



# **COURION CART-MATIC**

## **DESCRIPTION OF OPERATION**

(FOR USE WITH TRANSFER UNITS WITH ENCODER CONFIGURATION)

**Job Name:**

**Job Number:**



# DESCRIPTION OF OPERATION

## Legend of Field Switches for COURION Control Wiring Diagram

Item	Description	Page *	Module **	Location	Purpose
OL	Door Open	5	Slot 2 CA 3 & 4	Limit Switch at the bottom of the Interlock	Detects hoistway door position during Open cycle
CL	Door Closed	5	Slot 2 CA 5 & 6	Limit Switch at the top of the Interlock	Detect hoistway door position during Close cycle
ZONE	Control Zone	5	Slot 2 CA 7	Zone Contact in Interlock	Detects car at a particular landing
SL	Service Level	6	Slot 3 CA 6	Contact in Service Level Interlock	Detects car at Service Level
S	Rear Level	6	Slot 3 CA 7	Contact in Rear Interlock	Detects car at Rear Entry Level
GP1	Gate Open/Closed	6	Slot 3 CA 0	Top Proximity Switch directly behind the Car Gate	Detects gate position during Open and Close cycle
GP2	Gate Open/Closed	6	Slot 3 CA 1	Lower Proximity Switch directly behind the Car Gate	
GATE	Gate Closed	6	Slot 3 CA 2	Gate Contact switch on top of the Car Enclosure	Detects Gate "FULL CLOSED" position
ASR	Area Full	6	Slot 3 CB 7	Sensor located in Lobby ceiling	Detects if Lobby is full
CO	Cart On Car	6	Slot 3 CA 5	Sensor on side of Car in Roller Assembly	Detects loaded Cart
FU	Front Unload	7	Slot 4 Output 7	Outputs from Door Control to CART-MATIC Ejector Control	Instructs CART-MATIC Ejector Control to go to the "Front Unload" position
FL	Front Load	7	Slot 4 Output 6		Instructs CART-MATIC Ejector Control to go to the "Front Load" position
RU	Rear Unload	8	Slot 5 Output 6		Instructs CART-MATIC Ejector Control to go to the "Rear Unload" position.
RL	Rear Load	8	Slot 5 Output 5		Instructs CART-MATIC Ejector Control to go to the "Rear Load" position.

## Legend of Field Switches for COURION CART-MATIC Ejector Control Wiring Diagram

Item	Description	Page ***	Module **	Location	Purpose
RM	Rear Movement	6	Slot 2 Output 1	Limit Switch at the rear of Transfer Unit	Transfer Unit centering switch
FM	Front Movement	6	Slot 2 Output 0	Limit Switch at the front of Transfer Unit	Transfer Unit centering switch

\* Reference to Page # of COURION's Control Wiring Diagram - attached

\*\*Reference to Input/Output Module & LED position on COURION's Control and CART-MATIC Ejector Control

\*\*\*Reference to Page # of COURION's CART-MATIC Ejector Control Wiring Diagram - attached





# DESCRIPTION OF OPERATION

## Sequence of Operation: Dispatch (Send) Cycle with Automatic Load

Description of Operation	Equipment Condition	PLC Program Logic
<b>INITIAL CONDITIONS</b>	<p><b>Hall Station Positions</b></p> <ul style="list-style-type: none"> <li>• “Program” key set to “Dispatch”</li> <li>• “Cart-Matic” key set to “Auto”</li> <li>• “Maintenance” off</li> <li>• Not on Inspection</li> </ul> <p><b>Courion Equipment</b></p> <ul style="list-style-type: none"> <li>• Retiring Cam de-energized</li> <li>• Contacts in Interlock closed</li> <li>• Hoistway Doors and Car Gate closed</li> <li>• Car at Service Level</li> <li>• Transfer Unit centered</li> <li>• Cart ejected (cart off)</li> <li>• Lobby Full Sensors energized at the Receiving Floors and de-energized at the Service Level</li> </ul>	
<b>CALL FOR DISPATCH TO LOAD CART</b>	<p>Cart is positioned at hoistway opening at Service Level. When cart is in proper position, “Cart Ready” light illuminates and Jamb Roller Guide Switch automatically enters call illuminating the “Call” register light on Hall Station (“Dispatch” button can be pressed also to initiate the call).</p> <p>The elevator lift controller sends the Courion Door Controller an automatic “Open” signal.</p>	Elevator Controller closes contact between Terminals A1 and A.
<b>AUTOMATIC DOOR OPEN</b>	<p>With car at Service Level, or upon arrival of car, hoistway and car doors open automatically.</p> <p>The Courion Door Controller determines if it needs to open the hoistway doors and car gate. This is determined by the status mode (dispatch or return), service level interlock contact, cart position (on or off), doors and gate closed, and that the lift is at the landing.</p>	<p>If the status mode is “Dispatch (send)”, lift is at the Service Level, and no cart is loaded in the Car Enclosure, the CART LOAD bit (C67) (line 143) energizes. This bit in turn energizes bit AO (C70) (line 144). This in turn energizes the TIMER TD 1-SEC (T106) (line 123). This timer prevents against sporadic auto open signals.</p> <p>Once TIMER TD (T106) is complete this locks in the open signal FO (C57) (line 125) to the doors and gate. If the CART LOAD bit (C67) does not energize or de-energizes before TIMER TD (T106) times out</p>





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Description of Operation	Equipment Condition	PLC Program Logic
		<p>the door and gate will not open.</p> <p>FO (C57) (line 125) in turn energizes OPEN DOOR (C342) (line 130) and OPEN GATE (C352) (line 131).</p> <p>OPEN DOOR energizes DOOR ENABLE (Y0) (line 153) and DOOR SPD CONTROL (Y2) (line 155). This starts the doors opening in fast speed. As the doors are opening the DOOR CLOSED LIMIT SWITCH (CL) changes state.</p> <p>After 1 second the GATE ENABLE (Y3) (line 157) and GATE SPD CONTROL (Y5) (line 159) energize to start the gate opening.</p> <p>After another .5 seconds the DOOR SPD CONTROL (Y2) de-energizes and the door changes to slow speed. The door continues in slow speed until the DOOR OPEN LIMIT SWITCH (OL) changes state and then DOOR ENABLE (Y0) de-energizes and stops the door operation.</p> <p>1.5 seconds after the GATE CONTACT (GATE) changes state the GATE SPD CONTROL (Y5) de-energizes and the gate changes to slow speed.</p> <p>After both GATE PROXIMITY SWITCHES (GP1 and GP2) are made GATE ENABLE (Y3) de-energizes and the gate stops.</p> <p>At this point the hoistway doors and gate are open.</p>
<p><b>CART-MATIC AUTOMATIC LOAD</b></p>	<p>Cart-Matic automatically extends from car and engages cart, which is moved into car.</p> <p>During the opening of the door and gate the program determines if the ejector should do something.</p>	<p>If CART LOAD (C67) is energized and CART EJECTED (C64) is energized, FOX (C71) (line 145) energizes. FOX in turn energizes either FRONT LOAD (C73)(line 147) for non-rear landing load or REAR LOAD (C75) (line 149) for rear landing load.</p> <p>FRONT LOAD or REAR LOAD in turn energize FRONT LOAD OUT (Y6) (line 160) or REAR LOAD OUT (Y15) (line 166) respectively.</p> <p>For ease we will assume that FRONT LOAD is energized (non rear landing). FRONT LOAD in turn energizes FRONT LOAD OUT.</p>





# DESCRIPTION OF OPERATION

Description of Operation	Equipment Condition	PLC Program Logic
		<p>THE FOLLOWING OCCURS IN THE CART-MATIC EJECTOR CONTROL.</p> <p>FRONT LOAD OUT in turn energizes FRONT LOAD CYCLE (M252) (line 181). FRONT LOAD CYCLE in turn energizes RUN EJECTOR FORWARD (M301) (line 190). RUN EJECTOR FORWARD in turn energizes EJECTOR ENABLE (Q0000) (line 206) and FAST SPEED FRONT LOAD EXTEND (M310) (line 209). EJECTOR ENABLE and FAST SPEED FRONT LOAD EXTEND in turn energize EJECTOR FAST SPEED (Q0002) (line 217). This starts the ejector moving forward at fast speed.</p> <p>When the ejector is approximately 5" (127mm) from the front load position, FAST SPEED FRONT LOAD EXTEND will de-energize and in turn de-energize EJECTOR FAST SPEED. This sets the ejector to slow speed.</p> <p>When the ejector is at the front load position, FRONT LOAD EXTEND COMPLETE (M320) (line 198) energizes which in turn energizes EXTEND COMPLETE (M300) (line 202). When EXTEND COMPLETE energizes it de-energizes RUN EJECTOR FORWARD which in turn de-energizes EJECTOR ENABLE and stops the ejector. EXTEND COMPLETE also energizes RUN EJECTOR REVERSE (M302) (line 194) and FAST SPEED FRONT LOAD RETRACT (M311) (line 210) which energizes EJECTOR FAST SPEED (Q0002) (line 217). After RUN EJECTOR FORWARD is de-energized EJECTOR ENABLE (Q0000) (line 206) and EJECTOR REVERSE (Q0001) (line 208) energizes. This starts the ejector moving in reverse at fast speed.</p> <p>When the ejector is approximately 5" (127mm) from center position, FAST SPEED FRONT LOAD RETRACT (M311) (line 210) will de-energize and in turn de-energize EJECTOR FAST SPEED. This sets the ejector to slow speed. When the FM Limit Switch is no longer made, RUN EJECTOR REVERSE de-energizes which in turn de-energizes EJECTOR ENABLE and EJECTOR REVERSE and stops the ejector.</p> <p>1 second after the EJECTOR ENABLE and Limit Switches FM and RM</p>





# DESCRIPTION OF OPERATION

Description of Operation	Equipment Condition	PLC Program Logic
		<p>(line 159) are de-energized, EJECTOR AT HOME AND NOT MOVING (Q0004) (line 161) and CYCLE COMPLETE (M200) (line 162) are energized and EXTEND COMPLTE (M300) (line 163) is de-energized.</p> <p>EJECTOR AT HOME AND NOT MOVING (Q0004) signals the Courion Door Control that the ejector is centered and has completed the Load Cycle.</p> <p>At this point, the hoistway doors and car gate are OPEN with the Ejector centered in the Car Enclosure with a cart loaded.</p>
<p><b>AUTOMATIC DOOR CLOSE</b></p>	<p>With Ejector centered in the Car Enclosure and cart loaded, the hoistway doors and car gate close automatically.</p> <p>Car buzzer sounds prior to and during automatic closing of hoistway and car doors.</p> <p>Arrival lantern remains illuminated until car leaves floor.</p>	<p>After the CART-MATIC Ejector Control has sent the signal that the ejector is home, TIMER TBD (T111) (line 134) starts. When TIMER TBD is complete (time is variable from 5 to 15 seconds and is set by CH2 on the front of the PLC), this energizes FC (C62) (line 135).</p> <p>FC energizes CLOSE DOOR (C343) (line 136) and CLOSE GATE (C353) (line 137).</p> <p>CLOSE GATE energizes GATE ENABLE (Y3), GATE CLOSE (Y4) (line 158), and GATE SPD CONTROL (Y5) (line 159). This starts the gate closing in fast speed.</p> <p>1.5 seconds after GATE PROXIMITY SWITCH GP1 is off, GATE SPD CONTROL (Y5) de-energizes placing the gate in slow speed.</p> <p>When the Gate is FULLY closed, GATE ENABLE (Y3) and GATE CLOSE (Y4) de-energize and the gate stops. The GATE CONTACT changes state to indicate that the Gate is "FULL CLOSED".</p> <p>At this point DOOR ENABLE (Y0), DOOR CLOSE (Y1), and DOOR SPD CONTROL (Y2) energize starting the door closing in fast speed. 1.5 seconds after the DOOR OPEN LIMIT (OL) changes state DOOR SPD CONTROL (Y2) de-energizes and the doors go into slow speed. When the door is FULLY closed, the DOOR ENABLE (Y0) and DOOR CLOSE (Y1) de-energize and the door motor stops.</p>
<p>Courion Controller then sends the following outputs to the Elevator Controller: Hoistway doors and Car Gate are CLOSED, a Cart is on the Car, and there are no faults. Upon receipt of these outputs the Car should travel to Dispatch Level.</p>		





# DESCRIPTION OF OPERATION

## Sequence of Operation: Dispatch (Send) Cycle with Automatic Unload

Description of Operation	Equipment Condition	PLC Program Logic
<b>INITIAL CONDITIONS</b>	<p><b>Hall Station Positions</b></p> <ul style="list-style-type: none"> <li>• “Program” key set to “Dispatch”</li> <li>• “Cart-Matic” key set to “Auto”</li> <li>• “Maintenance” off</li> <li>• Not on Inspection</li> </ul> <p><b>Courion Equipment</b></p> <ul style="list-style-type: none"> <li>• Retiring Cam de-energized</li> <li>• Contacts in Interlock closed</li> <li>• Hoistway Doors and Car Gate closed</li> <li>• Car at Non-Service Level</li> <li>• Transfer Unit centered</li> <li>• Cart On</li> <li>• Lobby Full Sensors energized at the Receiving Floors and de-energized at the Service Level.</li> </ul>	
<b>CALL TO DISPATCH TO UNLOAD CART</b>	<p>Cart is in Car Enclosure with Transfer Unit centered. Elevator travels to a non-service level.</p> <p>The elevator lift controller sends the Courion Door Controller an automatic “Open” signal.</p>	Elevator Controller closes contact between Terminals A1 and A.
<b>AUTOMATIC DOOR OPEN</b>	<p>With car at non-Service Level, or upon arrival of car, hoistway and car doors open automatically.</p> <p>The Courion Door Controller determines if it needs to open the hoistway doors and car gate. This is determined by the status mode (dispatch or return), service level interlock contact, cart position (on or off), doors and gate closed, and that the lift is at the proper landing.</p>	<p>If the status mode is “Dispatch (send)”, lift is at the service level, and no cart is in cab the CART LOAD bit (C67) (line 143) energizes. This bit in turn energizes bit AO (C70) (line 144).</p> <p>This in turn energizes the TIMER TD 1-SEC (T106) (line 121). This timer prevents against sporadic auto open signals.</p> <p>Once TIMER TD (T106) is complete this locks in the open signal FO (C57) (line 125) to the doors and gate. If the CART LOAD bit (C67) does not energize or de-energizes before TIMER TD (T106) times out the door and gate will not open.</p>





# DESCRIPTION OF OPERATION

		<p>FO (C57) (line 125) in turn energizes OPEN DOOR (C342) (line 130) and OPEN GATE (C352) (line 131).</p> <p>OPEN DOOR energizes DOOR ENABLE (Y0) (line 153) and DOOR SPD CONTROL (Y2) (line 155). This starts the doors opening in fast speed. As the doors are opening the DOOR CLOSED LIMIT SWITCH (CL) changes state.</p> <p>After 1 second the GATE ENABLE (Y3) (line 157) and GATE SPD CONTROL (Y5) (line 159) energize to start the gate opening.</p> <p>After another .5 seconds the DOOR SPD CONTROL (Y2) de-energizes and the door changes to slow speed. The door continues in slow speed until the DOOR OPEN LIMIT SWITCH (OL) changes state and then DOOR ENABLE (Y0) de-energizes and stops the door operation.</p> <p>1.5 seconds after the GATE CONTACT (GATE) changes state the GATE SPD CONTROL (Y5) de-energizes and the gate changes to slow speed.</p> <p>After both GATE PROXIMITY SWITCHES (GP1 and GP2) are made GATE ENABLE (Y3) de-energizes and the gate stops.</p> <p>At this point the hoistway doors and gate are open.</p>
<p><b>CART-MATIC AUTOMATIC UNLOAD</b></p>	<p>Cart-Matic automatically extends from car and discharges cart.</p> <p>CART-MATIC Transfer unit will not operate without recognizing that there is a "Cart On" in the Car Enclosure.</p> <p>During the opening of the door and gate the program determines if the ejector should do something.</p> <p>Cart-Matic retracts into car, car buzzer sounds prior to and during automatic closing of hoistway</p>	<p>If CART UNLOAD (C66) is energized and CART ON (C63) is energized, FOX (C71) (line 145) energizes. FOX (C71) in turn energizes either FRONT UNLOAD (C74) (line 148) for non-rear landing load or REAR UNLOAD (C77) (line 150) for rear landing load.</p> <p>If AREA FULL ASR (C76) is energized the hoistway doors will remain open waiting for the lobby area to be cleared.</p> <p>If AREA FULL ASR (C76) is de-energized, FRONT UNLOAD (C74) or REAR UNLOAD (C77) in turn energize FRONT UNLOAD OUT (Y7) (line 161) or REAR UNLOAD OUT (Y16) (line 167) respectively.</p> <p>For ease we will assume that FRONT UNLOAD is energized (non rear</p>





# DESCRIPTION OF OPERATION

	doors and car gate.	<p>landing).</p> <p>THE FOLLOWING OCCURS IN THE CART-MATIC EJECTOR CONTROL.</p> <p>FRONT LOAD OUT in turn energizes FRONT UNLOAD CYCLE (M253) (line 183). FRONT UNLOAD CYCLE in turn energizes RUN EJECTOR FORWARD (M301) (line 190). RUN EJECTOR FORWARD in turn energizes EJECTOR ENABLE (Q0000) (line 206) and FAST SPEED FRONT UNLOAD EXTEND (M312) (line 211). EJECTOR ENABLE and FAST SPEED FRONT UNLOAD EXTEND in turn energize EJECTOR FAST SPEED (Q0002) (line 217). This starts the ejector moving forward at fast speed.</p> <p>When the ejector is approximately 5" (127mm) from the front unload position, FAST SPEED FRONT UNLOAD EXTEND will de-energize and in turn de-energize EJECTOR FAST SPEED. This sets the ejector to slow speed.</p> <p>When the ejector is at the front unload position, FRONT UNLOAD EXTEND COMPLETE (M320) (line 198) energizes which in turn energizes EXTEND COMPLETE (M300) (line 202). When EXTEND COMPLETE energizes it de-energizes RUN EJECTOR FORWARD which in turn de-energizes EJECTOR ENABLE and stops the ejector.</p> <p>EXTEND COMPLETE also energizes RUN EJECTOR REVERSE (M302) (line 194) and FAST SPEED FRONT UNLOAD RETRACT (M313) (line 212) which energizes EJECTOR FAST SPEED (Q0002) (line 217). After RUN EJECTOR FORWARD is de-energized EJECTOR ENABLE (Q0000) (line 206) and EJECTOR REVERSE (Q0001) (line 208) energizes. This starts the ejector moving in reverse at fast speed.</p> <p>When the ejector is approximately 5" (127mm) from center position, FAST SPEED FRONT UNLOAD RETRACT (M313) will de-energize and in turn de-energize EJECTOR FAST SPEED. This sets the ejector to slow speed. When the FM Limit Switch is no longer made, RUN EJECTOR REVERSE de-energizes which in turn de-energizes EJECTOR ENABLE and EJECTOR REVERSE and stops the ejector.</p>
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# DESCRIPTION OF OPERATION

		<p>1 second after the EJECTOR ENABLE and Limit Switches FM and RM (line 159) are de-energized, EJECTOR AT HOME AND NOT MOVING (Q0004) (line 161) and CYCLE COMPLETE (M200) (line 162) are energized and EXTEND COMPLTE (M300) (line 163) is de-energized.</p> <p>EJECTOR AT HOME AND NOT MOVING (Q0004) signals the Courion Door Control that the ejector is centered and has completed the Unload Cycle.</p> <p>At this point, the hoistway doors and car gate are OPEN with the Ejector centered in the Car Enclosure with no cart loaded.</p>
<p><b>AUTOMATIC DOOR CLOSE</b></p>	<p>With Ejector centered in the Car Enclosure and cart unloaded, the hoistway doors and car gate close automatically.</p> <p>Car buzzer sounds prior to and during automatic closing of hoistway and car doors.</p> <p>Arrival lantern remains illuminated until car leaves floor.</p> <p>Car returns to Service Level, ready to begin next dispatch cycle. Next dispatch may be registered as soon as, but not before, loaded car leaves the Service Level.</p>	<p>After the ejector control has sent the signal that the ejector is home, TIMER TBD (T111) (line 124) starts. When TIMER TBD is complete (time is variable from 5 to 15 seconds and is set by CH2 on the front of the PLC), this energizes FC (C62) (line 135).</p> <p>FC energizes CLOSE DOOR (C343) (line 136) and CLOSE GATE (C353) (line 137).</p> <p>CLOSE GATE energizes GATE ENABLE (Y3), GATE CLOSE (Y4) (line 158), and GATE SPD CONTROL (Y5) (line 159). This starts the gate closing in fast speed.</p> <p>1.5 seconds after GATE PROXIMITY SWITCH GP1 is off, GATE SPD CONTROL (Y5) de-energizes placing the gate in slow speed.</p> <p>When the Gate is FULLY closed, GATE ENABLE (Y3) and GATE CLOSE (Y4) de-energize and the gate stops. The GATE CONTACT changes state to indicate that Gate is "FULL CLOSED".</p> <p>At this point DOOR ENABLE (Y0), DOOR CLOSE (Y1), and DOOR SPD CONTROL (Y2) energize starting the door closing in fast speed. 1.5 seconds after the DOOR OPEN LIMIT (OL) changes state DOOR SPD CONTROL (Y2) de-energizes and the doors go into slow speed. When the door is FULLY closed, the DOOR ENABLE (Y0) and DOOR CLOSE (Y1) de-energize and the door motor stops.</p>
<p><b>LOBBY FULL SENSORS</b></p>	<p>If a previously dispatched cart is activating the Lobby Full Sensor at the dispatch level</p>	





# DESCRIPTION OF OPERATION

	unloading station, the hoistway doors will open, but the cart will not unload until the cart is removed from the Lobby Full area.	
Courion Controller then sends the following outputs to the Elevator Controller: Hoistway doors and Car Gate are CLOSED, a Cart is not on the Car, and there are no faults. Upon receipt of these outputs the Car should automatically return to Service Level ready to begin next dispatch cycle.		

## Sequence of Operation: Return Cycle with Automatic Load & Unload

The sequence is the same for a Return mode of operation with the following exceptions:

1. The cart will be loaded at a non-service level and will be unloaded at the Service Level.
2. If a previously returned cart is activating the Lobby Full Sensor at the Service Level, the hoistway doors will open, but the cart will not unload until the cart is removed from the Lobby Full Service area.
3. The Elevator Control will hold and answer all calls with a top to bottom scanner which gives equal attention to each floor in turn. After the first registered call is answered, the next lower call is to receive attention. After the lowest call has been satisfied, the scanner starts over with the highest registered call and continues to scan until no calls remain.
4. Lobby Full Sensors de-energized at the Receiving Floors and energized at the Service Level.

## Operational Notes:

1. When the program switch is changed from "DISPATCH" to "RETURN", or from "RETURN" to "DISPATCH", all push-buttons become inoperable until such time as all existing registered dispatches or calls are satisfied, at which time the system will switch to the new program.
2. All doors will remain closed whenever the lift is at rest with no calls registered. Doors do not open unless in response to a registered dispatch or call.
3. The Door closing buzzer on car begins sounding five (5) seconds before doors begin to close, and continues until doors are nearly closed.
4. If the automatic operations ("DOOR OPEN", "DOOR CLOSE", "Cart-Matic LOAD", or "Cart-Matic UNLOAD") are prevented from completing their cycle within the time allowed for each function, the control will shut off, and simultaneously, an indicator lamp, marked "NON-OPERATING" will be illuminated.
5. After the cause of the safety shut-off of the control has been cleared, the "RESET" button may immediately be pressed to put the automatic transfer equipment and doors back into operation.
6. The lamps, marked "CART-ON", will illuminate whenever a cart is in the car.
7. Key switch, marked "MAINT" - "OFF" - "ON", located on control stations at Service Level, is for maintenance to car. When the "MAINTENANCE" switch is moved to "ON" position, car moves to Service Level. With the car at Service Level, automatic operation is shut down, (to open doors, press push-button marked "DOOR OPEN"). To close doors, press push-button marked "DOOR CLOSE". **NOTE:** The Maintenance Switch will not override the Inspection mode.





# DESCRIPTION OF OPERATION

## ATTACHMENTS

1. COURION PLC LED Indicator Chart
2. COURION Controller Wiring Diagram
3. COURION Controller Ladder Logic Diagram
4. COURION CART-MATIC Ejector Control Wiring Diagram
5. COURION CART-MATIC Ejector Control Ladder Logic Diagram

