

MULTI-ANGLE BALL SORTER

Supplemental Operating Instructions



- Supplemental manual for use with IB-E04F Control Cards
- Read this manual before use
- Please refer to all safety, installation and maintenance instructions in the Multi-Angle Ball Sorter (MABS) User Manual before using this product.
- The MABS User Manual can be found at: <https://itohdenki.com/wp-content/uploads/MABS-Manual.pdf>

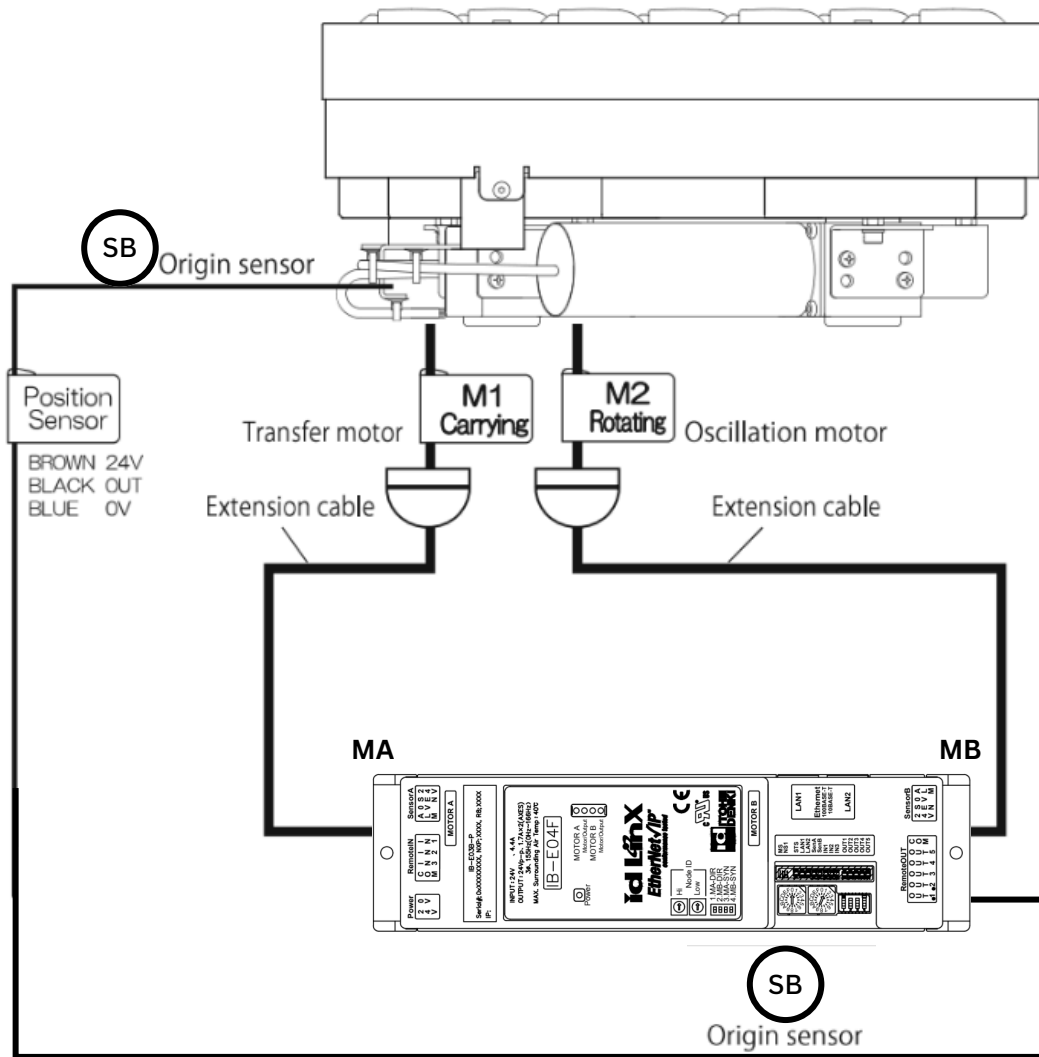
Specifications subject to change without notice

Revised 4/18/2024

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CONNECTING THE MABS2 TO THE IB-E04F:

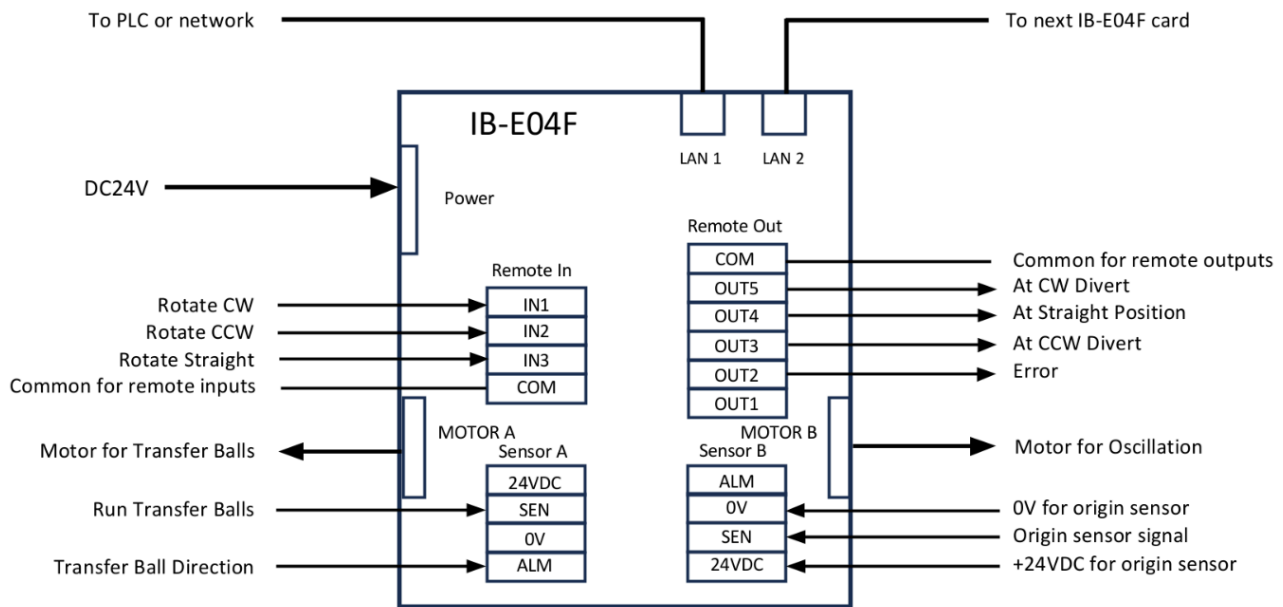
- Refer to the labels for cables coming from the MABS2 main unit, and securely connect the motor connectors and extension cables to the controller.



Supplemental Operating Instructions

FOR HARDWIRED CONTROL:

- For hardwired control, follow the diagram below for the first IB-E04F card.
- Each additional card will need to have the 24V DC power, LAN connections, motor A and motor B cables and the origin sensor connected. The other signals are optional depending on the feedback desired for the application.

**FOR NETWORK CONTROL:**

- For network control, connect the 24V DC power, LAN connections, motor A and motor B cables and the origin sensors for all of the cards.

Supplemental Operating Instructions

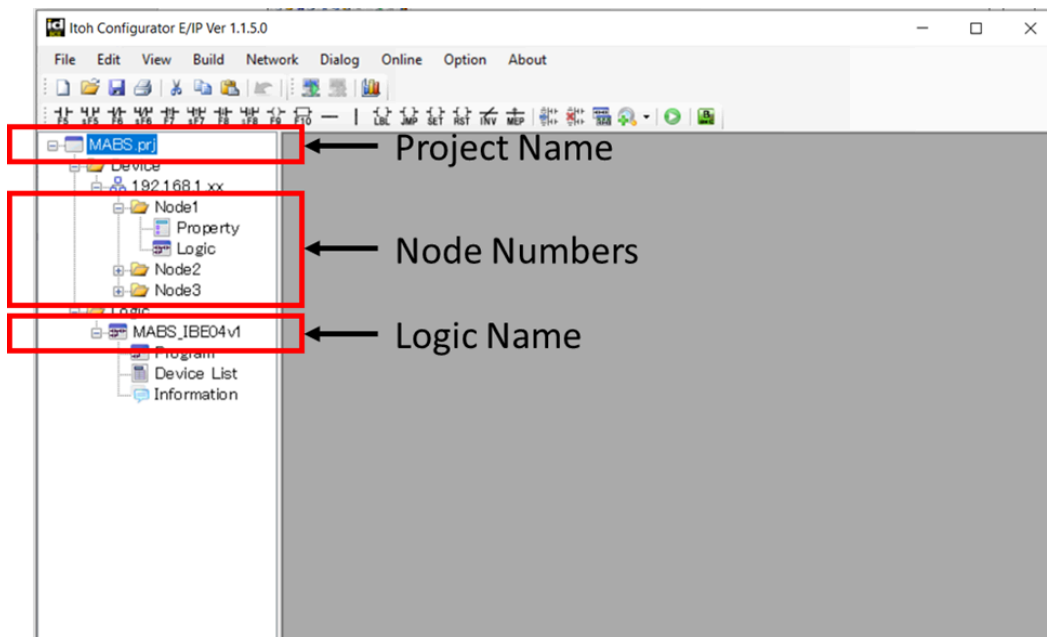
FOR HARDWIRE AND NETWORK CONTROL:

- The tags listed in this document refer to the Module Defined tags created when an IB-E04F is added to a Rockwell Automation ControlLogix or CompactLogix PLC project using Studio 5000 software.
- For non-Rockwell Automation PLCs refer to the IB-E04F manual at <https://itohdenki.com/wp-content/uploads/IB-E-Manual.pdf>

| PIN | I/O | Tag | Description | Details |
|-----|--------------|--------------------------------|--------------------------|--|
| | Motor A | | For Transfer | M1: Carrying (specified on the motor cable) |
| | Motor B | | For Oscillating | M2: Rotating (specified on the motor cable) |
| #2 | Sensor A SEN | Module_Name:O1.D_OutData[0].0 | Transfer Ball RUN | Signal to run transfer balls (transfer from upstream to downstream) |
| #4 | Sensor A ALM | Module_Name:O1.D_OutData[0].1 | Transfer Ball DIR | Signal to switch the rotation direction of the transfer balls |
| #2 | Sensor B SEN | Module_Name:I.D_InData[0].0 | Origin Sensor Input | ON when the transfer balls are in the straight direction |
| #1 | RemoteIN 1 | Module_Name:O1.D_OutData[1].0 | Rotate CW | Signal to rotate the balls in a CW direction |
| #2 | RemoteIN 2 | Module_Name:O1.D_OutData[2].0 | Rotate CCW | Signal to rotate the balls in a CCW direction |
| #3 | RemoteIN 3 | Module_Name:O1.D_OutData[3].0 | Rotate Straight | Signal to rotate the balls to the straight direction |
| #4 | COM | | Input COM | Common for remote inputs (0V for PNP, 24V DC for NPN) |
| #2 | RemoteOUT 2 | Module_Name:I.D_InData[0].3 | Error Output | Output is active if there is an error on the unit |
| #3 | RemoteOUT 3 | Module_Name:I.D_InData[0].1 | At CW Divert | Output is active when the balls are in the CW divert position |
| #4 | RemoteOUT 4 | Module_Name:I.D_InData[0].0 | At Straight Position | Output is active when the balls are in the straight position |
| #5 | RemoteOUT 5 | Module_Name:I.D_InData[0].2 | At CCW Divert | Output is active when the balls are in the CCW divert position |
| #6 | COM | | Output COM | Common for remote outputs (24V DC for PNP, 0V for NPN) |
| | | Module_Name:O1.D_OutData[15].0 | Disable Hardware Control | Disables hardwire control signals when controlling the MABS from a PLC |

SETTINGS FOR HARDWARE CONTROL:

- Refer to the instructions in the IB-E03B, IB-E04F, and Itoh Configurator E/IP Software manual (<https://itohdenki.com/wp-content/uploads/IB-E-Manual.pdf>) to set the IP address on the IB-E04F cards and open the MABS sample project using the Itoh Configurator for E/IP.
- Itoh Configurator for E/IP software can be downloaded at <https://itohdenki.com/wp-content/uploads/ICE-Ver1.1.5.0-setup.zip>
- After opening the project and expanding the Device and Logic folder, the following information should be shown:
 - Project Name – MABS.prj
 - Node Numbers – Nodes 1-3 are in the project. Nodes can be added or deleted as needed.
 - Logic Name – MABS_IBE04v“x”



Supplemental Operating Instructions

MOTOR SETTINGS:

- Expand the folders for the first node on the left side of the main screen. Double click on **Property**.
- On the Motor tab for Roller Setting MA and Roller Setting MB, set the motor type to “Other”.
- Set the Roller Diameter for Roller Setting MA to 2.52”.
- Set the Gear Reduction to 5.0.
- Set the Roller Diameter for Roller Setting MB to 3.43”.
- Set the Gear Reduction to 53.59.
- Set the Motor Current Limit for Roller Setting MA and Roller Setting MB to 7A.
- Double click on the IP address for the rest of the nodes and complete the settings for each one.

Property Setting

Select Address: 192.168.1.1

Logic: MABS_IBE04v1

Read Logic DnL ALL Logic UpL

Write OK Cancel ☐ Logic backup

Master 192.168.1.1

Master 192.168.1.2

Master 192.168.1.3

PLC

Motor Error/Network Acceleration/Deceleration Timer Counter Pulse Counter

Roller Setting MA

| | | |
|-----------------|-------|--------|
| Roller diameter | 2.52 | inch |
| Gear Reduction | 5.00 | |
| Speed1 | 200.0 | ft/min |
| Speed2 | 100.0 | ft/min |
| Speed3 | 100.0 | ft/min |
| Speed4 | 100.0 | ft/min |

Roller Setting MB

| | | |
|-----------------|-------|--------|
| Roller diameter | 3.43 | inch |
| Gear Reduction | 53.59 | |
| Speed1 | 75 | ft/min |
| Speed2 | 75 | ft/min |
| Speed3 | 75 | ft/min |
| Speed4 | 75 | ft/min |

Speed

☒ Per minute

☐ Per second

☐ RPM

IB-E Series

☐ IB-E01/03B

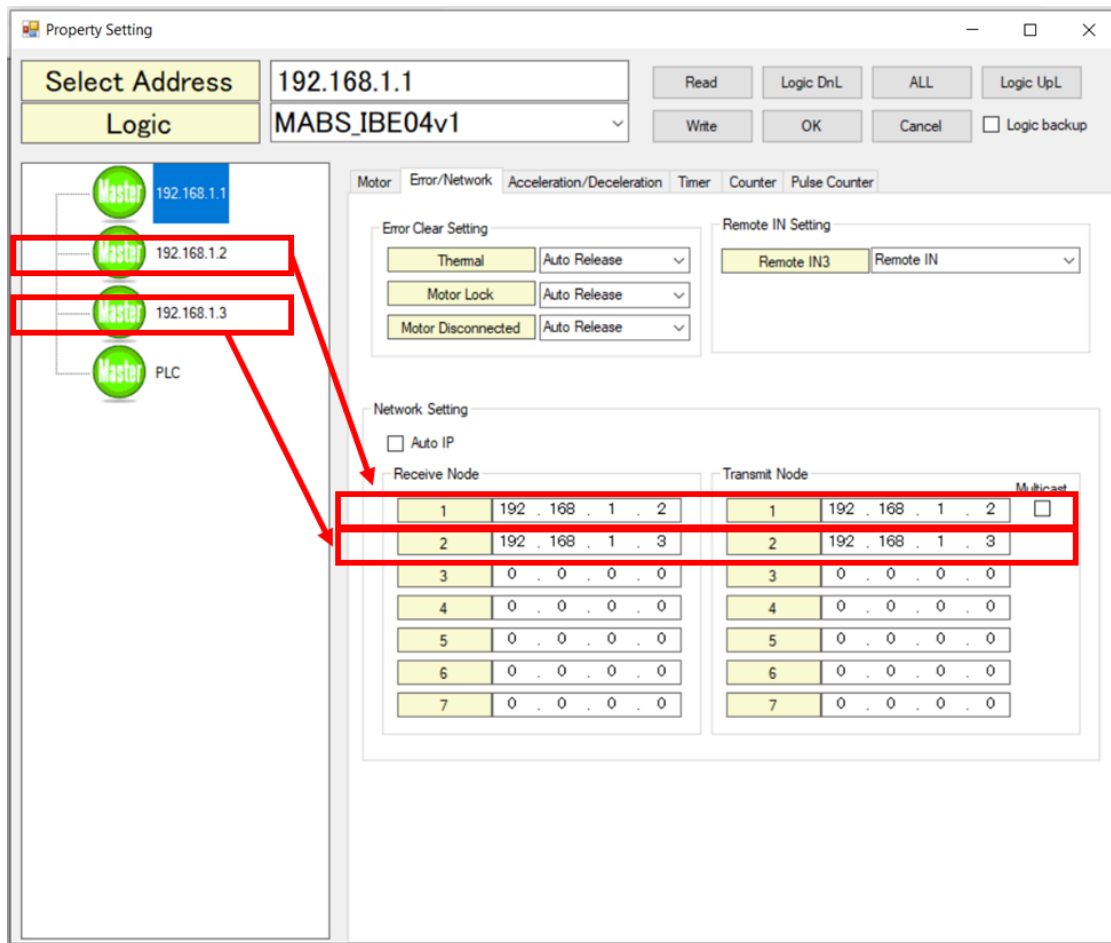
☒ IB-E02/04F

☐ IB-E04xxFT

| Name | MA | MB |
|---------------------------|---------|---------|
| Sensor Setting | dark | dark |
| Sensor Alarm Setting | dark | dark |
| Motor Type | Other | Other |
| Direction | CW | CW |
| Motor Complementary | Disable | Disable |
| Gear Stage | 2-stage | 2-stage |
| Mechanical Brake | Normal | Normal |
| Brake | Dynamic | Dynamic |
| Motor Port Setting | Motor | Motor |
| Motor Lock Timeout | 1.0sec | 1.0sec |
| Servo brake Current Limit | 1.0A | 1.0A |
| Motor Current Limit | 7.00A | 7.00A |
| PCB Thermal Alarm Set | 95 | 95 |
| PCB Thermal Alarm Clear | 90 | 90 |

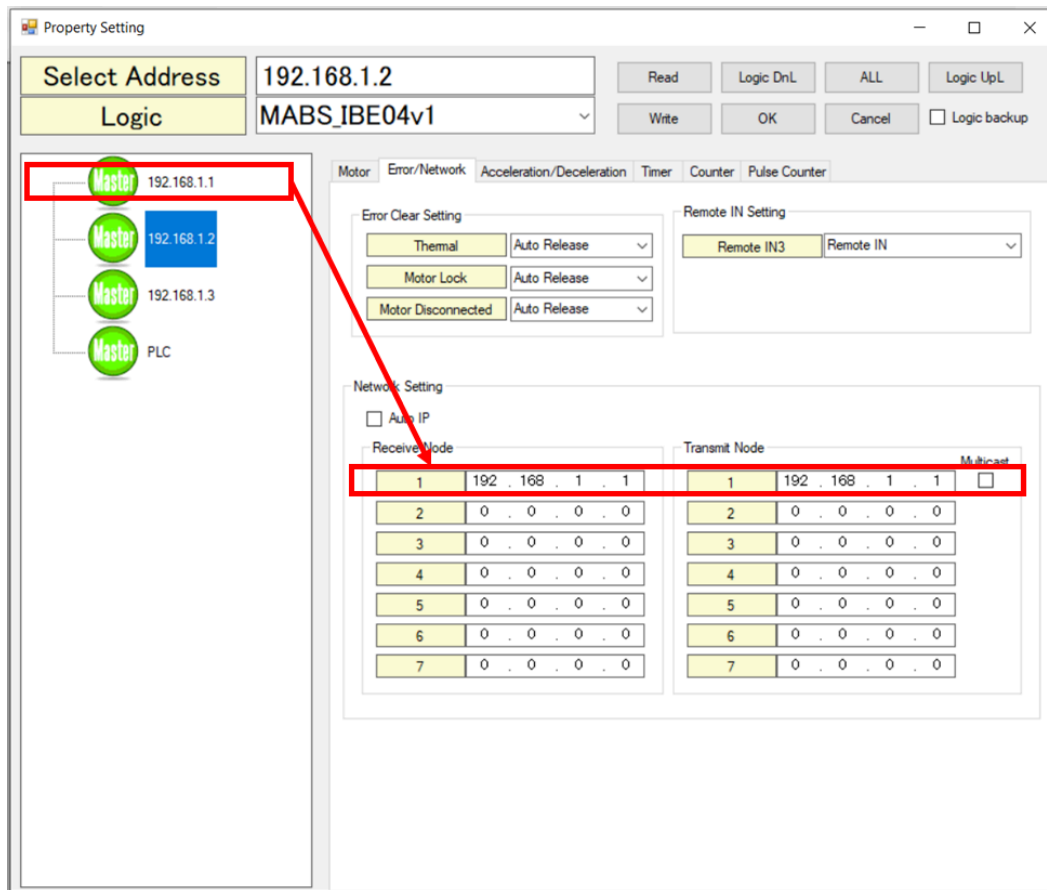
NETWORK COMMUNICATION SETTINGS:

- The cards need to be set up to communicate with each other. Double click on Property for the first (Upstream) node on the main screen.
- Click and drag the green circle next to the node for the second MABS unit to the Receive Node and Transmit Node for connection 1.
- Drag the green circle for the node for the third MABS unit to the Receive Node and Transmit Node for connection 2.



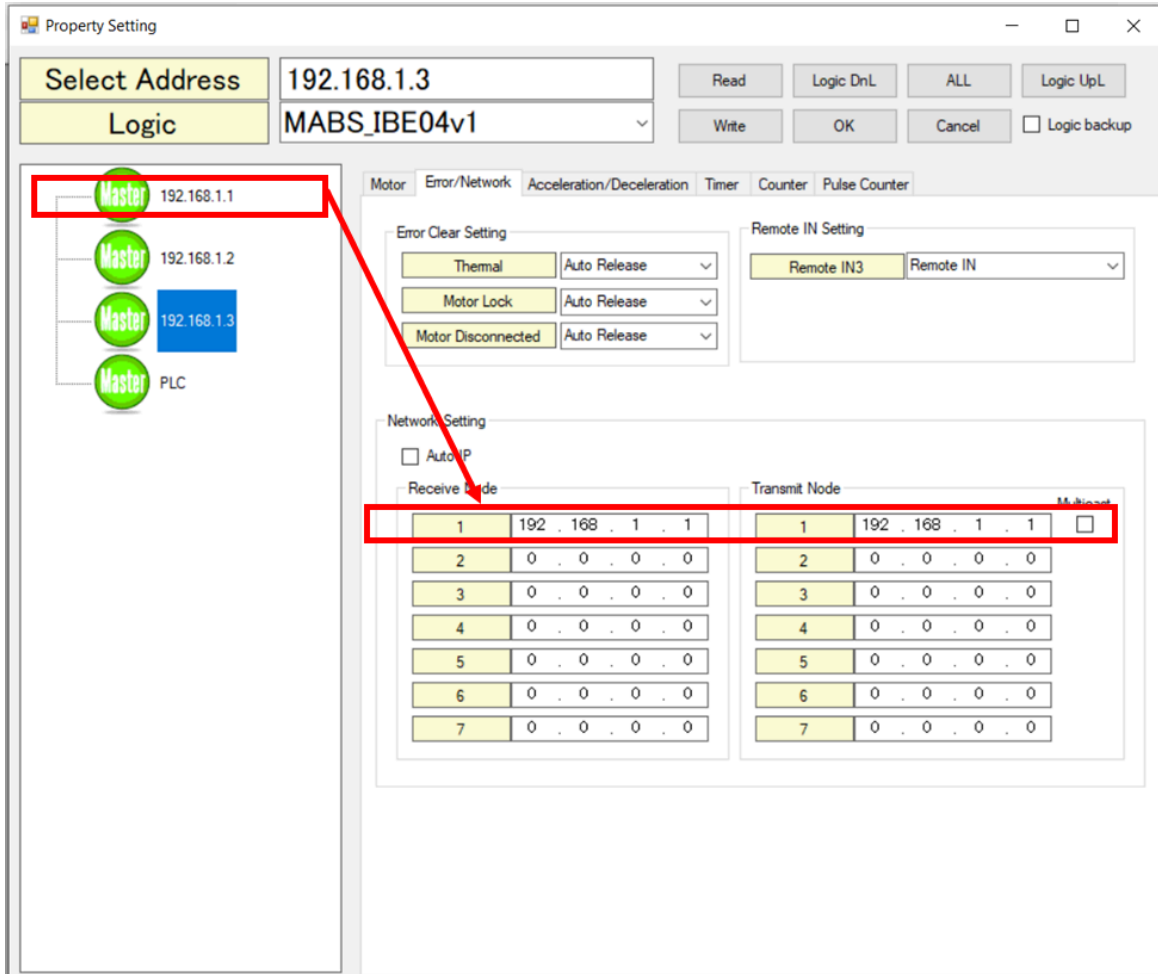
NETWORK COMMUNICATION SETTINGS (CONT):

- Double click on the IP address for the second node on the left side of the screen.
- Drag the green circle next to the IP address for the first node to the Receive Node and Transmit Node for connection 1.



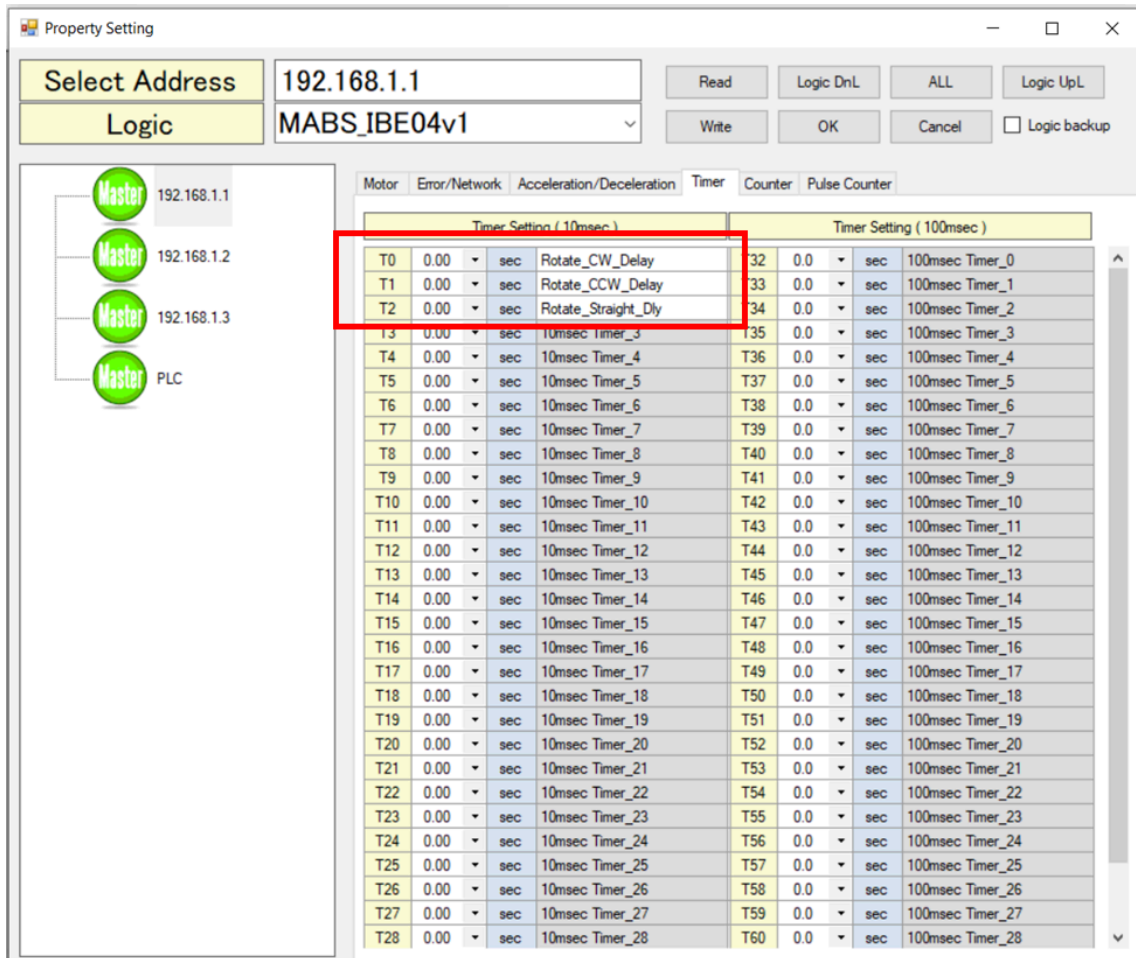
NETWORK COMMUNICATION SETTINGS (CONT):

- Double click on the IP address for the third node on the left side of the screen.
- Drag the green circle next to the IP address for the first node to the Receive Node and Transmit Node for connection 1.



START DELAY TIMERS FOR BALL ROTATION:

- The rotation of the balls can be delayed if desired by setting the values of T0, T1 and T2 using the drop-down menu.



| Timer | Timer Name | Timer Description |
|-------|-----------------------|---|
| T0 | Rotate_CW_Delay | Used to set a delay before turning the balls clockwise from the straight position |
| T1 | Rotate_CCW_Delay | Used to set a delay before turning the balls counter-clockwise from the straight position |
| T2 | Rotate_Straight_Delay | Used to set a delay before turning the balls from counter-clockwise or clockwise to the straight position |

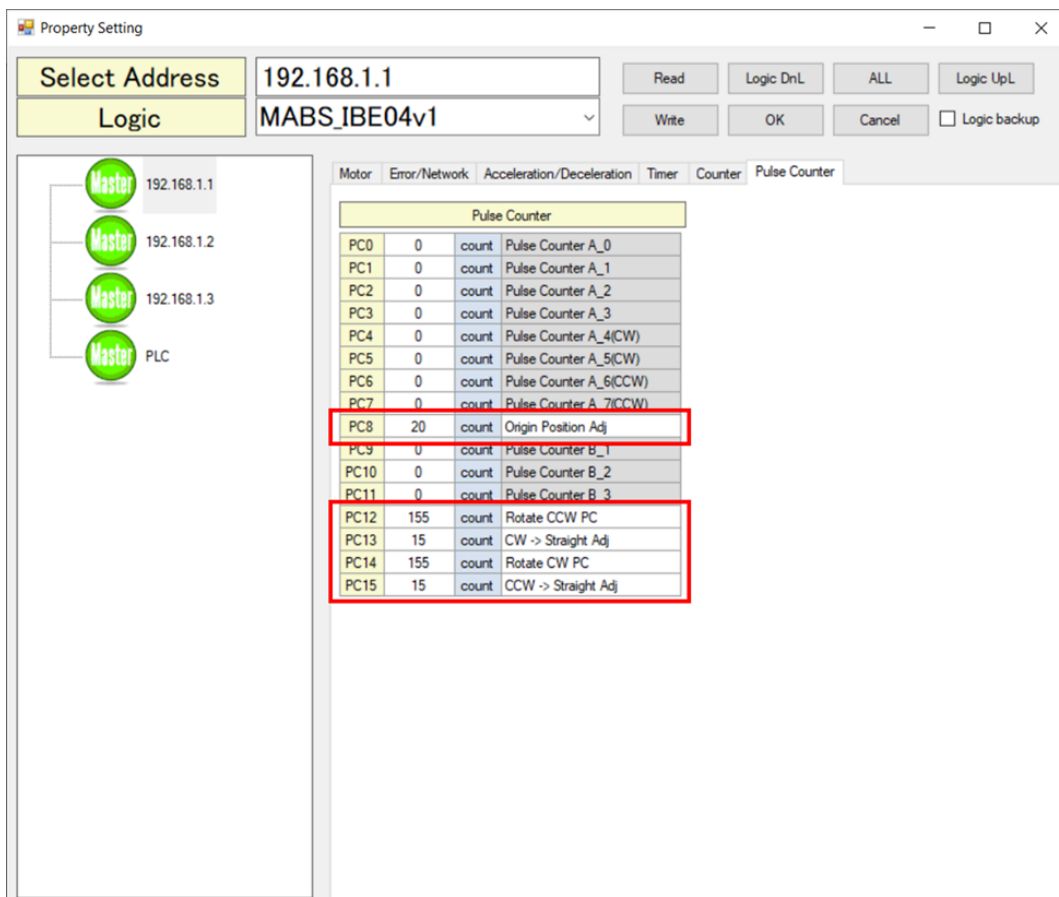
Supplemental Operating Instructions

PULSE COUNTER SETTINGS:

- The degree of rotation of the balls is determined by the number of pulses returned from the motor to the IB-E04F. Five pulse counters are available to tune the angle of rotation. The speed of rotation may affect the degree of rotation due to how fast the logic sees the origin sensor.
- The reference values for the number of pulses of CW/CCW rotation for various degrees of rotation are below:

| At 55 FPM | Angle (°) | Pulses |
|--------------|-----------|--------|
| Origin (PC8) | 0 | 10 |
| | 30 | 55 |
| | 60 | 105 |
| | 90 | 155 |

- These values are for approximate and each MABS unit will need to be adjusted individually.



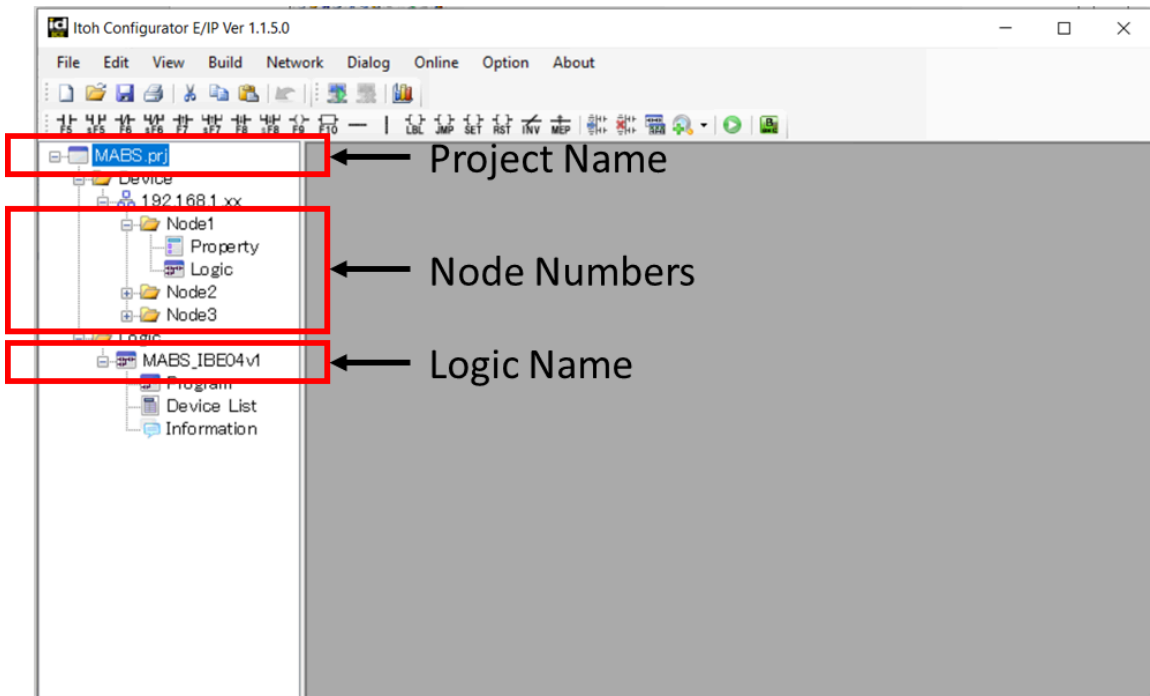
PULSE COUNTER SETTINGS (CONT):

| Pulse Counter | Pulse Counter Name | Pulse Counter Description |
|---------------|---------------------|--|
| PC8 | Origin Position Adj | Used to adjust the distance the balls move after the leading edge of the origin sensor is detected during the initialization process |
| PC12 | Rotate CCW PC | Used to set the number of pulse the balls will rotate in the CCW direction |
| PC13 | CW -> Straight Adj | Used to adjust the distance the balls move after the leading edge of the origin sensor is detected when the balls are rotating from the CW to the straight position |
| PC14 | Rotate CW PC | Used to set the number of pulse the balls will rotate in the CW direction |
| PC15 | CCW -> Straight Adj | Used to adjust the distance the balls move after the leading edge of the origin sensor is detected when the balls are rotating from the CCW to the straight position |

- Complete the settings for all nodes and click OK when finished.
- See the section titled *Downloading the project (hardwire and network control)* for instructions to download the project to the IB-E04F cards.

SETTINGS FOR NETWORK (PLC) CONTROL:

- Refer to the instructions in the IB-E03B, IB-E04F, and Itoh Configurator E/IP Software manual (<https://itohdenki.com/wp-content/uploads/IB-E-Manual.pdf>) to set the IP address on the IB-E04F cards and open the MABS sample project using the Itoh Configurator for E/IP.
- Itoh Configurator for E/IP software can be downloaded at <https://itohdenki.com/wp-content/uploads/ICE-Ver1.1.5.0-setup.zip>
- After opening the project and expanding the Device and Logic folder, the following information should be shown:
 - Project Name – MABS.prj
 - Node Numbers – Nodes 1-3 are in the project. Nodes can be added or deleted as needed.
 - Logic Name – MABS_IBEO4v“x”



MOTOR SETTINGS:

- Expand the folders for the first node on the left side of the main screen. Double click on Property.
- On the Motor tab for Roller Setting MA and Roller Setting MB set the motor type to “Other”.
- Set the Roller Diameter for Roller Setting MA to 2.52”.
- Set the Gear Reduction to 5.0.
- Set the Roller Diameter for Roller Setting MB to 3.43”.
- Set the Gear Reduction to 53.59.
- Set the Motor Current Limit for Roller Setting MA and Roller Setting MB to 7A.
- Double click on the IP address for the rest of the nodes and complete the settings for each one

Property Setting

Select Address: 192.168.1.1

Logic: MABS_IBE04v1

Read Logic DnL ALL Logic Up L

Write OK Cancel Logic backup

Motor Error/Network Acceleration/Deceleration Timer Counter Pulse Counter

Roller Setting MA

| | | |
|-----------------|-------|--------|
| Roller diameter | 2.52 | inch |
| Gear Reduction | 5.00 | |
| Speed1 | 200.0 | ft/min |
| Speed2 | 100.0 | ft/min |
| Speed3 | 100.0 | ft/min |
| Speed4 | 100.0 | ft/min |

Roller Setting MB

| | | |
|-----------------|-------|--------|
| Roller diameter | 3.43 | inch |
| Gear Reduction | 53.59 | |
| Speed1 | 75 | ft/min |
| Speed2 | 75 | ft/min |
| Speed3 | 75 | ft/min |
| Speed4 | 75 | ft/min |

Speed

☒ Per minute

☐ Per second

☐ RPM

IB-E Series

☐ IB-E01/03B

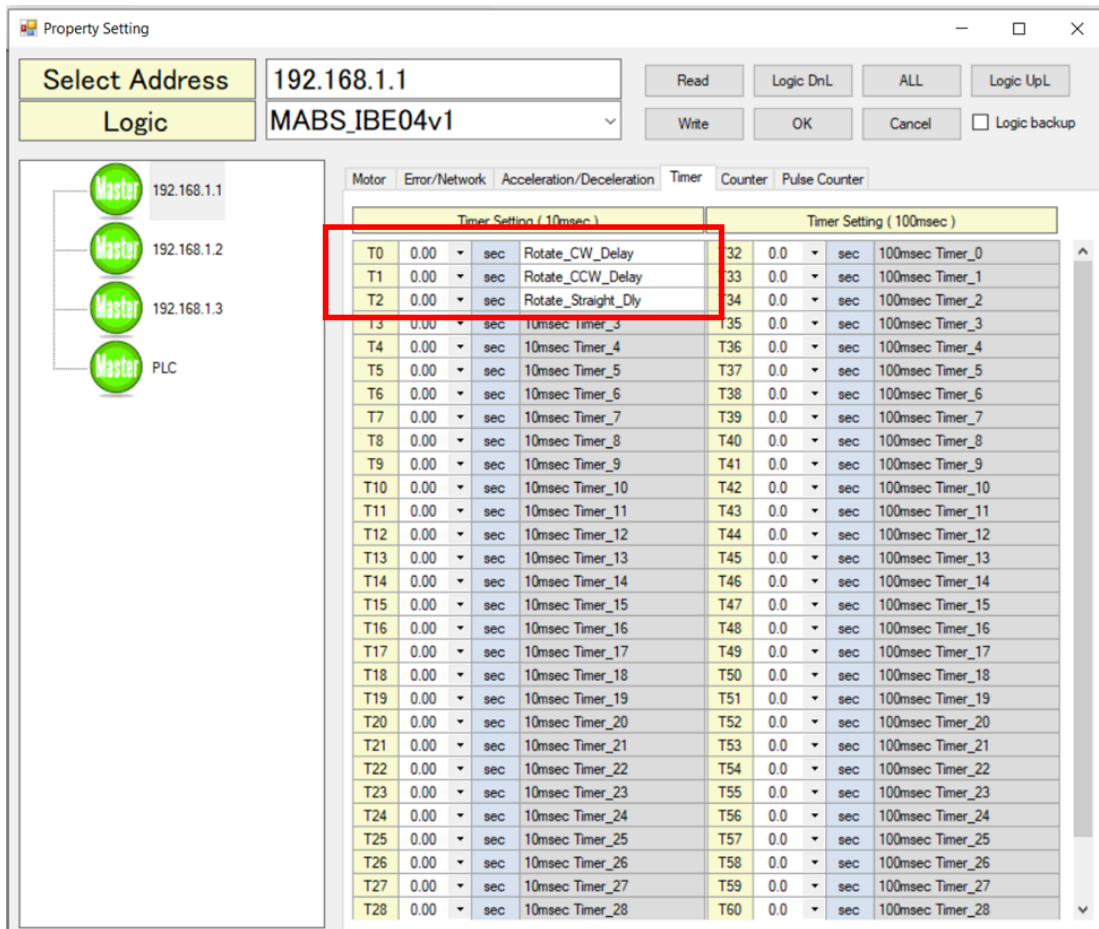
☒ IB-E02/04F

☐ IB-E04xxFT

| Name | MA | MB |
|---------------------------|---------|---------|
| Sensor Setting | dark | dark |
| Sensor Alarm Setting | dark | dark |
| Motor Type | Other | Other |
| Direction | CW | CW |
| Motor Complementary | Disable | Disable |
| Gear Stage | 2-stage | 2-stage |
| Mechanical Brake | Normal | Normal |
| Brake | Dynamic | Dynamic |
| Motor Port Setting | Motor | Motor |
| Motor Lock Timeout | 1.0sec | 1.0sec |
| Servo brake Current Limit | 1.0A | 1.0A |
| Motor Current Limit | 7.00A | 7.00A |
| PCB Thermal Alarm Set | 95 | 95 |
| PCB Thermal Alarm Clear | 90 | 90 |

START DELAY TIMERS FOR BALL ROTATION:

- The rotation of the balls can be delayed if desired by setting the values of T0, T1 and T2 using the drop-down menu.



PULSE COUNTER SETTINGS:

- The degree of rotation of the balls is determined by the number of pulses returned from the motor to the IB-E04F. Five pulse counters are available to tune the angle of rotation. The speed of rotation may affect the degree of rotation due to how fast the logic sees the origin sensor.
- The reference values for the number of pulses of CW/CCW rotation for various degrees of rotation are below:

| At 55 FPM | Angle (°) | Pulses |
|--------------|-----------|--------|
| Origin (PC8) | 0 | 10 |
| | 30 | 55 |
| | 60 | 105 |
| | 90 | 155 |

- These values are for approximate and each MABS unit will need to be adjusted individually.

Property Setting

Select Address: 192.168.1.1

Logic: MABS_IBE04v1

Buttons: Read, Logic DnL, ALL, Logic UpL, Write, OK, Cancel, Logic backup

Master 192.168.1.1
Master 192.168.1.2
Master 192.168.1.3
Master PLC

Motor | Error/Network | Acceleration/Deceleration | Timer | Counter | **Pulse Counter**

| Pulse Counter | | | |
|---------------|-----|-------|------------------------|
| PC0 | 0 | count | Pulse Counter A_0 |
| PC1 | 0 | count | Pulse Counter A_1 |
| PC2 | 0 | count | Pulse Counter A_2 |
| PC3 | 0 | count | Pulse Counter A_3 |
| PC4 | 0 | count | Pulse Counter A_4(CW) |
| PC5 | 0 | count | Pulse Counter A_5(CW) |
| PC6 | 0 | count | Pulse Counter A_6(CCW) |
| PC7 | 0 | count | Pulse Counter A_7(CCW) |
| PC8 | 20 | count | Origin Position Adj |
| PC9 | 0 | count | Pulse Counter B_1 |
| PC10 | 0 | count | Pulse Counter B_2 |
| PC11 | 0 | count | Pulse Counter B_3 |
| PC12 | 155 | count | Rotate CCW PC |
| PC13 | 15 | count | CW -> Straight Adj |
| PC14 | 155 | count | Rotate CW PC |
| PC15 | 15 | count | CCW -> Straight Adj |

PULSE COUNTER SETTINGS (CONT):

- Complete the settings for all nodes and click OK when finished.

| Pulse Counter | Pulse Counter Name | Pulse Counter Description |
|---------------|---------------------|--|
| PC8 | Origin Position Adj | Used to adjust the distance the balls move after the leading edge of the origin sensor is detected during the initialization process |
| PC12 | Rotate CCW PC | Used to set the number of pulse the balls will rotate in the CCW direction |
| PC13 | CW -> Straight Adj | Used to adjust the distance the balls move after the leading edge of the origin sensor is detected when the balls are rotating from the CW to the straight position |
| PC14 | Rotate CW PC | Used to set the number of pulse the balls will rotate in the CW direction |
| PC15 | CCW -> Straight Adj | Used to adjust the distance the balls move after the leading edge of the origin sensor is detected when the balls are rotating from the CCW to the straight position |

DOWNLOADING THE PROJECT

DOWNLOADING THE PROJECT (HARDWIRE AND NETWORK CONTROL):

- After all the settings are complete, the project can be downloaded to the IB-E04F cards. Use the ALL button to download the project to all the nodes.

Property Setting

Select Address: 192.168.1.1

Logic: MABS_IBE04v1

Buttons: Read, Logic DnL, **ALL**, Logic UpL, Write, OK, Cancel, Logic backup

Network Diagram:

- Master 192.168.1.1
- Master 192.168.1.2
- Master 192.168.1.3
- PLC

Roller Setting MA

| | | |
|-----------------|-------|--------|
| Roller diameter | 2.52 | inch |
| Gear Reduction | 4.45 | |
| Speed1 | 100.1 | ft/min |
| Speed2 | 100.1 | ft/min |
| Speed3 | 100.1 | ft/min |
| Speed4 | 100.1 | ft/min |

Roller Setting MB

| | | |
|-----------------|-------|--------|
| Roller diameter | 3.43 | inch |
| Gear Reduction | 28.66 | |
| Speed1 | 75.0 | ft/min |
| Speed2 | 75.0 | ft/min |
| Speed3 | 75.0 | ft/min |
| Speed4 | 75.0 | ft/min |

Speed

☒ Per minute
☐ Per second
☐ RPM

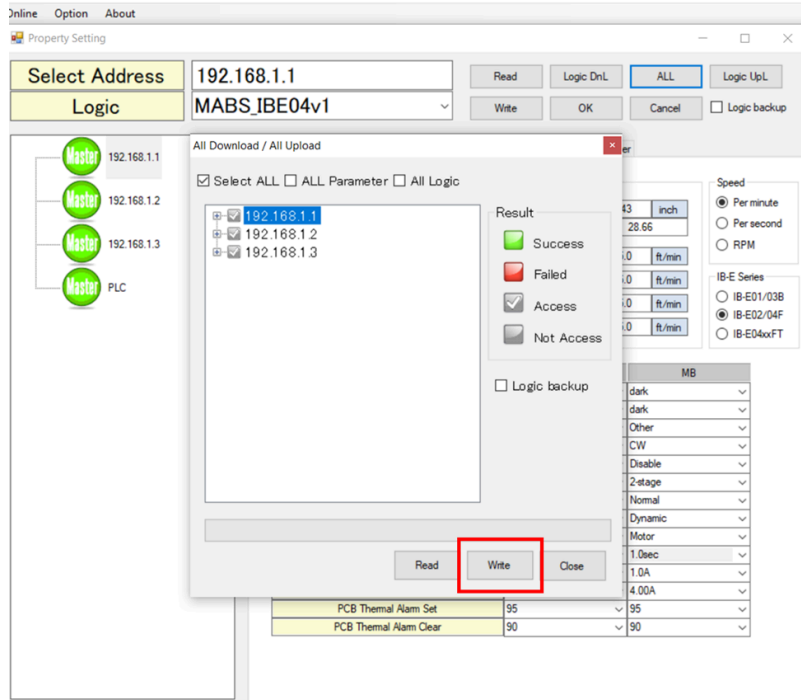
IB-E Series

☐ IB-E01/03B
☒ IB-E02/04F
☐ IB-E04xxFT

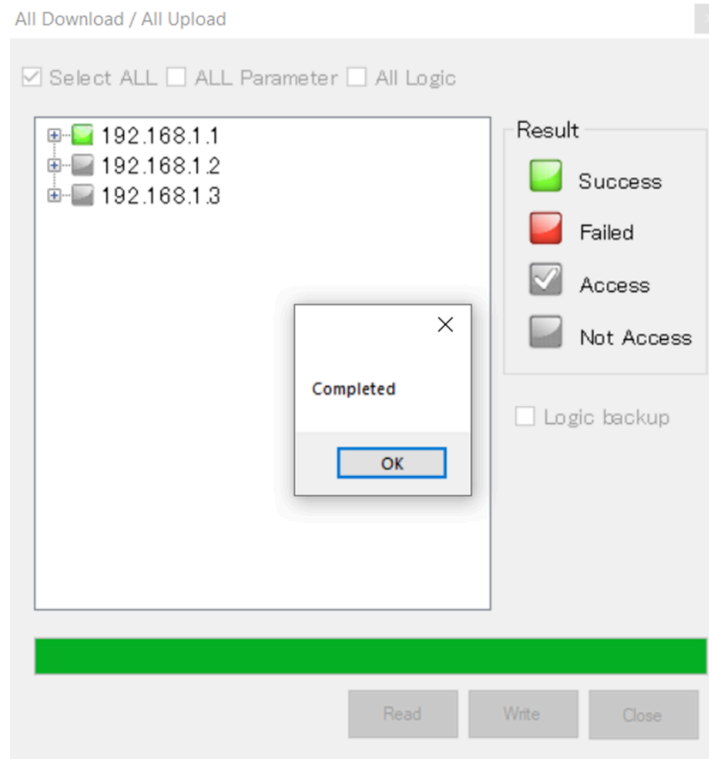
| Name | MA | MB |
|---------------------------|---------|---------|
| Sensor Setting | dark | dark |
| Sensor Alarm Setting | dark | dark |
| Motor Type | Other | Other |
| Direction | CW | CW |
| Motor Complementary | Disable | Disable |
| Gear Stage | 2-stage | 2-stage |
| Mechanical Brake | Normal | Normal |
| Brake | Dynamic | Dynamic |
| Motor Port Setting | Motor | Motor |
| Motor Lock Timeout | 1.0sec | 1.0sec |
| Servo brake Current Limit | 1.0A | 1.0A |
| Motor Current Limit | 4.00A | 4.00A |
| PCB Thermal Alarm Set | 95 | 95 |
| PCB Thermal Alarm Clear | 90 | 90 |

Supplemental Operating Instructions

- A box will open that allows you to select which node's properties or logic will be downloaded to.
- Leave the box for Select ALL checked. Click Write.



- When the download is complete, click OK. Close the All Download/All Upload window.



Please refer to all safety, installation and maintenance instructions in The MABS User Manual before using this product. The MABS User Manual can be found at <https://itohdenki.com/wp-content/uploads/MABS-Manual.pdf>

INITIALIZATION:

- When powered up or after downloading logic or properties, the unit will perform an initialization routine if the origin sensor is not on (transfer balls are not straight).

HARDWARE CONTROL USING THE REMOTE INPUTS:

- Apply a signal to Sensor A SEN to run the transfer balls.
- Apply a signal to Sensor A ALM to change the direction of the transfer balls. This signal should be applied before the transfer ball run signal is applied.
- Apply a signal to RemoteIN1 to rotate the transfer balls to the clockwise (CW) divert position.
- Apply a signal to RemoteIN2 to rotate the transfer balls to the counter clockwise (CCW) divert position.
- Apply a signal to RemoteIN3 to rotate the transfer balls to the straight position.
**** Important – Only one signal should be on at a time. The signal can be turned off after the transfer balls begin rotating. ****

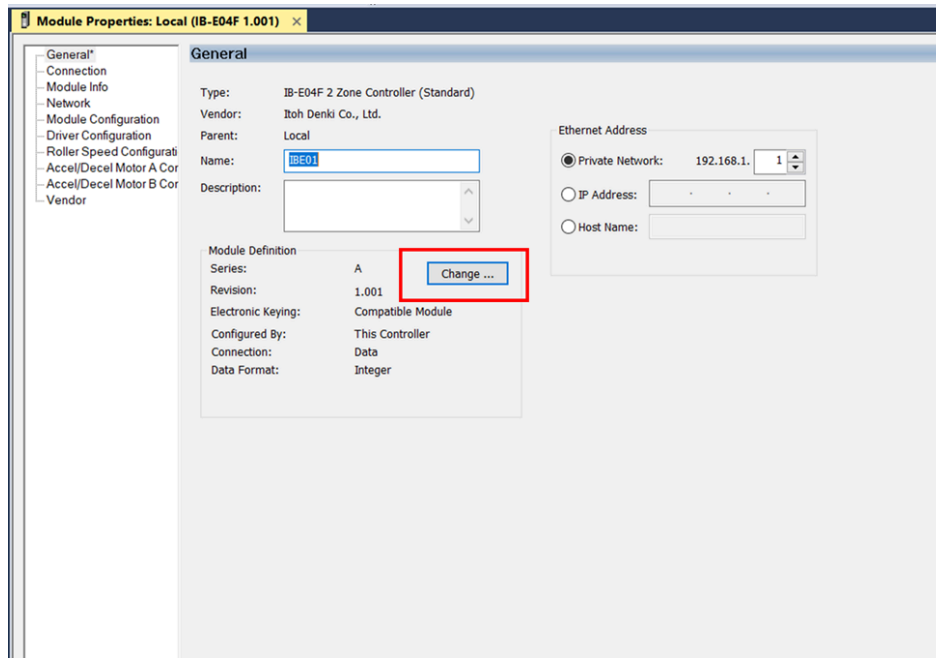
NETWORK CONTROL:

- PLC Tags: The tags listed in this document refer to the Module Defined tags created when an IB-E04F is added to a Rockwell Automation ControlLogix or CompactLogix PLC project using Studio 5000 software. For non-Rockwell Automation PLCs, refer to the IB-E04F manual: <https://itohdenki.com/wp-content/uploads/IB-E-Manual.pdf>
- The IB-E04F is set to Master mode by the Itoh Configurator for E/IP software. Although the controller will be able to access the Input Tags, the card operates via its own logic (not in the controller).

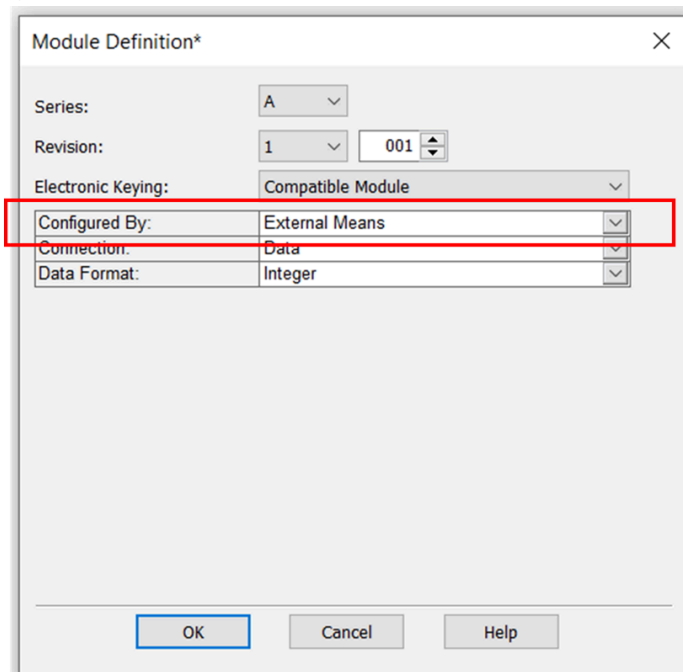
Supplemental Operating Instructions

NETWORK CONTROL (CONT):

- To connect to an IB-E in “Master” mode, the module must be set to “External means” for the “Configured By:” parameter under “Module Definition” in the Add On Profile.
- A new set of output tags will be created for this specific mode of operation.
- On the General tab of the Add On Profile, click the Change button under Module Definition.



- Set Configured By to External Means.



OUTPUTS:

- Turn ON Module_Name:O1.D_OutData[15].0 to enable network control and disable hardwire control using the remote inputs.
- Module_Name:O1.D_OutData[0].0 is used to run the transfer balls.
- Module_Name:O1.D_OutData[0].1 is used to reverse the transfer ball direction if needed.
- Module_Name:O1.D_OutData[1].0 is used to rotate the balls in a clockwise (CW) direction.
- Module_Name:O1.D_OutData[2].0 is used to rotate the balls in a counter clockwise (CCW) direction.
- Module_Name:O1.D_OutData[3].0 is used to rotate the balls to the straight position.

INPUTS:

- Module_Name:I.D_InData[0].0 is turned ON when the transfer balls are in the straight position. The signal is ON when the origin sensor is turned ON.
- Module_Name:I.D_InData[0].1 is turned ON when the transfer balls are turned to the clockwise (CW) divert position.
- Module_Name:I.D_InData[0].2 is turned ON when the transfer balls are turned to the counter clockwise (CCW) divert position.
- Module_Name:I.D_InData[0].3 is turned ON if there is a motor A or motor B error on the IB-E04F.

**** Important – Only one signal should be on at a time. The signal can be turned off after the transfer balls begin rotating. ****