Path: c:\directsoft5\projects\wtt revised1.prj
Save Date: 09/20/11 14:43:22
Creation Date: 09/15/11 10:51:30
PLC Type: 06
Class ID: DirectLogic 06 Series
Link Name: 06 KSeq

When any Push Button on the remote is pressed (1-8), the corresponding plc input activates an upcounter with an associated function
Pressing a button increases that counter by increments of 1,starting from 0 (reset point)
The counter counts to 2 and resets to 0, having only 2 states, 0 or 1 (off/on)

If any counter value is equal to 1 (K1), the corresponding function is on/latched/activated

if any counter equals 2 (K2), the counter resets back to 0 and the function is off/unlatched or de-activated

Rungs use Boolean Logic to determine the state of the counters

Rungs with functions of motor reversing are digitally interlocked by using the specific function counter accumulated value, either it is 0 (off) or 1 (on)

Pitch (+) function is interlocked with rung 8: pitch home (-) by inserting an inline NC contact using the bit associated with the opposing function. The NC contact position is determined by a Boolean comparison. Here CTA4 is the pitch (-) function bit, if this is already active (equal to 1) then the pitch (+) function cannot be activated until the motors are stopped first before reversing.

1

PB 1 (push button) pitches positive (+) until manual stop pitch +
X0

pitch home (-) function bit
CTA4 ≠ K1

pitch (+) function bit
CTA3 ≥ K2

CNT
PB 1 pressed 1X increases counter CT3 from 0 to 1 latching function (pitch +) PB 1 again increases CT3 to 2 and rests counter Pitch(+) latch
CT3
K2

when either pitch function (+ or-) is stopped (reset) the pitch delay timer is also reset

2

pitch (+) function bit
CTA3 ≥ K2

pitch home (-) function bit
CTA4 ≥ K2

TMR
T6
K40

pitch + counter CT3 value (CTA3) is equal to the preset contstant (K) of 1 (K1) , latching the pitch + function,
this activates the pitch brake delay timer to release the brakes

3

pitch (+) function bit
CTA3 = K1

TMR
brake on delay timer for pitch (+) function
Delay is in increments of .1 sec, timer is set to count to 0.5 sec. until T0 bit closes
(+) brake delay
T0
K5

Pitch + positive and home (-) both require time delay to energize brake first to release shaft before motor power is applied

100 ms after the function is latched the brakes are energized

4

brake delay timer for pitch positive (+) function bit
TA0 ≥ K1

brake delay timer for pitch home (-) function bit
TA3 ≥ K1

pitch brake blade A
brake energize and release of shaft
Y112
OUT

pitch brake blade B
brake energize and release of shaft
Y113
OUT

pitch brake blade C
brake energize and release of shaft
Y114
OUT

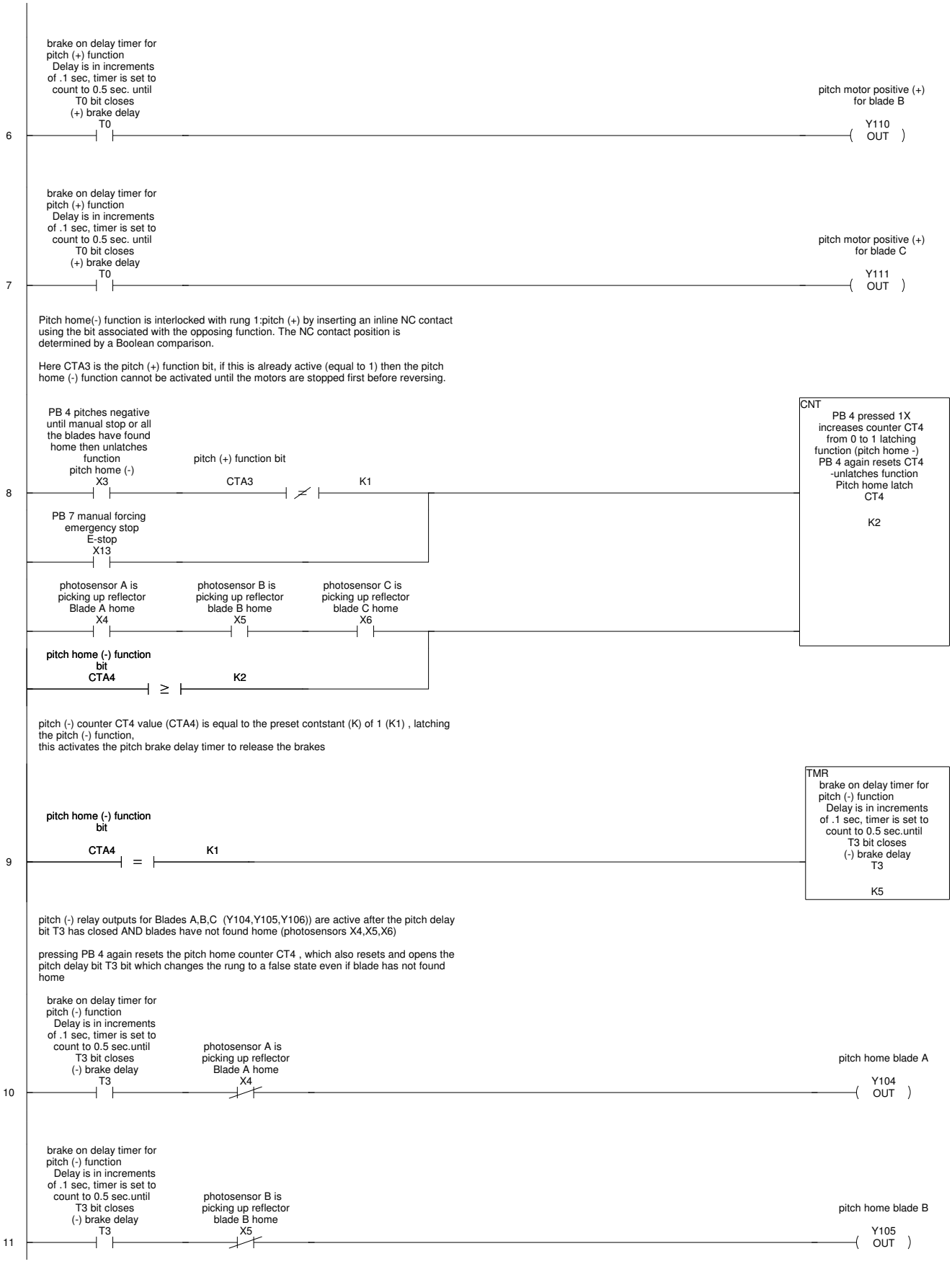
pitch + relay outputs for Blades A,B,C (Y107,Y110,Y111)) are active after the pitch delay bit T3 has closed, approx. 500ms (0.5 seconds) after function bit was latched

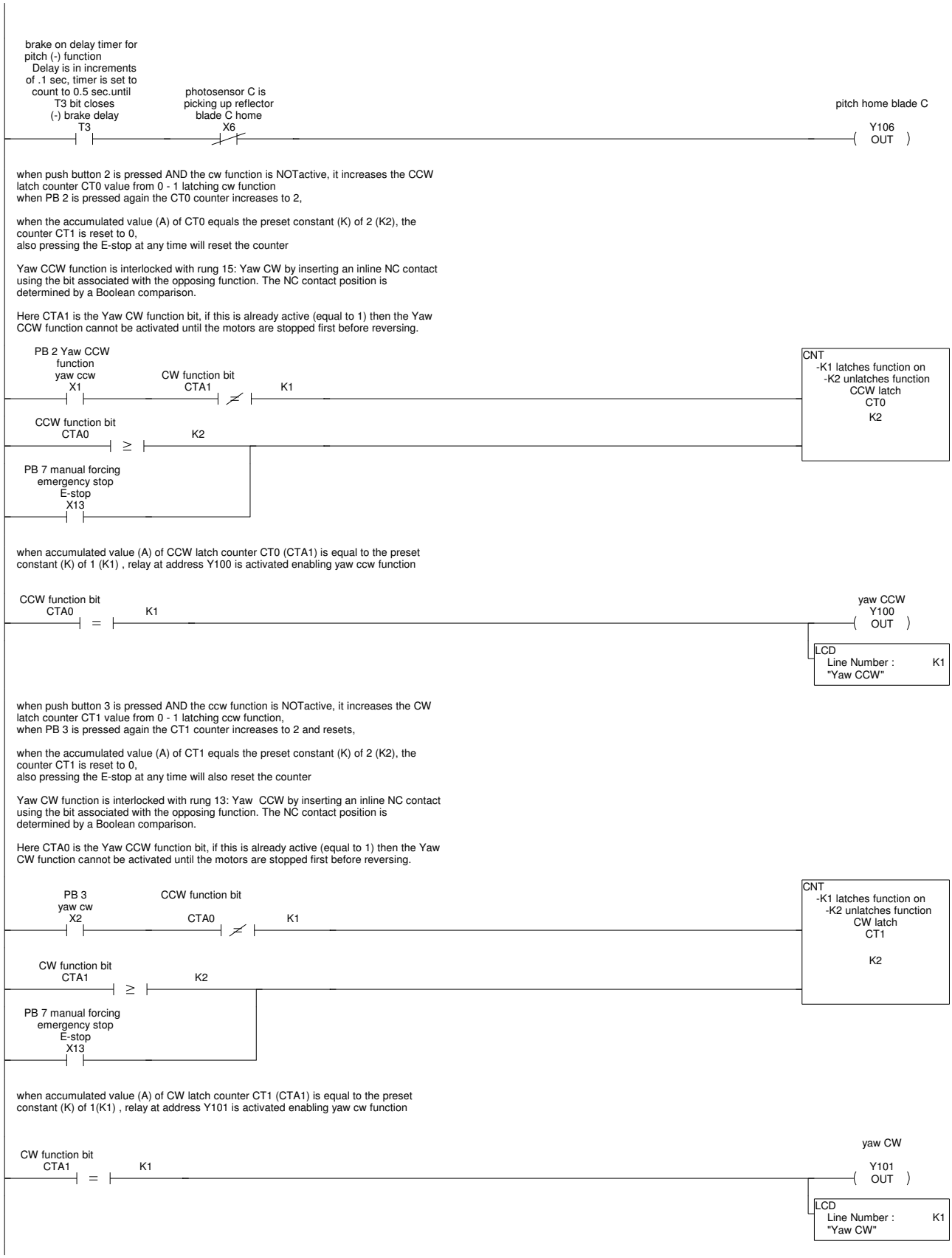
pressing PB 1 again resets the pitch + counter CT3 , which also resets and opens the pitch delay bit T3 bit which changes the rung to a false state

5

brake on delay timer for pitch (+) function
Delay is in increments of .1 sec, timer is set to count to 0.5 sec. until T0 bit closes
(+) brake delay
T0

pitch motor positive (+) for blade A
Y107
OUT

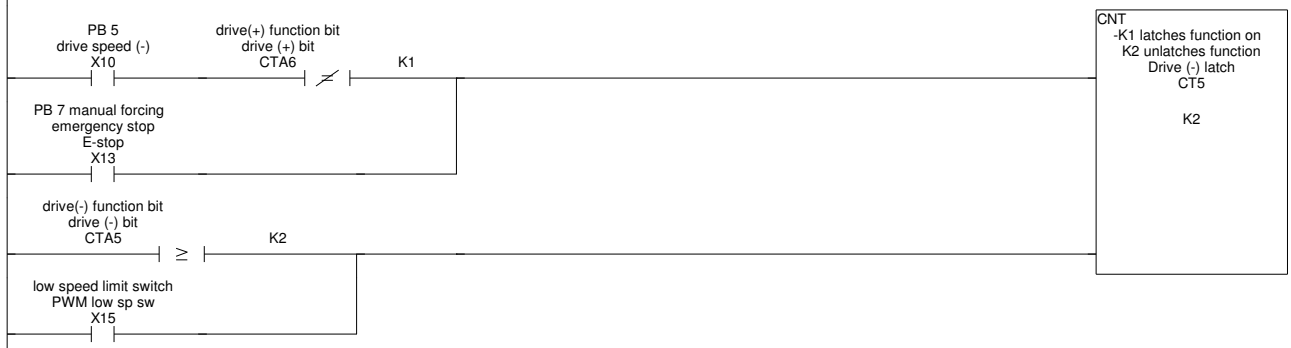

brake on delay timer for pitch (+) function Delay is in increments of .1 sec, timer is set to count to 0.5 sec. until T0 bit closes (+) brake delay
T0
pitch motor positive (+) for blade B
Y110
OUT
6
brake on delay timer for pitch (+) function Delay is in increments of .1 sec, timer is set to count to 0.5 sec. until T0 bit closes (+) brake delay
T0
pitch motor positive (+) for blade C
Y111
OUT
7
Pitch home(-) function is interlocked with rung 1:pitch (+) by inserting an inline NC contact using the bit associated with the opposing function. The NC contact position is determined by a Boolean comparison.
Here CTA3 is the pitch (+) function bit, if this is already active (equal to 1) then the pitch home (-) function cannot be activated until the motors are stopped first before reversing.
PB 4 pitches negative until manual stop or all the blades have found home then unlatches function pitch home (-)
X3
pitch (+) function bit
CTA3
K1
CNT
PB 4 pressed 1X increases counter CT4 from 0 to 1 latching function (pitch home -) PB 4 again resets CT4 -unlatches function Pitch home latch
CT4
K2
8
PB 7 manual forcing emergency stop E-stop
X13
photosensor A is picking up reflector Blade A home
X4
photosensor B is picking up reflector blade B home
X5
photosensor C is picking up reflector blade C home
X6
pitch home (-) function bit
CTA4
≥
K2
pitch (-) counter CT4 value (CTA4) is equal to the preset contstant (K) of 1 (K1) , latching the pitch (-) function,
this activates the pitch brake delay timer to release the brakes
TMR
brake on delay timer for pitch (-) function Delay is in increments of .1 sec, timer is set to count to 0.5 sec.until T3 bit closes (-) brake delay
T3
K5
pitch home (-) function bit
CTA4
=
K1
9
pitch (-) relay outputs for Blades A,B,C (Y104,Y105,Y106)) are active after the pitch delay bit T3 has closed AND blades have not found home (photosensors X4,X5,X6)
pressing PB 4 again resets the pitch home counter CT4 , which also resets and opens the pitch delay bit T3 bit which changes the rung to a false state even if blade has not found home
brake on delay timer for pitch (-) function Delay is in increments of .1 sec, timer is set to count to 0.5 sec.until T3 bit closes (-) brake delay
T3
photosensor A is picking up reflector Blade A home
X4
pitch home blade A
Y104
OUT
10
brake on delay timer for pitch (-) function Delay is in increments of .1 sec, timer is set to count to 0.5 sec.until T3 bit closes (-) brake delay
T3
photosensor B is picking up reflector blade B home
X5
pitch home blade B
Y105
OUT
11


brake on delay timer for pitch (-) function
Delay is in increments of .1 sec, timer is set to count to 0.5 sec.until T3 bit closes
(-) brake delay
T3
photosensor C is picking up reflector blade C home
X6
pitch home blade C
Y106
OUT
12
when push button 2 is pressed AND the cw function is NOTactive, it increases the CCW latch counter CT0 value from 0 - 1 latching cw function
when PB 2 is pressed again the CT0 counter increases to 2,
when the accumulated value (A) of CT0 equals the preset constant (K) of 2 (K2), the counter CT1 is reset to 0,
also pressing the E-stop at any time will reset the counter
Yaw CCW function is interlocked with rung 15: Yaw CW by inserting an inline NC contact using the bit associated with the opposing function. The NC contact position is determined by a Boolean comparison.
Here CTA1 is the Yaw CW function bit, if this is already active (equal to 1) then the Yaw CCW function cannot be activated until the motors are stopped first before reversing.
PB 2 Yaw CCW function
yaw ccw
X1
CW function bit
CTA1
K1
CNT
-K1 latches function on
-K2 unlatches function
CCW latch
CT0
K2
13
CCW function bit
CTA0
≥
K2
PB 7 manual forcing emergency stop
E-stop
X13
when accumulated value (A) of CCW latch counter CT0 (CTA1) is equal to the preset constant (K) of 1 (K1) , relay at address Y100 is activated enabling yaw ccw function
CCW function bit
CTA0
=
K1
yaw CCW
Y100
OUT
LCD
Line Number :
K1
"Yaw CCW"
14
when push button 3 is pressed AND the ccw function is NOTactive, it increases the CW latch counter CT1 value from 0 - 1 latching ccw function,
when PB 3 is pressed again the CT1 counter increases to 2 and resets,
when the accumulated value (A) of CT1 equals the preset constant (K) of 2 (K2), the counter CT1 is reset to 0,
also pressing the E-stop at any time will also reset the counter
Yaw CW function is interlocked with rung 13: Yaw CCW by inserting an inline NC contact using the bit associated with the opposing function. The NC contact position is determined by a Boolean comparison.
Here CTA0 is the Yaw CCW function bit, if this is already active (equal to 1) then the Yaw CW function cannot be activated until the motors are stopped first before reversing.
PB 3
yaw cw
X2
CCW function bit
CTA0
K1
CNT
-K1 latches function on
-K2 unlatches function
CW latch
CT1
K2
15
CW function bit
CTA1
≥
K2
PB 7 manual forcing emergency stop
E-stop
X13
when accumulated value (A) of CW latch counter CT1 (CTA1) is equal to the preset constant (K) of 1(K1) , relay at address Y101 is activated enabling yaw cw function
CW function bit
CTA1
=
K1
yaw CW
Y101
OUT
LCD
Line Number :
K1
"Yaw CW"
16

push button 5 increases drive negative (-) counter CT5 from 0-1 latching function, pressing PB 5 again increases counter to 2 resetting to 0 and unlatching function, when PWM gearmotor has reached its min. travel limit it will also reset the counter

drive (-) function is interlocked with rung 19: Drive(+) by inserting an inline NC contact using the bit associated with the opposing function. The NC contact position is determined by a Boolean comparison.

Here CTA6 is the Drive (+) function bit, if this is already active (equal to 1) then the Drive (-) function cannot be activated until the motors are stopped first before reversing.

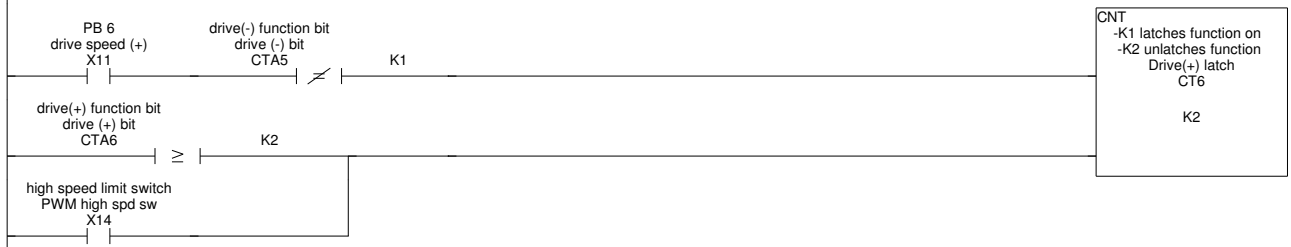


As long as the drive negative function is latched AND the PWM gearmotor has not reached its min. travel limit, drive speed will decrease

push button 6 incresases drive positive (+) counter CT6 from 0-1 latching function, pressing PB 6 again increases counter to 2 resetting to 0 and unlatching function, when PWM gearmotor has reached its max. travel limit it will also reset the counter

drive (+) function is interlocked with rung 17: Drive(+) by inserting an inline NC contact using the bit associated with the opposing function. The NC contact position is determined by a Boolean comparison.

Here CTA5 is the Drive (-) function bit, if this is already active (equal to 1) then the Drive (+) function cannot be activated until the motors are stopped first before reversing.



As long as the drive increase function is latched AND the PWM gearmotor has not reached its max. travel, drive speed will increase

PWM high speed limit switch has been activated, starts timer to establish time range for message to be displayed and then overwritten to clear screen

Briefly displays "max speed" status to LCD screen

briefly printing blank message to overwrite previous message essentially clearing screen

Pressing PB 7 simulates the E-stop function

This would normally be series string of contacts making up what is known as the "safety loop" in the system.

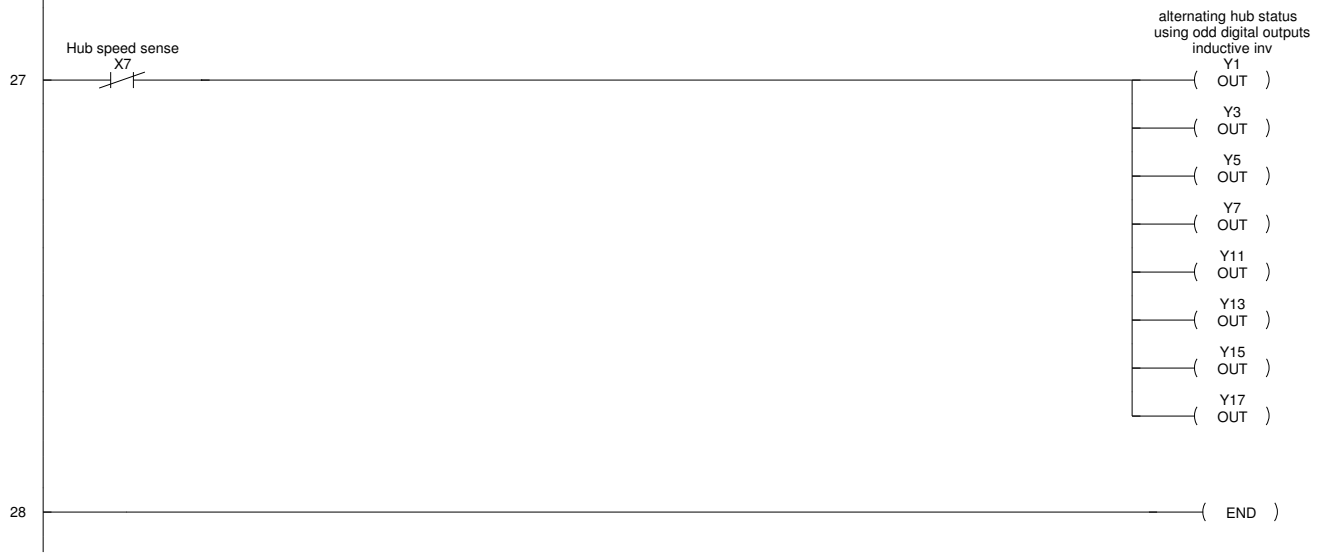
When any 1 of a number of inputs (contacts) opens up the loop is broken and initiates an Emergency Shutdown procedure to prevent further damage to the turbine.

Here the E-stop is designed to :
1) stop the yaw function
2) ramp the drive speed down
3) pitch the blades home

Pressing PB 8 simulates finding and fixing the fault(s) that initiated shutdown.
Putting the turbine in RUN, this also writes the status on the LCD display.

Inductive sensor when "on" picking up ferrous washers on hub for mainshaft speed sense
outputs are the unused digital outputs on plc used as status indicator (red LEDs labeled X0)

Inductive sensor when 'off' using NC to alternate status lights on unused digital outputs on plc




29
NOP