indicator

Run-Jog: Allows for operation of the control in normal run or in jog mode for set-up and troubleshooting

Jog Push-button: Allows for jogging when switch is depressed. When released, brake is re-engaged. Active only when Run-Jog switch is in Jog mode.

Front Panel Indicators

Power on: Integral to Power On-Off Switch
Clutch on: Green LED
Brake on: Red LED
Home Marker: Yellow LED
Fault: Red LED

Enclosure Connectors

5 Pin Brad Harrison for encoder connections:

Mating connector for wiring to encoder cable: Brad Harrison # 1A5000-34 screw terminal connections

9 Pin Brad Harrison for clutch, brake, power and switching.

Mating connector for wiring to power, load, and switching circuits:
Brad Harrison
309002A01F030 with 3 foot pigtails
309002A01F060 with 6 foot pigtails
309002A01F120 with 12 foot pigtails

Certifications

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Internal Connections and Functions

Internal Wiring Connections: via plug on Molex type terminal blocks

Internal Switches: SW1: Set-up/Normal switch used for initial set up and calibration of control

Keypad functions: 0 through 9 numeral inputs when in programming mode

Start and Stop functions:

Note: Start key also functions as the home set up key in set-up mode.

Up, Down and right arrow keys for scrolling and selecting data

Edit Key: Run/PGM Key for entering set up modes

Reset/Clear Key: For resetting variables or clearing data in programming mode

Fault Relay: In the event of a fault, relay contacts via terminal strip for external customer connections.

Contacts: Rated at 1 Amp, 120 VAC resistive load

Fault Conditions: Low voltage, feedback too fast, process time fully utilized

Clutch-Brake Output Level: Programmable via display and keypad

Output Frequency: Programmable via display and keypad

Communications: RS-485 communications port via terminal strip

Optional OEX function card: An optional OEX function card can be added for special applications that require reduced build-up times of the clutch or brake magnets.

Input/Outputs: Additional programmable inputs and outputs available but not active for other specific functions and typically are not used when this controller is used for replacing the CBC1500-AHFC or being used in pusher type applications. Consult factory for further information.

Control Part Number: 6051-448-002 CBPC-3590 Control

Encoder Part Number: 6060-101-061 Encoder, 600 PPR with marker pulse and cable

Installation

Replacing CBC1500-AHFC Control with CBPC-3590 Control

❏ 1. Insure that power is turned off and disconnected to the CBC1500-AHFC control.

❏ 2. Disconnect both the encoder cable connector and the main power/clutch-brake wire connector from the plugs on the controller.

❏ 3. Remove the 4 bolts or nuts fastening the controller to the isolation mounts on the machine frame.

❏ 4. Remove the controller and set aside.

❏ 5. Install the CBPC-3590 controller on the isolation mounts and reattach with either the bolts or nuts depending on what was originally used. Make sure bolts or nuts are securely tightened.

❏ 6. Reconnect the power/clutch-brake wiring connector to the large plug on the CBPC-3590 control and tighten snugly.

❏ 7. Reconnect the encoder cable connector to the small plug on the CBPC-3590 control and tighten snugly.

❏ 8. Insure everything is connected properly and the control is secured properly to the machine frame.

❏ 9. This completes the replacement of the control. Proceed to the Start-Up Section on page 9 for set up and programming.

First Time New Installation of CBPC-3590 Control

Refer to the dimensional diagram, Figure 1 for actual mounting dimensions.

❏ 1. Select the location where the control will be mounted. Insure that mounting will not interfere with anything else and that wiring access will not be impeded.

❏ 2. Using the dimensional information from the diagram below, drill 4 mounting holes to accept ¼-20 studs from the vibration mounts for attaching the controller to the machine frame.

❏ 3. Depending on the type of vibration isolator mounts used, male to male or male to female, attach one end of the mount to the machine frame at all 4 points.
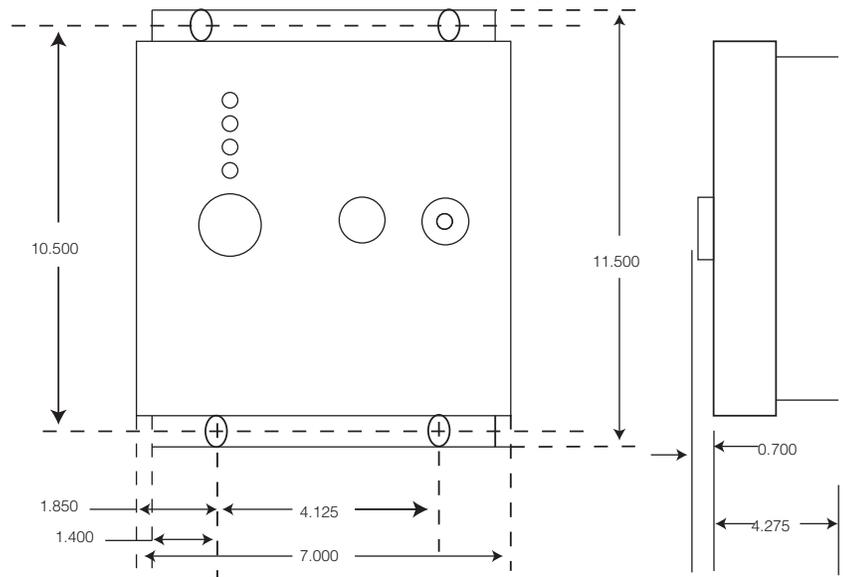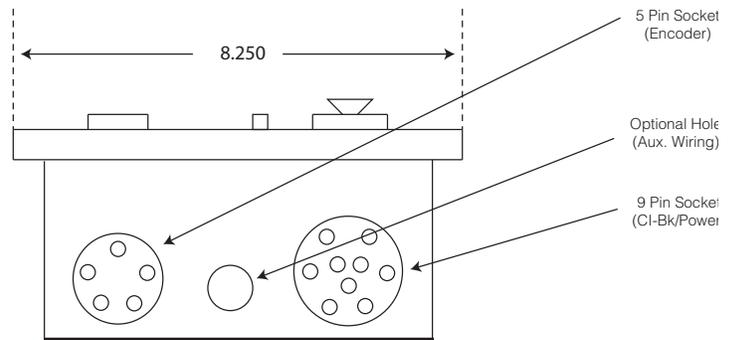
❏ 4. Mount and attach the CBPC-3590 controller to the other side of the vibration isolator mount. Insure that control and mounts are fastened securely at both the control and the machine frame.

❏ 5. With the control mounted, route the wiring cables such that they can be easily attached to the external connectors on the control. Insure sufficient length so that undue stress is not placed on either the connectors or the cables to the control.

Note: For new installations where no wiring previously exists, see the connector wiring diagram, Figure 4 for pin/function descriptions.
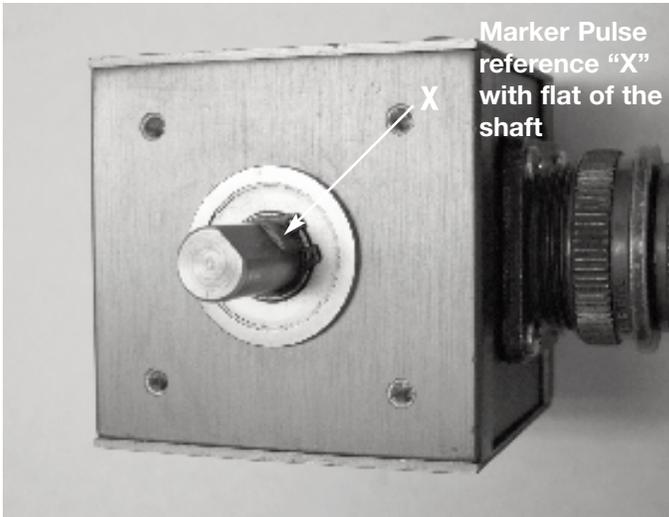

Figure 1
Dimensional Diagram

Encoder Mounting & Installation

Normally, if the CBPC-3590 is replacing an existing CBC1500-AHFC control, the encoder has already been installed and set-up correctly.

For new installations follow the procedure below referring to figures 2 and 3 for correct encoder mounting and positioning.

❑ 1. Taking the encoder, position the flat on the shaft to the position shown in Figure 2 below.

Marker Pulse reference "X" with flat of the shaft

Figure 2
Encoder Marker Pulse Position Reference

❑ 2. Position the paddles on the pusher parallel to the length of the pusher. This will be the position the paddles are in when the pusher is static or not rotating.

❑ 3. Determine if the pusher operates in a clockwise (CW) or counter-clockwise (CCW) direction when operating.

❑ 4. Mount the encoder with the bracket into the pusher shaft keeping the shaft aligned in the position as shown or as close as possible using figures 3A or 3B for positioning the marker pulse within the desired range.

❑ 5. Double check mounting and insure encoder is fastened properly.

❑ 6. Connect encoder cable and tighten connector securely.

❑ 7. This completes encoder mounting for new application.

Note: Properly mounting the encoder in this method insures the marker pulse will occur in the 50 to 450 pulse count range consistently. This is mandatory for proper control operation.
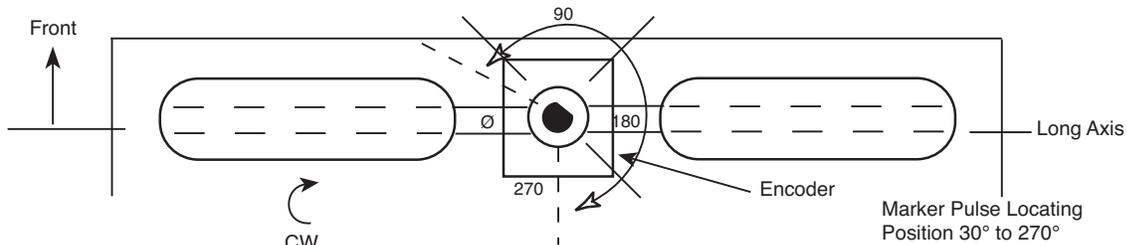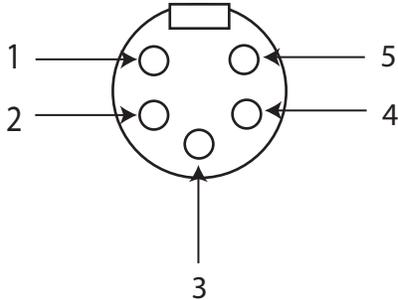

Figure 3a
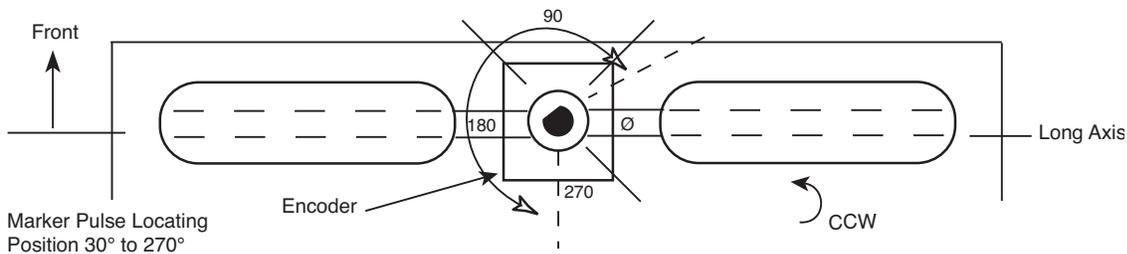
Figure 3b

System Wiring

### Figure 4 - Connector Pinouts and Designations

Encoder Connector (5 Pin)   **Inside Wire Colors**

Pin 1 – Encoder Signal "A"   White
Pin 2 – Encoder +12 VDC Power   Red
Pin 3 – Encoder Signal "Z" - Ref   Green
Pin 4 – Encoder Signal "B"   Orange
Pin 5 – Encoder DC Common   Black

Power/Clutch-Brake Connector (9 Pin)   **Inside Wire Colors**

Pin 1 – AC Start Signal (Hot 120 VAC)   Orange/Black
Pin 2 – Channel 1 output (-) Brake   Blue
Pin 3 – Channel 2 output (-) Clutch   Red/Black
Pin 4 – Channel 2 output (+) Clutch   Green/Black
Pin 5 – AC Power 120 VAC neutral line   White
Pin 6 – AC Power 120 VAC hot line   Red
Pin 7 – AC Earth Ground   Green/Yellow
Pin 8 – Channel 1 output (+) Clutch   White/Black
Pin 9 – AC Start Signal (Neutral 120 VAC)   Green/Black

Mating connector accessory are called out in the specification section, Pages 3 and 4.
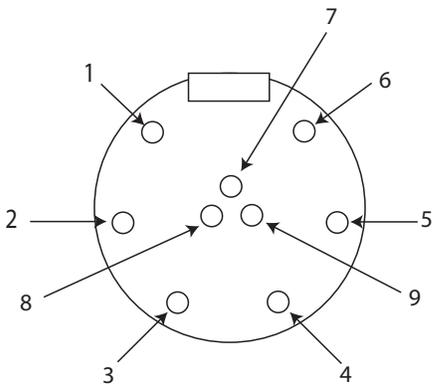
Wiring the Warner Electric encoder (6060-101-061) and cable to the connector

❑ 1. Route the encoder cable to avoid strains, kinking and interference with mechanical components.

❑ 2. Once cable has been routed and excess length remains, cut the excess length off but allow sufficient length for connection to control. Strip the outer jacket to the appropriate length for insertion of the wires into the connector assembly.

❑ 3. Open the connector by removing the strain relief nut and removing the rubber bushing inside the housing. Snap the two halves of the housing apart and separate from the header connector.

❑ 4. Thread the encoder cable through the strain relief nut and the rubber bushing pulling enough cable through to strip and work on the header and cable.

❑ a. Strip the cable jacket approximately ¾" from the end of the wires.

❑ b. Strip the red lead (+12 VDC) approximately ¼" and fasten to terminal 2 of the connector and fasten securely.

❑ c. Strip the black lead (DC Com) approximately ¼" and fasten to terminal 5 of the connector and fasten securely.

❑ d. Strip the orange lead (Signal A) approximately ¼" and fasten to terminal 1 of the connector and fasten securely.

❑ e. Strip the brown lead (Signal B) approximately ¼" and fasten to terminal 4 of the connector and fasten securely.

❑ f. Strip the green lead (Signal Z ref) approximately ¼" and fasten to terminal 3 of the connector and fasten securely.

Note: This wiring is for clockwise (CW) operation. If during start up, the counter operates in the reverse direction (that is, counter counts down instead of up) or counter-clockwise (CCW) operation is required, reverse the connections on terminals 1 and 4 on external encoder connector plug.

❏ 5. Reassemble the connector assembly by snapping the two halves together over the header connector. Slide the rubber bushing up into the housing assembly and then thread the strain relief grip onto the assembly snugly. The outer jacket of the encoder cable should be held by the strain relief grip.

❏ 6. This completes the wiring of the encoder cable to the connector assembly using the Warner encoder. If other than a Warner Electric encoder is used, proceed to the next section for wiring a different encoder.

Wiring other than the Warner Electric encoder and cable assembly to the connector.

❏ 1. Route the encoder cable to avoid strains, kinking and interference with mechanical components.

❏ 2. Once cable has been routed and excess length remains, cut the excess length off. Allow sufficient length for connection to control.

Strip the outer jacket to the appropriate length (¾" typically) for insertion of the wires into the connector.

❏ 3. Open the connector by removing the strain relief nut and removing the rubber bushing inside the housing. Snap the two halves of the housing apart and separate from the header connector.

❏ a. Determine which lead on the encoder cable is the +12 VDC power and strip the lead approximately ¼" and attach to terminal 2 of the connector and tighten securely.

❏ b. Determine which lead on the encoder cable is the DC common and strip the lead approximately ¼" and attach to terminal 5 of the connector and tighten securely.

❏ c. Determine which lead on the encoder cable is the Signal A and strip the lead approximately ¼" and attach to terminal 1 of the connector and tighten securely.

❏ d. Determine which lead on the encoder cable is the Signal B and strip the lead approximately ¼" and attach to terminal 4 of the connector and tighten securely.

❏ e. Determine which lead on the encoder cable is the Signal Z ref and strip the lead approximately ¼" and attach to terminal 3 of the connector and tighten securely.

Note: This wiring is for clockwise (CW) operation. If during start up, the counter operates in the reverse direction (that is, counter counts down instead of up) or counter-clockwise (CCW) operation is required, reverse the connections on terminals 1 and 4.

❏ 4. Reassemble the connector assembly by snapping the two halves together over the header connector. Slide the rubber bushing up into the housing assembly and then thread the strain relief grip onto the assembly snugly. The outer jacket of the encoder cable should be held by the strain relief grip.

❏ 5. This completes the wiring of the encoder cable to the connector assembly.

Connecting the encoder cable and power/ switching/and clutch-brake cables to the controller.

❏ 1. Connect the encoder cable connector by locating the tab on the control male plug to the tab on the encoder female connector and insert and tighten securely. Do not force the female connector into the male connector as damage to the pins could occur if they are not properly aligned. This is what the locating tab is for and if connector tabs are properly aligned, they will slide together easily.

❏ 2. Determine if an interconnect cable with connectors on each end will be used or a cable with a connector on one end and pig tails on the other end will be used for the power/switching/and clutch-brake connections.

Note: If an intermediate switch disconnect panel is used then typically wiring is done inside the panel for interconnection of power, start signal, and clutch-brake wiring. This will typically have a connector for wiring to the controller.

❏ 3. Connect the interconnect cable connector by locating the tab on the control male plug to the tab on the cable female connector and insert and tighten securely. Do not force the female connector in the male connector as damage to the pins could occur if they are not properly aligned. This is what the locating tab is for and if connector tabs are properly aligned, they will slide together easily. Make sure the connector on the other end at the disconnect panel is connected and secured properly.

Auxiliary Relay Wiring for Fault Detection

The CBPC-3590 control was designed to provide certain fault indications as well as providing an interface to external control systems via an internal relay. The relay activates on power up and is designed to drop out in the event of a fault to alert the user.

To wire the relay to an external control circuit follow the steps below:

❏ 1. Remove the insert cover between the two cable connectors on the CBPC-3590 controller. Refer to Figure 1, page 5.

❏ 2. Using a 3/4" seal tight connector, insert into the conduit hold and securely tighten.

❏ 3. Wire the terminal block according to the requirements of the system for contact switching. The relay provides a common, normally open, and normally closed contacts

for switching external circuits. Remember with the control powered off, the normally open and normally closed contacts will be reversed once power is applied.

See Figure 6, page 10 for specific location of terminal block.

❏ a. Typically the common contact and the normally closed contact would be used to control an external alarm or switching circuit in the event of a fault condition.

❏ 4. This completes the wiring for the auxiliary relay if used.

The control is now ready for commissioning. Proceed to the Start-Up Section of the manual.

Start-Up

Start-up and calibration of this controller is much simpler than the previous CBC1500-AHFC controller in that most of the programming and calibration steps associated with the previous controller has been eliminated. Refer to Figure 5, page 10 for switch locations.

❏ 1. Turn power on to the system and the CBPC-3590 control. Push the power button on the front of the controller and the red indicator light on the power switch should illuminate. The controller should power up with the brake engaged and the front brake light LED illuminated.

❏ 2. Place the front panel run/jog switch in the jog position.

❏ 3. Push the front panel jog button until the pusher paddles are in the proper home position. This may require pushing the button and cycling the load through a complete cycle until the proper position is desired.

❏ 4. Once the paddles are in the desired home position, place the front panel run/jog switch in the run position.

Figure 5. Faceplate functions and Indicators
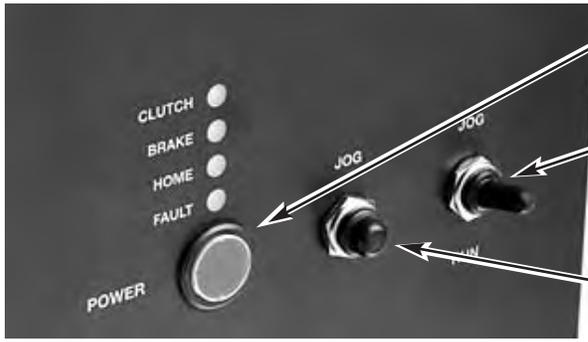
Power Switch
Push - "ON"
Push - OFF"
Step 1

Run/Jog Switch
Up - "JOG"
Down - "RUN"
Step 2
Step 4

Jog Pushbutton
Step 3

❑ 5. Open the controller front cover. This will give you access to the control board and the keypad/display portion of the controller.

Refer to Figure 6, below, for internal display/keypad and set up control functions.

Start Key
Step 8
Step 11

Reset/Clear Key
Step 6

Fault Relay
Terminal Block

Calibrate LED
On - "Calibrate"
Off - "Normal"

Normal/Set-up Switch
Up - "Set-up"
Down - "Normal"
Step 7
Step 9

Figure 6. Internal Set Up Switches/Indicators and Keypad/Display Layout

❑ 6. Press the reset/clear key on the keypad/display.

❑ 7. Move the normal/set-up switch to the set up position. The set up position is with the lever in the up position. In the set-up position the Set-Up LED will illuminate.

❑ 8. Press the start key on the keypad. The controller will make one or more complete cycles and stop.

Note: Once the calibration cycle has completed, the paddles can stop in any location, not necessarily the home position.

❑ 9. Move the normal/set-up switch, to the normal position.The "Normal" position is in the down mode. The "Calibrate LED" should go out at this time.

❑ 10. This completes the set-up and calibration procedure for the control.

❑ 11. After calibration is complete, press the start button on the display/keypad panel and the control should cycle each time the switch is pressed.

❑ 12. The display should be reading the count position on each cycle and the load should be returning to its home position each cycle.

❑ 13. Cycle the control about 5 to 6 times so that the braking distance average will average out correctly observing the stop point on the counter. Close and latch the control.

If the pusher does not stop in the correct home position after several start cycles, follow the instructions below to resolve the problem.

❑ a. Press the RUN/PGM key on the keypad

❑ b. Enter 1, 0, 0, 0, and then press the down arrow key once.

❑ c. The display should show "h" and some number value.

❑ d. Insure the value displayed is between 50 and 450.

❑ e. If the value is outside the above range, the encoder must be reset physically.

❑ f. Follow the procedure below to reset the encoder position.

⚠CAUTION   Pusher must be disabled and appropriate lock-out procedures followed to prevent accidental starts. Failure to do so could result in system damage, injury or even death.

❑ 1. Loosen the encoder bracket and rotate encoder at least 90 degrees.

❑ 2. Re-tighten encoder bracket securely.

❑ 3. Proceed to step 1 of the start-up procedure, page 9 to recalibrate the system.

Note: If in doubt about encoder positioning, refer to new encoder installation procedure, page 6.

This completes the installation and set-up of the CBPC-3590 control. Close and latch the control securely.

As the controller has been designed as an improved version of the CBC1500-AHFC with additional features and improved performance and reliability, programming of the various parameters should only be accomplished by qualified personnel.

To Enter the programming mode, follow the steps below:

Open the controller front cover for access to the keypad/display. Press the RUN PGM key on the keypad/display

    Display will show LOC. 0
    Then press 1, 0, 0, 0
    Display will show LOC. 1000

This has now placed you in the programming mode where various parameters can be changed by using the down arrow key to increment through the various parameters.

Programming Functions: Default Settings

Press	Display	Default Value	Function
↓	h xxx	--	Home Position
↓	bd. xx	--	Brake Distance, PPR
↓	bdAue. 3	3	Cycles Averaged
↓	cc. 0.5000	0.5000	Count Correction
↓	dP. oFF	oFF	Decimal Point
↓	FrSt. oN	oN	Front Panel Reset
↓	PLoc. oFF	oFF	Panel Lock
↓	CrEt. oFF	oFF	Count Retention
↓	ArSt. oN	oN	Auto Reset
↓	o1. 0.20	0.20	Start Signal, ms
↓	o2. 0.01	0.01	Early Warning, ms
↓	o3. 0.20	0.20	Stop Signal, ms
↓	o4. 0.10	0.10	Zero Speed, ms
↓	o5. 0.05	0.05	Zero Speed + delay 1, ms
↓	o6. 0.05	0.05	Zero Speed + delay 2, ms
↓	o8. LatCH	LatCH	Batch Auto Reset
↓	d1. 0.10	0.10	Delay 1, ms
↓	d2. 0.01	0.01	Delay 2, ms
↓	05P .25	.25	Zero Speed Window, sec
↓	5 -.-.-.-.-.-.	-.-.-.-.-.-.	Start Release
↓	L -.-.-.-.-.-.	-.-.-.-.-.-.	Move Preset Release
↓	E -.-.-.-.-.-.	-.-.-.-.-.-.	Early Warning Release
↓	r -.-.-.-.-.-.	-.-.-.-.-.-.	Reset Release
↓	bd. OFF	OFF	Baud Rate
↓	Par. None	None	Parity
↓	PFr. 80	80	**Output Frequency, Hz.**
↓	cPr. 90	90	**Clutch Output Percentage**
↓	bPr. 75	75	**Brake Output Percentage**
↓	JPr. 40	40	Jog Output Percentage
↓	cBt 15	15	Clutch Boost Percentage **
↓	bBt 40	40	Brake Boost Percentage **
↓	Id.no. xxx	xxx	Unit Number (Up to 3 digits)
↓	t0. rdy	rdy	Keyboard test
↓	t1. rdy	rdy	RAM test
↓	t2. rdy	rdy	Inputs test
↓	t3. rdy	rdy	Outputs test
↓	t4. rdy	rdy	Display test
↓	t5. rdy	rdy	Memory test
↓	t6. rdy	rdy	Date Code
↓	t7. rdy	rdy	Serial Test
↓	t8. rdy	rdy	Reset Default Program

** Only when the OEX add-on board is installed in the CBPC-3590 are these two functions active and operational for programming.

Pressing RUN PGM Key exits the programming mode and returns the display for normal count function.

RUN PGM   CNT | xxx |

Often problems encountered by the CBPC-3590 can be resolved by resetting the control or resetting the program to its default settings.

To reset the controlller:

❑ 1. Turn off power via the front panel power switch.

❑ 2. Wait 5 seconds or more.

❑ 3. Turn power back on to the control.

To reset the program to the original default values, follow the steps below.

❑ 1. Press the RUN PGM key
   Display will show LOC. 0

❑ 2. Enter 1,0,0,0
   Display will show LOC. 1000

❑ 3. Using the down ↓ key, scroll down until the display shows t8. rdy

❑ 4. Using the right → key, change the display to show t8. run

❑ 5. Press the RUN PGM key to exit the programming mode.
   Display will show CNT | xxx |

This completes the program reset function.

Note: After resetting program, control must be recalibrated.

RS-485 Hook Up and Programming

The CBPC-3590 Control was designed to accept an RS-485 serial interface connection for programming and data collection. Keypad and some external control inputs are supported. Additionally, facilities are provided for individual (local) and group (global) control of single and multiple unit configurations respectively. Knowledge of serial communications and the ASCII data format is required by the user who wishes to use the remote capabilities or to integrate the control into a larger system.

Two applications will be discussed. The first consists of a single CBPC-3590 and a display terminal. It explains the use of the serial commands that mimic the keypad operation and some control inputs. These are the LOCAL commands. Next, an application of multiple units under the control of a host computer will be discussed. The GLOBAL commands will also be discussed in this section.
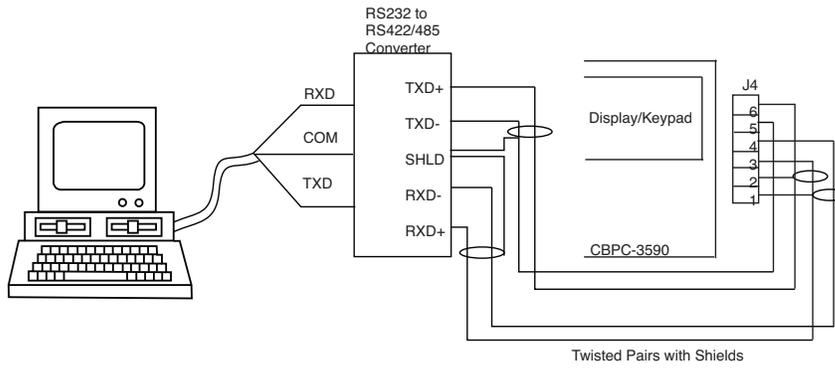
Figure 7a Single Unit Wiring

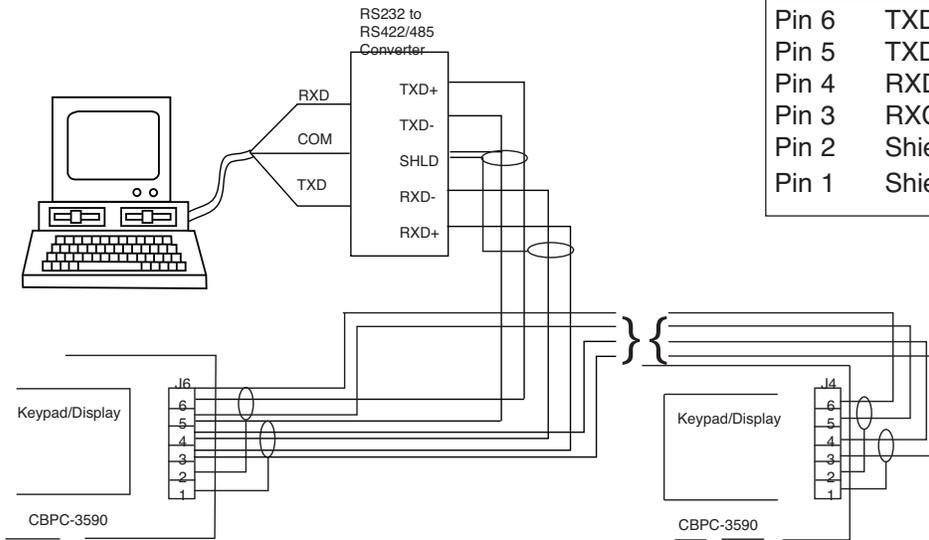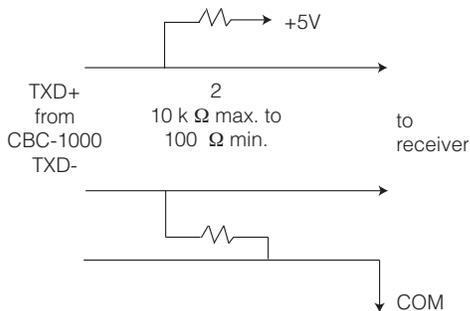| J4 Connections	
Pin 6	TXD+
Pin 5	TXD-
Pin 4	RXD-
Pin 3	RXC+
Pin 2	Shield to Chassis End
Pin 1	Shield to Chassis End

Figure 7b Multiple Unit Wiring

Termination

The RS-422A/485 receivers require termination to minimize the effects of noise while the bus is not being driven. The CBPC-3590 incorporates the terminations shown below internally. When connection is made to a RS-422/485 device other than the CBPC-3590, the receiver should be terminated as shown.

Cable Selection

The CBPC-3590 serial interface uses a simple interconnect scheme and low cost wiring making it superior to parallel data transfer schemes. Through two (2) wire shielded pairs, remote operation at distances up to 5,000 feet can be implemented. The following general guidelines should be observed.

1. Use # 24 AWG twisted pair, overall shielded cable.

2. Use a "daisy chained" connection scheme for bus systems.

3. If a "multidrop" system is used, keep the drop length at 10% of the main line.

4. Tie the cable shield to the Building Ground at the CBPC-3590 end of the cable.

Single Unit Operation

The operator can monitor the control locally via the keypad and display located inside the control housing. The serial interface extends these monitoring activities to a remote location. The connection of a remote display terminal is straightforward. The ID number of the control should be set to "0" (line 32 in the program table).

When power is applied to the CBPC-3590 control, it will start a continuous serial transmission of the count:

    CBPC-3590   R: CNT.   123456

when in the run mode.

The function keys (1,2,3,6,7, & 8) are used to scroll down through the eight RUN mode lines. For example:

terminal '1'	CBPC-3590	R:	CNT.	123456
terminal '2'	CBPC-3590	R:	Mov.Pst.	600
terminal '3'	CBPC-3590	R:	E.W.	50
terminal '6'	CBPC-3590	R:	BCH.	100
terminal '7'	CBPC-3590	R:	BCH.Pst.	0
terminal '8'	CBPC-3590	R:	Bd.	25

In the RUN mode, the numbers 1,2,3,6,7, & 8 cause new lines to be transmitted.

We have now seen how the CBPC-3590 control works for remote viewing; we will now see how programming may be done from a remote location.

You may program only one CBPC-3590 control at a time. If the unit is in the program mode via the keypad then it will not respond to the serial input. To enter the PROGRAM mode you must first send the RUN/PGM ("P") character. The control will "answer" by transmitting the LOC entry line as shown below:

terminal 'P'   CBPC-3590   R: LOC   0

The control remains active (in the RUN mode) until the proper LOC combination is entered. Each numeric entry is entered from right to left "calculator style". The character sequence 1-0-0-0 would produce the following display on the terminal:

terminal '1'	CBPC-3590	R:	LOC.	1
terminal '0'	CBPC-3590	R:	LOC.	10
terminal '0'	CBPC-3590	R:	LOC.	100
terminal '0'	CBPC-3590	R:	LOC.	1000

When this combination is correctly entered with the down cursor ('D' character), the control exits the RUN mode and enters the PROGRAM mode and returns with the following.

terminal 'D'   CBPC-3590   P: h.   ---

Note that the PROGRAM ('P') prompt is now shown. You are at the top of the PROGRAM table (line 1) as shown on page 11. Once the PROGRAM mode has been entered it is possible to program any line in the table. Refer to the COMMAND CHARACTER table for keypad equivalent serial characters. A programming example is shown below:

terminal 'C'	CBPC-3590	P:	Mov.Pst.	000
terminal '6'	CBPC-3590	P:	Mov.Pst.	6
terminal '0'	CBPC-3590	P:	Mov.Pst.	60
terminal '0'	CBPC-3590	P:	Mov.Pst.	600

The first serial entry ('C') clears the data field for the current line. As can be seen in the COMMAND CHARACTER table, this character mimics the RESET/CLEAR key. Numeric data entry is self-explanatory.

Multiple Unit Operation

For multiple unit systems (up to 999) a special addressing scheme is implemented in order that no conflicts arise on the serial bus. Each unit is given a unique address (ID number entered on line 32). Such a system application is shown on page 16. All units are programmed with the same baud rate and parity. It is advised that the initial ID number programming be done **before** the units are bussed together.

To control one CBPC-3590 in a bus oriented system the host must first address it by sending an ADDRESS COMMAND SEQUENCE. This is shown below:

host: (ESC) A nnn   (where nnn is the unit
                            number from 1 to 999)

This escape code sequence will suspend the transmission from all units including the one that is addressed. The addressed unit will respond to all subsequent commands while the other units just "listen" on their receive input and turn their transmit output off.

To receive data from an addressed unit the host sends it a command to resume transmission using the RESUME control character, (CTRL Q).

If you wish to suspend data transmission you may do so by using the SUSPEND control character, (CTRL S).

In some cases the host may want to send many commands to a CBPC-3590 control without waiting for responses. This may be done by first suspending transmission (CTRL S) then by requesting a single UPDATE.

host: (ESC) U

Setup Mode Operation

The SETUP mode may be entered directly from the RUN mode by cursoring to the desired SETUP lines (4 – 8) using the 'D' command character then sending the 'L' command character which mimics the KEY keypad key. This action will place the control in the SETUP mode allowing the user to change the data in lines 3 through 8 in the program table. Refer to page 11 for a complete operational description.

Preset setpoints are changed using the numeric, RST/CLR and DOWN cursor keys. The SETUP mode is exited by sending another 'L' command character at which time the controls reverts back to the RUN mode.

Remote Operation

Some of the unit's CONTROL inputs are effectively duplicated by serial commands, so it is possible to implement a single or multiple unit system with remote capability. Such a system can be used for multiple machines. Keep in mind the addressing requirements for multiple unit systems previously discussed.

Two types of commands are available, LOCAL and GLOBAL. LOCAL commands affect only the unit that is currently addressed. GLOBAL commands on the other hand affect all units regardless of address. In this way it is possible to command many units to begin control at the same point in time. The table below lists the LOCAL and GLOBAL commands that are supported.

Local and Global Commands

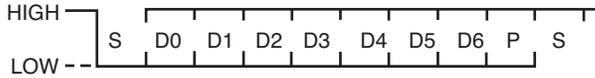| Control Commands	Local	Global	Comments
Control Output	(ESC) L0	(ESC) G0	Simulates Output Control Input
Batch Reset	(ESC) LB	(ESC) GB	Resets Batch to zero
Counter Reset	(ESC) LR	(ESC) GR	Resets Counter to zero

Formats and Protocol

Character Format
The serial interface sends and receives information by characters consisting of 10 bits. The RS422A/485 interface requires a 0.2 V minimum differential across the + and – terminals. A logic high (mark) is a positive differential and a logic low (space) is a negative differential.

Note: Connection to EIA-422/485 equipment that uses the opposite polarity requires swapping the + and – connections at the other equipment.

The character format is as follows:

Start bit ("low" logic level)
ASCII data (7 bits), least to most significant
Parity bit (programmable)
Stop bit ("high" logic level)

```
HIGH ─────┐   ┌───┬───┬───┬───┬───┬───┬───┬───┬───┐
          │   │ S │D0 │D1 │D2 │D3 │D4 │D5 │D6 │ P │ S │
LOW  ─ ─ ─┘   └───┴───┴───┴───┴───┴───┴───┴───┴───┘
```

Parity Bit
The parity bit is programmable as "Odd," "Even," or "No" parity. Odd and Even parity force the total number of data bits to be an even or odd for data that is transmitted by the CBPC-3590 control. Incoming parity is always compared to the calculated parity. Characters with parity errors are discarded. If No parity is selected incoming parity is ignored. Characters are transmitted with Odd or Even parity as selected on line 25 of the program table. If No parity is selected then "high" bit is added as an extra stop bit.
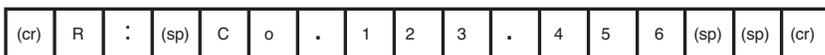
Baud Rate
Select the baud rate to match the device communicating with the control. You may select: 300, 600, 1200 or 2400 baud on line 24 of the program table. Baud rate is common to both transmitter and receiver.

Line Format
The CBPC-3590 control transmits only complete lines. The driver is turned off when not transmitting causing the bus to enter a "float" state, ignoring data on the bus during this "float" time. Unless otherwise commanded the CBPC-3590 control continuously transmits the Count Value. The line format is as follows:

- a carriage return at the beginning of a line
- a prefix indicating RUN, SETUP, or PROGRAM
- a unique line mnemonic
- a five digit data field with decimal point
- a carriage return at the end of the line

(cr)	R	:	(sp)	C	o	.	1	2	3	.	4	5	6	(sp)	(sp)	(cr)

Note: To make changes in Parity or Baud Rate power must first be removed and reapplied after program changes to either are made. Both Parity and Baud Rate are initialized when the control "powers up".

Command Characters
Command Characters mimic the operation of the keypad. Below is a list of the serial equivalents of the keypad keys.

START	'S'	STOP	"Q"	EDIT	'E'	RUN PGM	'P'
▲	"U"	▼	'D'	▶	'R'		
RESET CLEAR	'C'	0	thru		'0' THRU '9'		
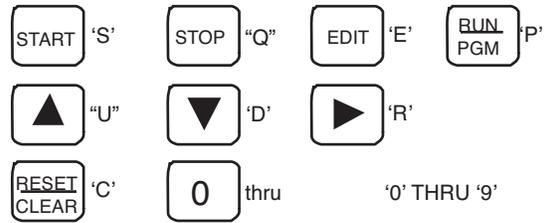
Control Characters
Two control characters are used to start and stop the transmission from the CBPC-3590 control. They are shown below:

(CTRL) S   Suspends transmission following the completion of a line being sent. The driver will then be turned Off.

(CTRL) Q   Resumes transmission from a unit that had been turned Off. The RUN mode line currently selected will be continuously updated.

Escape Code Sequences

Escape code sequences are a group of special commands used for bus oriented systems. Every CBPC-3590 control recognizes these commands. The two listed below are in addition to those listed in the table of LOCAL and GLOBAL commands.

(ESC) A nnn   The Address command is used to select a single control within a system. Only that unit whose serial I.D. number matches the three digit serial address (nnn) will be selected. Only that unit will respond to subsequent serial commands. All units, even the addressed one, suspend transmission.

(ESC) U   The Update command instructs the currently addressed unit to transmit a single line only.

Protocol

The CBPC-3590 will "buffer" up to 16 Command and Control Characters (but not Escape Code Sequences), listed above, sent in "burst mode".

Those characters are read, in order, every 20 milliseconds. The protocol should be careful not to overflow the receive buffer. Additionally, Escape Code Sequences should not be sent until the buffer has emptied and all characters have been processed.

Troubleshooting

⚠ WARNING **Only Authorized Personnel to Set Up and Maintain this Unit.**

The CBPC-3590 control has several internal diagnostic features that illuminate an indicator light showing fault condition and a fault indication on the display. Once a fault condition occurs, the control has to be opened to access the display panel and read the fault condition. Not every fault that is possible will be displayed with an indication, only the most prevalent ones.

The following conditions will cause the front panel fault LED to illuminate and the fault relay internal to the control to drop out.

Fault	Display	Corrective Action to be Taken
Low Voltage	Lo Volt Red fault LED "On" Fault Relay drops out	After normal voltage is restored, unit returns to normal operation.
Feedback too fast	Error 2 Red fault LED "On" Fault Relay drops out	Reset clears fault. Speed or encoder resolution must be reduced or corrected to prevent further errors.
Process time fully utilized	Error 3 Red fault LED "On" Fault Relay drops out	Reset clears fault. Speed or encoder resolution must be reduced or corrected to prevent further errors.

Additionally, other faults can occur with the CBPC-3590 which can effect the operation of the system. Some common faults that could occur are listed below.

Fault	Possible Cause	Solution
Count direction negative rather than positive	Encoder signals "A" and "B" reversed	Reverse signal "A" and "B" wiring on encoder connector plug.
Unit does not start when external start signal is applied	Start signal voltage incorrect or not present	Check switching voltage on start input line (120 VAC) or make sure start switching circuit is functional. If system will start with start key on keypad, then fault is external to the control.
Control does not operate	No power to control	Check that power light in "On/Off" switch is turned on. Check that the AC power is applied to control at control cable. Check fuse. Check that "On/Off" power switch is turned on.
	Clutch-Brake not connected	Check that the clutch-brake is mounted and connected to output of control.
	Cables are not connected to control	Check that both encoder cable and power/Cl-Bk cable is connected to controller.

Fault	Possible Cause	Solution
Unit does not stop accurately	Brake not completely burnished	Cycle unit several hundred cycles to burnish brake properly.
	Not enough cycles completed to get average braking distance calculation	Cycle unit several times to get braking distance calculation based on average number of cycles set point.
Unit does not stop at all	Unit is not getting encoder signals	Check that encoder is providing both "A" and "B" signals to the control.
		Check that encoder is providing "Z" pulse by checking that home indicator LED flashes every 360 degree cycle.
		Check that Z signal (home position) marker pulse is between 50 and 450 counts. See "h" on programming setup, page 11.
Stop point varies from cycle to cycle	Brake output level set too low	Set output level to brake higher by entering program mode and going to line 28 in programming mode and increasing output level.
	Brake is possibly worn out	Check number of cycles on brake and replace if worn excessively.
Count jumps when system is at standstill	Electrical noise being generated and coupled to control via wiring or air	Determine source of electrical noise and suppress appropriately.
		Reroute control wiring if necessary and isolate power and signal lines.
	Excessive vibration on machine	Check encoder mounting and isolate if necessary.
During start, clutch does not seem to have enough torque to drive load	Clutch output level set too low	Set output level to clutch higher by entering program mode and going to line 27 in programming mode and increasing output level.
	Clutch is new and has not been burnished as yet	Cycle clutch until burnish is obtained. Number of cycles will be dependent on loading.
	Clutch is possibly worn out	Check number of cycles on clutch and replace if worn excessively.

By no means does this cover every possible fault that could be encountered with the control and clutch-brake. This is only a basic overview of the more common faults that occur with the control. If a specific problem is encountered that cannot be resolved the best solution is to contact your local Warner Electric Distributor, Representative, or the factory for further assistance in resolving your problem.

Notes and Set Up Information

Warranty

Warner Electric LLC warrants that it will repair or replace (whichever it deems advisable) any product manufactured and sold by it which proves to be defective in material or workmanship within a period of one (1) year from the date of original purchase for consumer, commercial or industrial use.

This warranty extends only to the original purchaser and is not transferable or assignable without Warner Electric LLC's prior consent.

Warranty service can be obtained in the U.S.A. by returning any defective product, transportation charges prepaid, to the appropriate Warner Electric LLC factory. Additional warranty information may be obtained by writing the Customer Satisfaction Department, Warner Electric LLC, 449 Gardner Street, South Beloit, Illinois 61080, or by calling 815-389-3771.

A purchase receipt or other proof of original purchase will be required before warranty service is rendered. If found defective under the terms of this warranty, repair or replacement will be made, without charge, together with a refund for transportation costs. If found not to be defective, you will be notified and, with your consent, the item will be repaired or replaced and returned to you at your expense.

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