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1. INTRODUCTION

CNC-210EXD is a new series of COIL WINDING MACHINE CONTROLLER developed by TAILY AUTOMATION. It not only retains all the features of previous designs, CNC-210EXD also features an integrated design: putting stepper motor driver, speed controller interface, power supplier control circuits into one control box, simultaneously achieving size reduction, high performance and low cost.

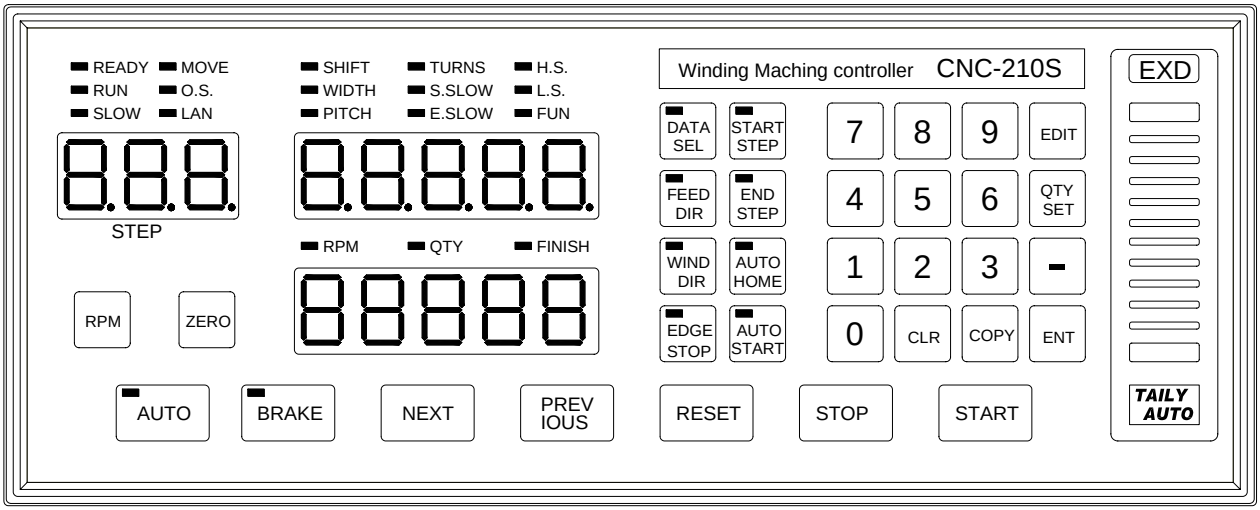
CNC-210EXD Series offers CNC-210EXD1"External Connection Model 1" and CNC-210EXD2 "External Connection Model 2," depending on whether a close-loop driver is provided for various applications.

- ◆ **CNC-210EXD1** ：With winding spindle control interface circuit and 2A stepper motor driver for guiding traverse.
- ◆ **CNC-210EXD2** ：With winding spindle motor control interface circuit and guiding traverse stepper motor control interface circuit.

2. MAIN FEATURES

- ◆ Single chip Microprocessor design, has further higher performance and higher functions; it also has less sensitive to external power fluctuation or to external electromagnetic interference.
- ◆ Memory use FLASH ROM, capacity capable storing up to 1000 steps winding data, 9 winding parameters, and 5 options can be independently assigned for each step. Off-power memory retention without battery.
- ◆ Can aim at differ the compliant situation, change the winding, and operation mode hence it is applicable to a wide range of fields.
- ◆ Winding speed can be specified using the front panel keypad, resulting in easy programming of multi-step, multi-speed settings.
- ◆ Guiding traverse shaft stepper motor with a constant-current driver offering fast wire guiding speeds.
- ◆ Guiding traverse shaft offering 10 steps moving speed selection.
- ◆ Offering RS-485 interface for PC linking or data transfer.
- ◆ Program version can update by personal computer.
- ◆ Power input AC100V~240V 100VA(max).

3. FRONT PANEL DESCRIPTION



3.1. Key pads

0 ~ 9 : 10 key, for entering numerical values.

EDIT : Enter into PARAMETER EDIT mode.

QTY SET : Specify target production quantity.

START STEP : Specify starting step in memory.

END STEP : Specify ending step in memory.

DATA SEL : During programming, select parameter to be programmed.

FEED DIR : During programming, select guiding direction.

WIND DIR : During programming, select winding direction.

EDGE STOP : During programming, select whether or not to stop at the two edges.

AUTO HOME : During programming, select whether to have auto-positioning function for the starting position.

AUTO START : During programming, select whether to have auto-start function.

- : During programming, reduce step number by one.
  During ready mode, holding down this key for two seconds, reduce PIECE COUNTER by one.

CLR : During programming, clear current data to zero.

COPY : During programming, copy the data of previous step into current step.

ENT : During programming, write data into memory.

RPM : Switch display to shows PIECE COUNT or RPM.

ZERO : Hold down this key for two seconds to reset PIECE COUNTER to zero.

AUTO : To switch between AUTO and NON-AUTO mode.

BRAKE : Select whether brake will be applied to the winding spindle during stopping.

NEXT : During winding pause, skip current step and go to the next step.
During programming, make the guiding traverse shaft moving.

PREVIOUS： During winding pause, discard current step and go to the previous step.
During programming, make the guiding traverse shafts moving.

RESET： At any time, discontinues current operation and return to ready mode.

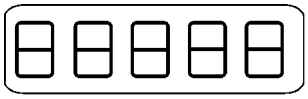
STOP： Pause during winding.

START： Restart during pause, or pause during winding.

3.2. Digital display

STEP DISPLAY：Show the current step number being wound or being programmed.

DATA DISPLAY：During programming, in combination with LED, shows the parameter being programmed. During winding or ready mode, show the current number of turns or show the guiding traverse shafts position.



PIECE COUNT DISPLAY：Shows PIECE COUNT or RPM.

3.3. Status indicators

- ☐ **READY :** lit means in READY mode, flash means PAUSE mode ,not lit means winding or programming in progress.
- ☐ **RUN :** lit means winding in progress**;** not lit means not in progress.
- ☐ **SLOW :** during winding, lit means low speed winding**;** not lit means high speed winding.
- ☐ **MOVE :** lit means guiding traverse is fixing the starting position for winding or is returning to the home position.
- ☐ **O.S :** lit means winding operation is over speeding, guiding traverse and winding spindle shaft are out of synchronization.
- ☐ **LAN :** lit means currently communicating with network.
- ☐ **FINISH :** will lit when reaching the preset piece count.
- ☐ **RPM :** lit means the PIECE COUNT DISPLAY shows RPM.
- ☐ **QTY :** lit means the PIECE COUNT DISPLAY shows the piece count.

4. PROGRAMMING WINGING PARAMETER

4.1. MEMORY RANGE SELECTION

CNC-210S contains 1000 memory step. By defining the region, users can effectively manage the memory. Various winding parameter can be stored in different regions and can be retrieved instantaneously. After specifying the regions, programming and winding can be done in those regions; all un-selected regions will retain their original contents and unmodified.

◆ **Specifying starting step：**

During ready mode, press [START STEP] [0~999] [ENT] to set. [Setting range 0 ~ 999].

◆ **Specifying ending step**

During ready mode, press [END STEP] [0~999] [ENT] to set. [Setting range 0 ~ 999].
When setting the STEP number, the Ending step number must be larger than the Starting step number, or the winding operation will not start.

4.2. Winding parameters definitions

☐**SHIFT** : Starting position of the guiding traverse, measured from the home position of the guiding traverse.
[Setting range 0.00~ 999.99 mm].

☐**WIDTH** : The traverse of the copper wire led by the traverse during winding. [Setting range 0 ~999.99 mm].

☐**PITCH** : Diameter of the copper wire. [Setting range 0~ 9.999mm].

☐**TURNS** : Total number of turns to be wound.
[Setting range 0.0~9999.9 or 0~99999 turns].

☐**S.SLOW** : Number of turns to be wound at low speed, when start winding.
[Setting range 0~999.9 turns].

☐**E.SLOW** : Number of turns to be done at low speed prior to stopping. [Setting range 0 ~999.9 turns].

☐**H.S.** : High winding speed. [Setting range from 0~99%].

☐**L.S.** : Low winding speed. [Setting range from 0~99%].

☐**FUN** : Not used by the Standard mode; reserved for future special occasions.

4.3. Guiding traverse shaft introduce setting

During set the 『SHIFT』, 『WIDTH』 and 『guiding traverse shaft travel limit』, can use numeric keypad to set location data or can also use [NEXT], [PREVIOUS] keys to leading the guiding traverse shaft location.

4.4. Programming winding parameter

In READY mode, press EDIT invokes the programming mode for the winding parameters. First, the START STEP number will shows at STEP DISPLAY, the parameter indicator 『SHIFT』 will lit, the starting position will shows at DATA DISPLAY . The starting position can be changed to the new position by pressing the numerical key followed by the ENT key. After setting the starting position, the STEP number in the STEP DISPLAY will automatically increase by one. Continue with the starting position selection for the next step. When the STEP number larger then the END STEP number, the STEP number will restore to the START STEP number and the indicator light will change from 『SHIFT』 to 『WIDTH』 for user to proceed to specifying the width for each STEP. Repeat the same procedure using numerical keys and the ENT key, all winding parameters for each STEP can thus programmed.

The following functions are also available:

- FEED DIR : To select guiding direction, forward or reverse.
- WIND DIR : To select winding direction, clockwise or counter-clockwise.
- EDGE STOP : To specify whether to suspend winding when the guiding traverse moves to the two edges of the width.
- AUTO HOME : To select whether guiding traverse returns to the starting position automatically or upon a manual pressing of the START key.
- AUTO START : To select whether winding start automatically or upon manual pressing of the START key.
- CLR : Clear the current value to zero.
- COPY : Copy the content of the previous step to the current step ; invalid when programming the first step.
- − : Go back to the previous programming step.
- DATA SEL : To scroll through different parameters.

Each time when change the PARAMETER or OPTIONS (the last five of the above function), ENT key must pressed to effect the change. The five options can be changed during programming any parameter in current step.

Using the above procedure, all the winding PARAMETERS and OPTIONS of each step can be set and checked. When finishing programming, press EDIT key once and get out of programming mode and the guiding traverse will reposition the starting position and go into READY mode.

4.5. Clear all winding parameter

In the READY mode, press EDIT CLR − ENT will clear all the winding parameter in the memory. Be cautious in using this function or all the data will be lost

5. WINDING METHOD SELECTION

Prior to winding, the general winding principles are explained below so the operators can have a better understanding of the performance of the controller and make better use of it.

5.1. Absolute counting

Using absolute counting, winding spindle shaft is capable of fixed-point stopping. Upon each restart, the turn count will reset only the integer portion of the turn's number to zero, with the decimal unchanged. For example, for a previous number of 100.3 turns, when restarting the next winding, the counting will start with 0.3 turn to avoid accumulation of spindle shaft free play error from consecutive windings. This counting method may cause insufficient winding by one turn, (e.g., a new winding starting from **0.9**) Therefore, when starting from **0.5~0.9**, the winding spindle shaft will turn to the **0.0** before it starts counting.

5.2. Relative counting

This counting method zeros the counter upon each restart, therefore it is easy to understand and will not cause insufficient winding.

5.3. Interlace wire-guiding

If the『WIDTH』of the step is zero, the wire-guiding becomes interlace mode. When it begins winding, the wire-guiding will follow the wire direction to proceed two wire diameters and regress one wire diameters cyclically until the step of winding ends. This mode especially suits the inductor winding.

5.4. Non wire-guiding

Sometimes, the winding device may be used to winding adhesive tapes or copper foil. When the wire-guiding is not needed, 『PITCH』may be adjusted to zero and the wire-guiding won't be move.

5.5. Continual mode

Before it begins winding, if『SHIFT』of the step set as 999.99, then the starting position, the width , the wire-guiding direction and the winding direction won't be re-read. The values are not changed, that is the wire guiding will continue guiding wires on the same position. The width and left-right margins are the same as the ones of the previous section. Both the wire-guiding and winding directions are not changed either. This mode especially suits to winding which have the multiple drawing tops in the same sets of coils.

5.6. Edges slow mode

If the winding mode selection (7.1.) selected Edge slow mode, the winding speed will

slow down before the guiding traverse reach to the two edges of the width (work with 『E. SLOW』 turns). After the guiding traverse veered, then restore to hi-speed winding.

5.7. Automatically circularly mode

If AUTO key set to on, it means Automatically circularly mode, in this mode when finish a step of winding it will automatically get into next step and start winding without press START key (work with AUTO START and AUTO HOME keys).

5.8. How to Correct setting turns

◆ **Preset method：**

Set the 『E.SLOW』 to zero first and then set the 『TURNS』 to the desired number. Set proper parameters according to copper wire, bobbin, tension, etc, then press START to start winding. When finished, obtain the actual number of turns and calculate the number of overshot turns. Go into programming mode and subtract the number of the overshot turns from the 『TURNS』 to obtain the required setting.
This method has a higher throughput, however, the resulting stopping location may not be precise.

◆ **High-Low speed method：**

This method uses a combination of 『H.S』/『L.S.』and 『E.SLOW』to achieve the desired number of turns.
The『L.S.』 should not be too high. The number of 『E.SLOW』turns must be adequate to allow the spindle shaft to slow down to low speed before reaching the total number of turns. This can result in precise stopping location.

◆ **Double-brakes method：**

As the winding turns of the winding shaft reach the numbers of the『E.SLOW』, brake for a short period first. After the winding shaft stops, continue winding at low speed. Therefore the numbers of the slow speed may be reduced and the efficiency of winding may be increased.

6. WINDING EXECUTION

6.1. To start winding

After set up all data items, press START key, the winding process begins in accordance with the set-up content. Press STOP key to pause winding.

The following key functions are available during PAUSE mode:

PREV IOUS ： Give up the numbers of the winding turns and regress one step.

NEXT ： Finish current step and proceed to next step.

START ： Continue winding.

RESET ： Give up winding and go back to the READY mode.

6.2. To switch the winding speed

During winding, press the 0 key, the winding speed can be switch between high speed and low speed.

6.3. To change the display mode

During winding or during PAUSE mode, press DATA SEL key, the DATA DISPLAY can be change the display mode between turns or guiding traverse position.

6.4. Winding speed (RPM) display

Pressing RPM key will cause the PIECE COUNT DISPLAY to display the spindle shaft RPM without interrupting the counting. Pressing RPM again will change the PIECE COUNT DISPLAY back to displaying the piece count.

6.5. Piece counter management

Upon turning on the POWER SWITCH, PIECE COUNT DISPLAY will shows the number of piece produced. During wining, each time the CONTROLLER goes from the START STEP to the END STEP, the piece counter will automatically increase by one.

◆ **Preset piece counter：**

In READY mode, press QTY SET key once and key in desired values 0~99999 followed by the ENT key. When the PIECE COUNTER reaches the preset value, the FINISH led will lit. [Setting range 0~99999].

◆ **Decrease piece counter：**

During READY or PAUSE mode, press the − key and hold down for two seconds the piece counter will decrease by one.

◆ **Reset piece counter：**

In any time holding down ZERO key for two seconds, it will set the piece counter to zero.

7. CONFIGURATION SETTING

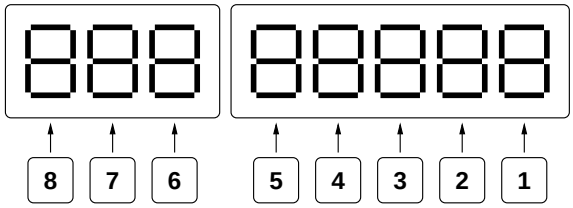
CNC-210S is a multi-purpose design, to meet various requirements; additional settings are configured to provide flexibility for additional applications.

In the READY mode, press the following keys combination as section 7.1. ~7.9, the DATA DISPLAY will show corresponding setting value. If no change is necessary, press the ENT key get back to READY mode. Or press − key to get into change mode, then the parameter can be changed by pressing the numerical key followed by the ENT key.

7.1. Winding mode selection EDIT DATA SEL 0

In this function the STEP display and the DATA display will shows eight digits, representing eight winding mode selections respectively.

Press numerical keys as below can change each digit.



1 **Moving speed**：The speed at which the guiding traverse is moving to the starting position or returning to the home position.

0 represents high speed**; 1** represents low speed.

Press 1 to select.

2 **Moving increment**：This is travel increment of the guiding traverse.

1 represents 0.01mm.

The guiding traverse moves 4 mm per revolution of the stepping motor.

2 represent 0.02mm.

The guiding traverse moves 8 mm per revolution of the stepping motor.

4 represent 0.04mm.

The guiding traverse moves 16 mm per revolution of the stepping motor.

Press 2 to select.

3 **Original Position**：select the zero point of the winding spindle shaft.

0 represents with zero point and using absolute counting mode.

1 represents without zero point and using relative counting mode.

Press 3 to select.

4 **Edge slow**：Slow down the winding speed before the guiding traverse reach to the two edges of the width.
0 represents not slow down**; 1** represents to slow down.
Press 4 to select.

5 **Braking mode**：The SINGLE MODE is to brake until the end of each winding step. The DOUBLE MODE is to brake a short period when the turns number match the E.SLOW turns, then winding to the end by LOW speed, and brake another time to finish the step.
0 represents single brake mode**; 1** represents double brake mode.
Press 5 to select.

6 **Counting unit**：you can choose 0.1 or 1 turns as your count unit. After you choose it, the TURNS, S.SLOW and E.SLOW, will use it as their basic unit.
0 represents **0.1**(0.0 to 9999.9 turns); **1** represents **1**(0 to 99999 turns).
Press 6 to select.

7 **Guiding traverse unit**：The Guiding traverse unit can be set by using mm or inch. After you choose it, the SHIFT, WIDTH and PITCH, will use it as their basic unit.
0 represents **mm; 1** represents **inch** (must using lead screw in imperial).
Press 7 to select.

8 **Starting mode**：There are two different mode to be select**:**
Single start mode**:** When press the foot switch, the motor start winding, and when you release the foot switch, the motor stop winding immediately. Double start mode: When press the foot switch, the motor start winding, and if you want to pause the motor, you have to release the foot switch then press it again.
0 represents Single start mode**; 1** represents Double start mode.
Press 8 to select.
The START key on the front panel always as the Double start mode.

7.2. Station number EDIT DATA SEL 1

Set the station number of the winding machine controller. This number is used to identify the station when using RS-485 communication function. Up to 32 stations can be operated on the same network. [Setting range 01~99].

7.3. Password EDIT DATA SEL 2

This password is used to protect the setting data in memory. After you set this password, you cannot change any winding parameter and configuration data in normal sequence. You have to key in four numbers of password before press the EDIT, START STEP, END STEP, QTY SET keys. If the password has been passed once, you can change any data in normal sequence until you turn off the power or press RESET key. You must to remember the password or you cannot change any data. [Setting range 0000~9999]. Set 0000 means no password.

7.4. Travel limit EDIT DATA SEL 3

Set the maximum travel distance of guiding traverse. During winding if the guiding traverse reaches this position, the motor stop winding immediately, and the DATA DISPLAY shows error massage, then RESET and go back to the READY mode. [Setting range 000.00~999.99]. 999.99 Means no limit.

7.5. Fixed location EDIT DATA SEL 4

To set how often, must be correct the guiding traverse location. Each time when finish this number of product pieces, the guiding traverse will moves to the home position to correct the location before moving to starting position.
[Setting range 00~ 99]. Set 00 means not to do this function.

7.6. Limited winding speed EDIT DATA SEL 5

This value is to limited winding speed and make sure the winding spindle shaft and guiding traverse are in synchronization. The controller uses this value to calculate with wire PITCH of current step, and then to limited maximum winding speed of current step.
[Setting range 0~ 99999]. Set 0 means not to do this function.

7.7. Brake holding time EDIT DATA SEL 6

To set the hold times for brake. [Setting range 0.1~9.9 sec].

7.8. Guiding traverse moving speed selection EDIT DATA SEL 7

The speeds at which the guiding traverse moving to the starting position and returning to the home position. [Setting range 0~9].

7.9. Winding spindle control mode selection EDIT DATA SEL 8

To select the out put mode of winding spindle shaft control interface.
0 represents the output signal CW=forward run/stop, CCW=reverse run/stop.
1 represents the output signal CW=run, CCW= forward/reverse

7.10. Reset all configuration data EDIT CLR 0 ENT

In READY mode press EDIT CLR 0 ENT keys, it will reset all the configuration data and

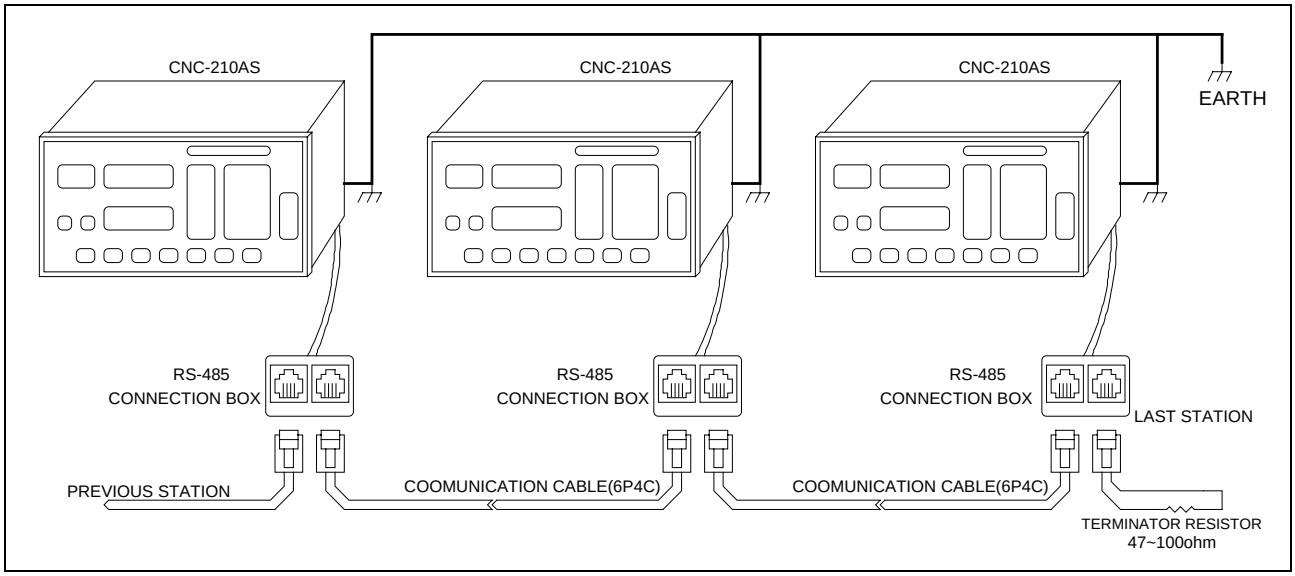
replace by initial data. Be cautious in use this function.

7.11. Data transmit

The CNC-210EXD has a RS-485 serial communication interface, can be used to send the winding data to the others station. Up to 32 stations can be operated on the same bus.

In this function, set station numbers to the controllers to recognize the controller to which the current data is being send. (See section 7.2. to set the station numbers.)

The communication bus wiring diagram as below：



In READY mode press following keys combination, its will sent each setting data to target station.

EDIT COPY 0 00~99 ENT ：Sends configuration setting data to the specify station.
EDIT COPY 1 00~99 ENT ：Sends winding parameters to the specify station.
EDIT COPY 2 00~99 ENT ：Sends password to specify station.

It will sends from START STEP to END STEP, during sent the winding parameters,
00~99 Represents target station number. If the target station number specify as “00,” all the stations on the same bus will receive the data is being sent.

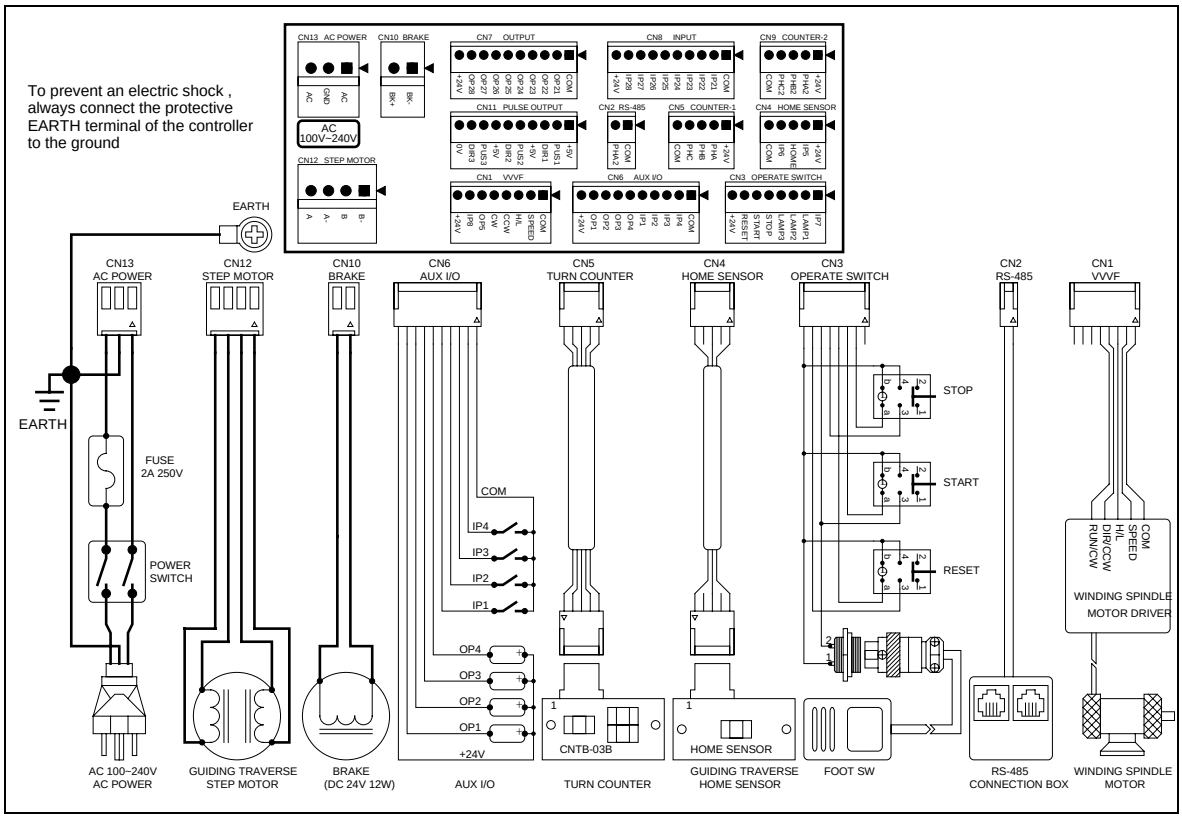
8. INSTALLATION AND WIRING

- ◆ The controllers should be operated in an environment that is protected from moisture, corrosive gases, or liquid, and free from airborne dust, metallic particles, and magnetic noise.
- ◆ Do not block the intake/exhaust ports of the controller. Otherwise, a fault may occur.
- ◆ Make sure that the power source supplies the correct voltage and is capable of supplying the required current to the controllers.
- ◆ Do not connect or disconnect wires and connectors while power is applied to the controller.
- ◆ Make sure the machine and controllers are properly grounded.
- ◆ Make sure that the leads and connectors are connected correctly.
- ◆ Normally operate under 10℃ ~ 40℃ environment**;** over 40℃ should perform under good ventilation, avoid heating.

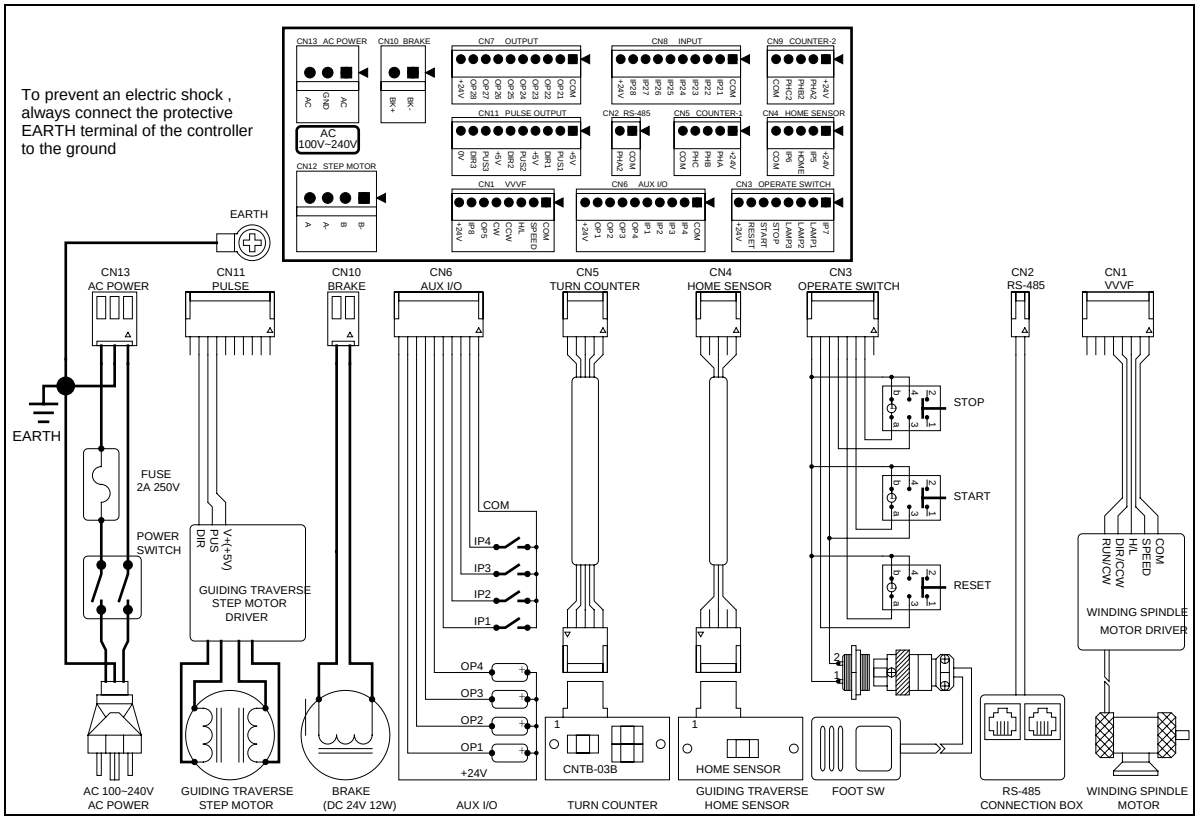
8.1. Accessories and options

NAME	CNC-210EXD1	CNC-210EXD2	NOTE
CN1 Winding spindle control signal cable	*	*	
CN2 RS-485 Connection box & cable			
CN3 Operate switches connection cable	*	*	
CN4 Home sensor cable	*	*	
HSB-01A Home sensor	*	*	
CN5 Counting sensor cable	*	*	
CNTB-03B Counting sensor	*	*	
DISC counting disc	*	*	
CN6 Aux I/O signal connection cable			
CN7 Extension I/O signal cable			
CN8 Extension I/O signal cable			
CN9 Extension I/O signal cable			
CN10 Brake connection cable	*	*	
CN11 Guiding traverse control signal cable		*	
CN12 Step motor connection cable	*		
CN13 AC Power connection cable	*	*	
Operate switches (START、STOP、RESET)			
Foot switch			
Power cord			
Power switch			
Fuse holder			
RS-485 Communication cable			

8.2. Wiring diagram for CNC-210EXD1

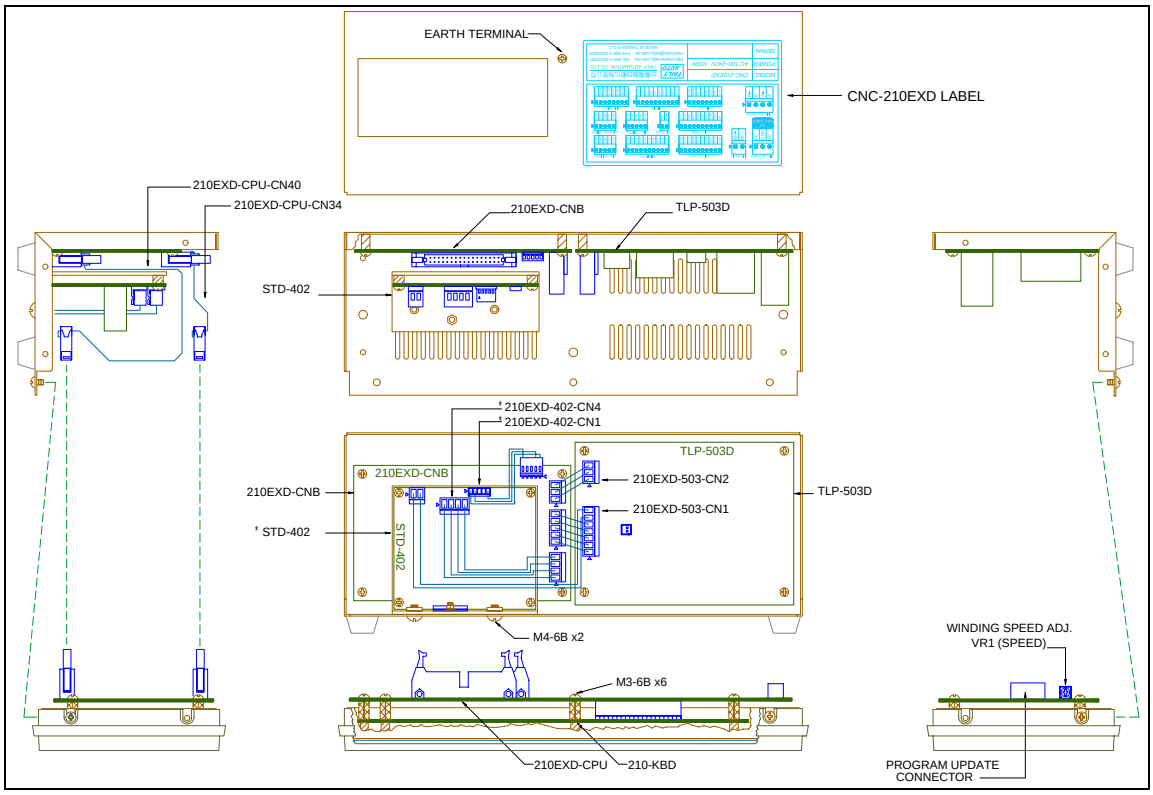


8.3. Wiring diagram for CNC-210EXD2



9. MAINTAIN AND TROUBLESHOOTING

9.1. Internal parts and wire connection



9.2. Periodically maintain

- ◆ Please periodically clean up the controller inner accumulate dust and dopants.
- ◆ Please periodically check the wire connection between controller and machine if have loose or bad contact.
- ◆ The following parts must be maintained or changed periodically as list below. If any part is found faulty, it must be changed immediately even when it has not yet reached the end of its life, which depends on the operating method and environmental condition.
- ◆ For parts replacement, please contact your sales representative.

NO	Parts name	Life guideline
1	Winding spindles Turns counter **CNTB-03B/03C**	2 years
2	Guiding traverses **HOME SENSOR**	2 years

9.3. Error message

When a fault occurs during operation, the DATA DISPLAY shows error massage, stop winding and then RESET go back to the READY mode.

Err-0： The parameters or data in memory are fault.
Err-1： The 『SHIFT』value sets exceed the Travel Limit.
Err-2： During winding, the guiding traverse exceed the Travel Limit.
Err-3： During winding, the guiding traverses reach to the Home sensor.
Err-5：RS-485 communication error.

9.4. Troubleshooting

This section provides information to guide the user in understanding different fault condition and their general troubleshooting procedures, and with their possible solutions.

- ◆ Do not connect or disconnect wires and connectors while power is applied to the controller.
- ◆ Make sure that the leads and connectors are connected correctly, before doing the troubleshooting procedures.
- ◆ Do not remove welded parts on the PC board without appropriate tools.

NO	Fault Description	Correctives Action
1	Power ON, but the display shows nothing.	**a.** Check AC power input. **b.** Check the LED lamp on TLP-503D power supply, if not lit replace TLP-503D **c.** Replace 210EXD-CPU.
2	Power ON, but the display shows confusion massage,	**a.** Replace 210EXD-CPU.
3	Power ON, but winding spindle didn't rotate, or cannot stop rotation, And controller cannot get into ready mode.	**a.** Press STOP to make the controller get into READY mode. **b.** Check the winding parameter『L.S.』setting value of START STEP, **c.** Check the wire connection between controller and motor driver of winding spindle. **d.** Replace turns counter CNTB-03B. **e.** Replace 210EXD-CPU.
4	Power ON, but guiding traverse didn't move or cannot stop moving, And controller cannot get into ready mode.	**a.** Press STOP to make the controller get into READY mode. **b.** Replace HOME SENSOR. **c.** Replace STD-402 step motor driver. **d.** Replace 210EXD-CPU.

NO	Fault Description	Correctives Action
5	Cannot edit parameters.	**a.** Check the READY LED lamp if not lit, do procedures number 3 and 4. **b.** Key in four numbers password before edit, if the password has been set before. **c.** Replace 210-KBD. **d.** Replace 210EXD-CPU.
6	Display shows Err-0, then reset, and get into READY mode.	**a.** Replace 210EXD-CPU.
7	Display shows Err-1/Err-2 then reset and get into READY mode.	**a.** Check winding parameters 『SHIFT』and 『WIDTH』setting value. **b.** Check configurations 『TRAVEL LIMIT』setting value.
8	Display shows Err-3, then reset, and get into READY mode.	**a.** Check winding parameters 『SHIFT』and 『WIDTH』setting value. **b.** Replace HOME SENSOR.
9	Display shows Err-5.	**a.** Check wire connection of RS-485 connection box. **b.** Check wire connections between two stations.
10	Brake failure.	**a.** Check wire connections of brake. **b.** Replace brake. **c.** Replace 210EXD-CPU
11	Winding spindle can not switching winding direction.	**a.** Check configurations 『 Winding spindle control mode selection 』setting value. **b.** Check the wire connection between controller and motor driver of winding spindle. **c.** Replace 210EXD-CPU.
12	Counting failure.	**a.** Replace turns counter CNTB-03B. **b.** Replace 210EXD-CPU.
13	Guiding traverse moves half pitch or double pitch.	**a.** Check Configurations『Moving increment』setting value.