

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>

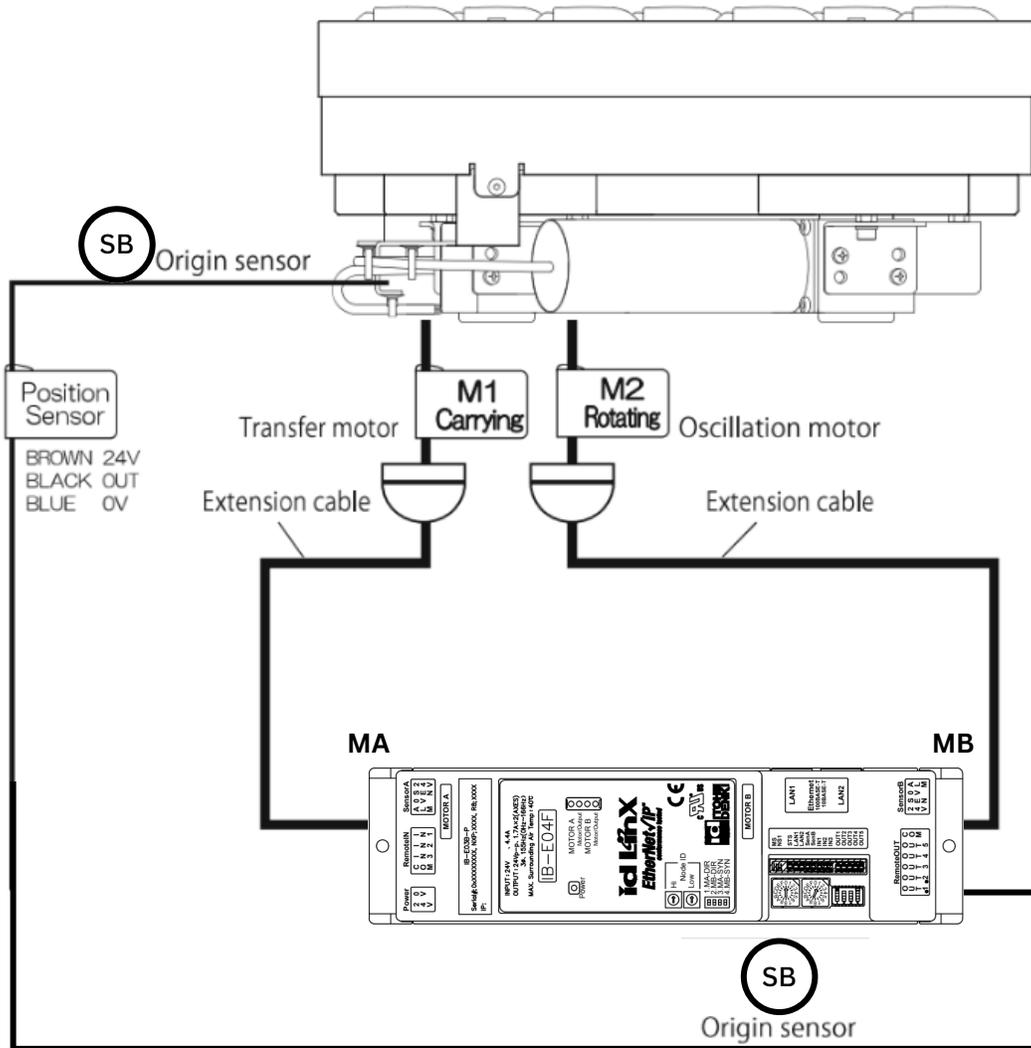
Specifications subject to change without notice

Revised 4/18/2024

SUBJECT	PAGE
Wiring -Connecting the MABS to the IB-E04F -For Hardwired Control -For Network Control	3-4
Inputs/Outputs for Hardwire and Network Control	5
Settings for Hardwire Control -Motor Settings -Network Communication Settings -Delay Timers -Pulse Counter Settings	6-13
Settings for Network (PLC) Control -Motor Settings -Delay Timers -Pulse Counter Settings	14-18
Downloading the Project	19-20
Controlling the MABS -Initialization -Hardware Control Using Remote Inputs -Network Control -Outputs -Inputs	21-23

CONNECTING THE MABS2 TO THE IB-E04F:

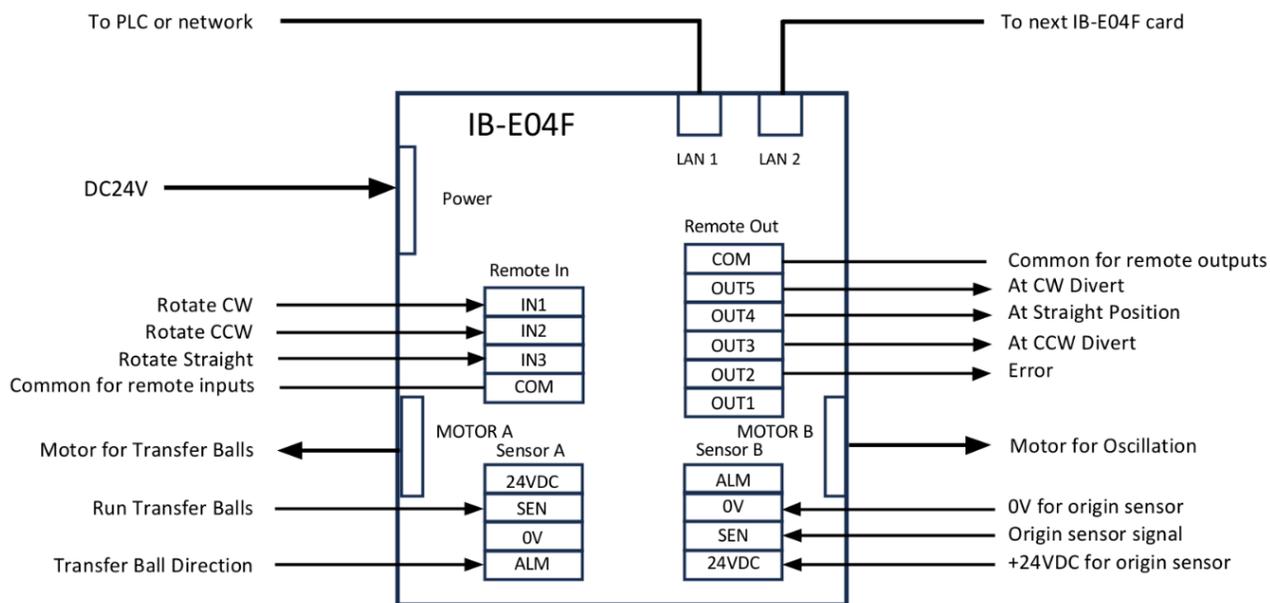
- Refer to the labels for cables coming from the MABS2 main unit, and securely connect the motor connectors and extension cables to the controller.



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

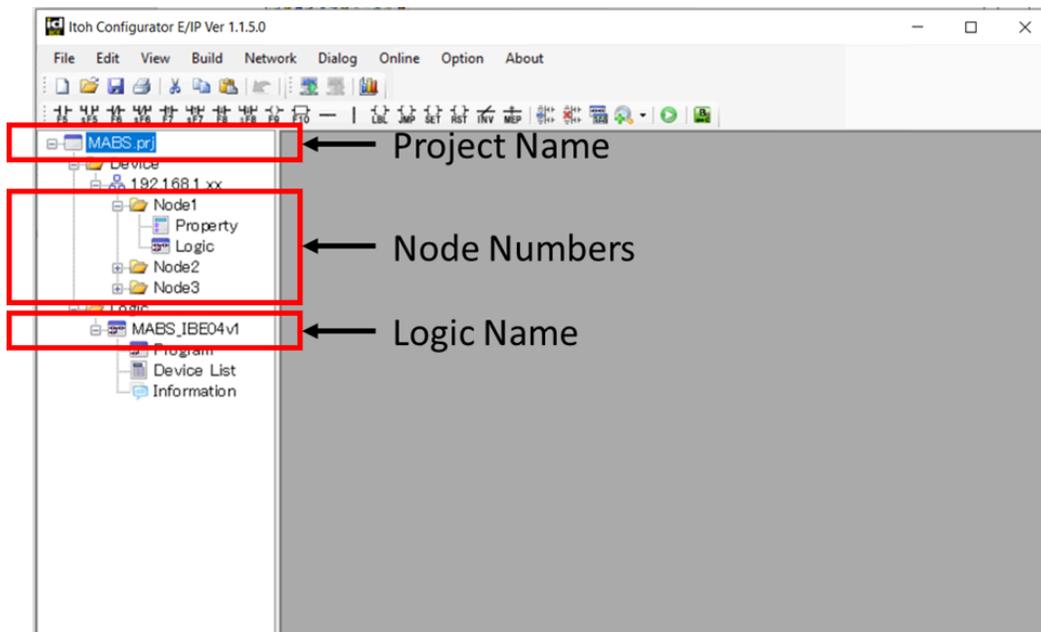
FOR HARDWIRE AND NETWORK CONTROL:

- 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 hardware 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”



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.

The screenshot shows the 'Property Setting' window. The 'Select Address' field is set to 192.168.1.1 and the 'Logic' dropdown is set to MABS_IBE04v1. The left sidebar shows a tree view with four 'Master' nodes at 192.168.1.1, 192.168.1.2, 192.168.1.3, and a 'PLC' node. The main area has tabs for 'Motor', 'Error/Network', 'Acceleration/Deceleration', 'Timer', 'Counter', and 'Pulse Counter'. The 'Motor' tab is selected, showing settings for 'Roller Setting MA' and 'Roller Setting MB'. Red boxes highlight the following fields:

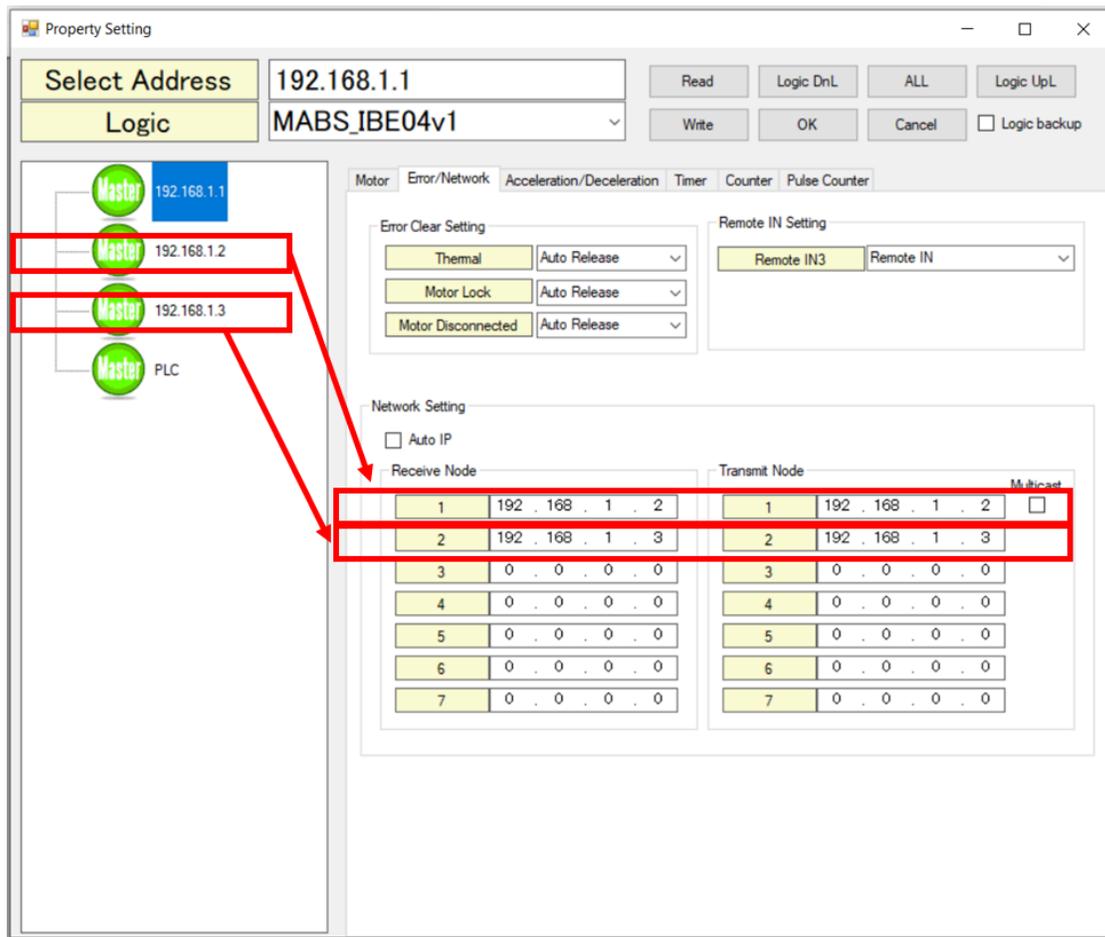
- Roller Setting MA: Roller diameter (2.52 inch), Gear Reduction (5.00)
- Roller Setting MB: Roller diameter (3.43 inch), Gear Reduction (53.59)
- Motor Type (Other) for both MA and MB
- Motor Current Limit (7.00A) for both MA and MB

Speed settings for both MA and MB are: Speed1 (200.0 ft/min), Speed2 (100.0 ft/min), Speed3 (100.0 ft/min), Speed4 (100.0 ft/min). The 'Speed' section has radio buttons for 'Per minute' (selected), 'Per second', and 'RPM'. The 'IB-E Series' section has radio buttons for 'IB-E01/03B', 'IB-E02/04F' (selected), and '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

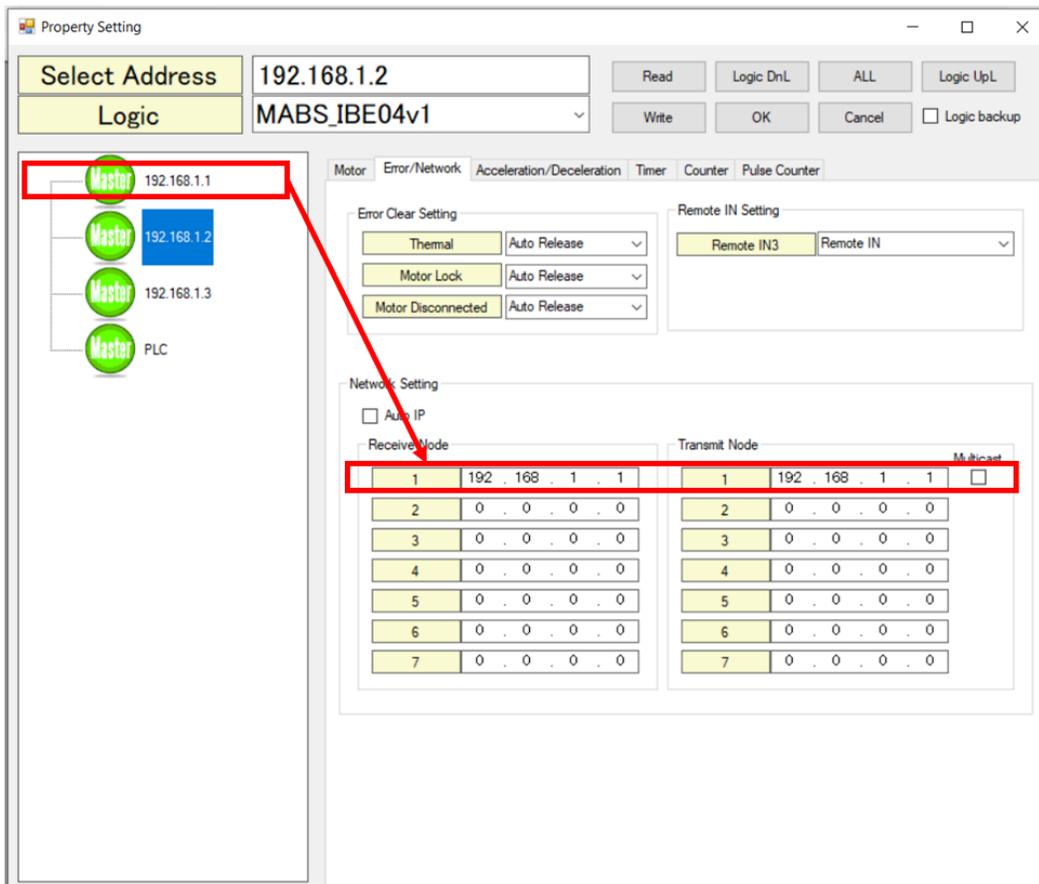
NETWORK COMMUNICATION SETTINGS:

- 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.



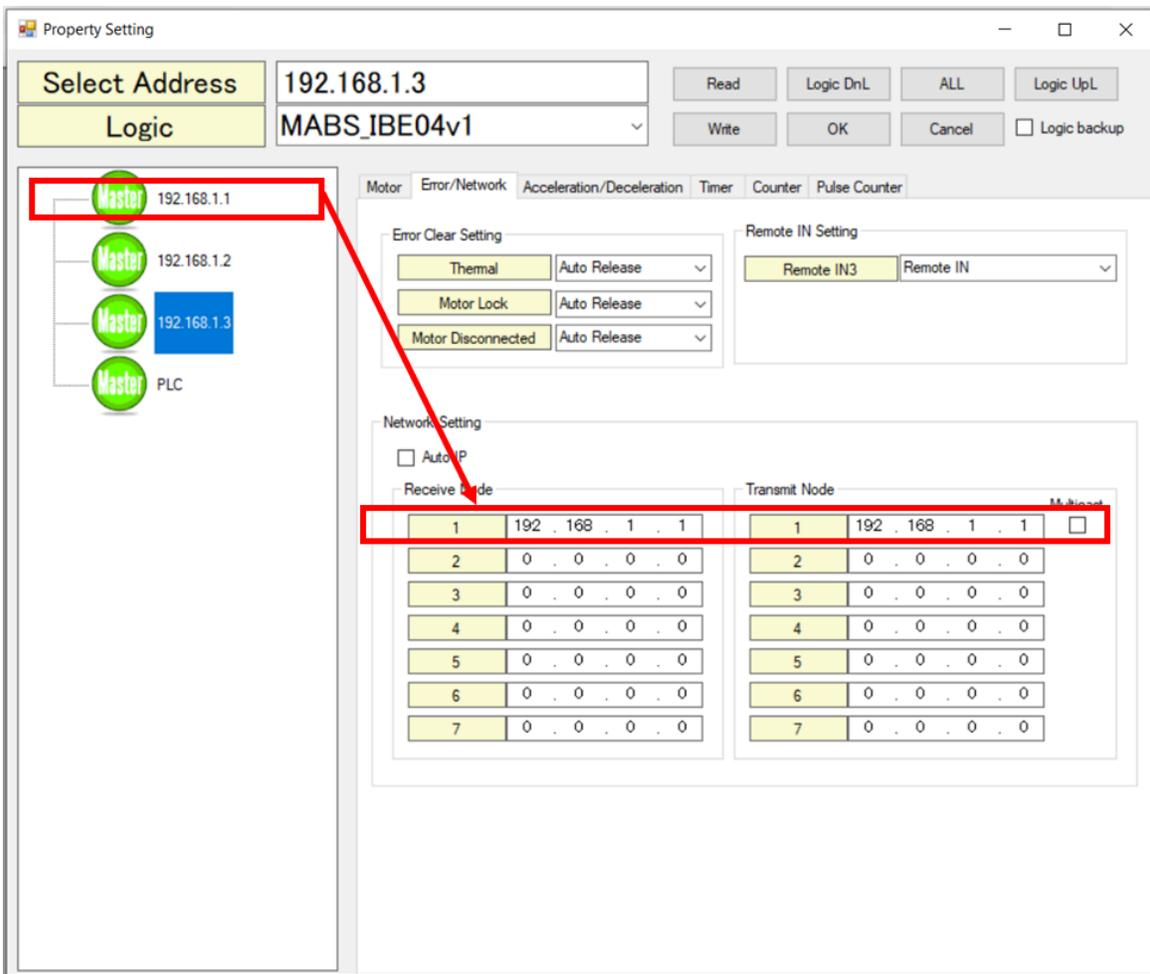
NETWORK COMMUNICATION SETTINGS (CONT):

- 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.



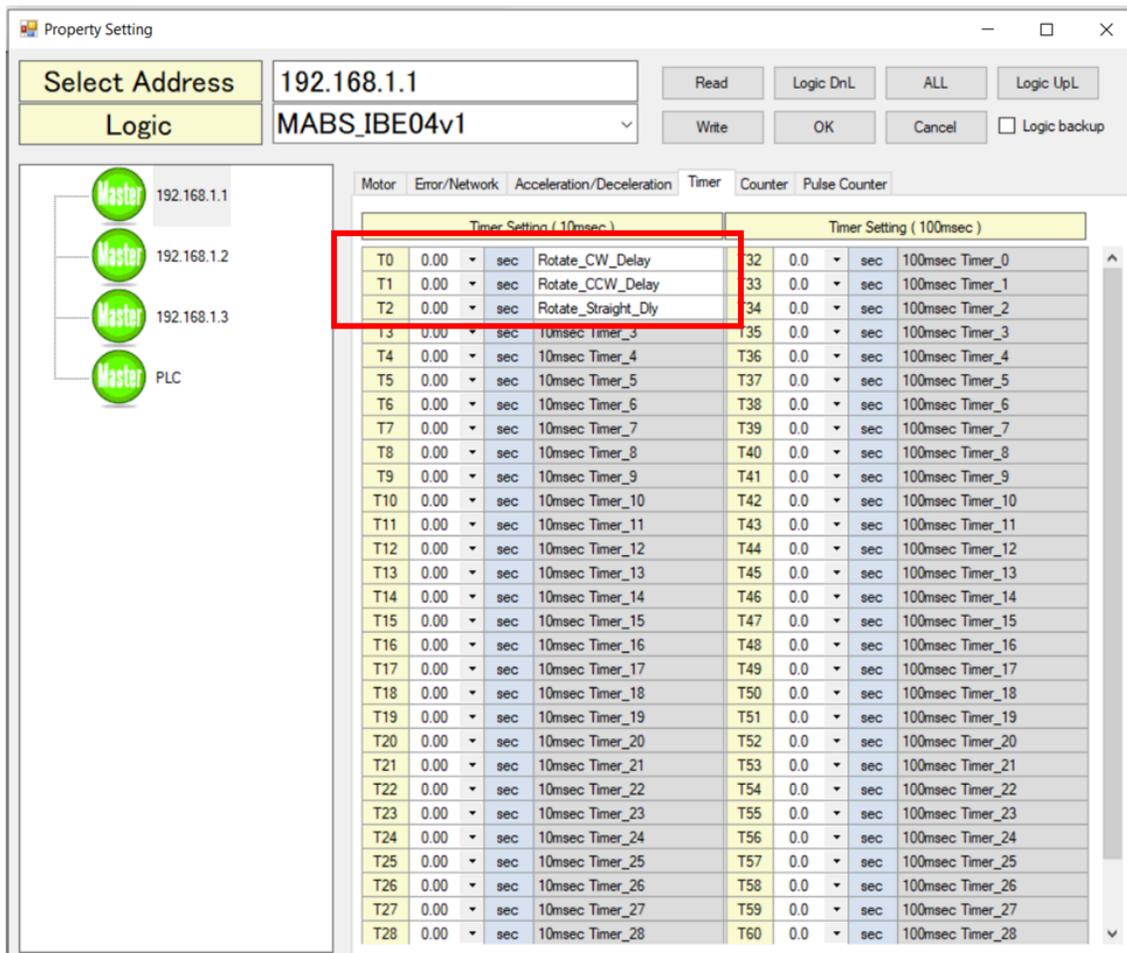
NETWORK COMMUNICATION SETTINGS (CONT):

- 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.

Property Setting

Select Address: 192.168.1.1

Logic: MABS_IBE04v1

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

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

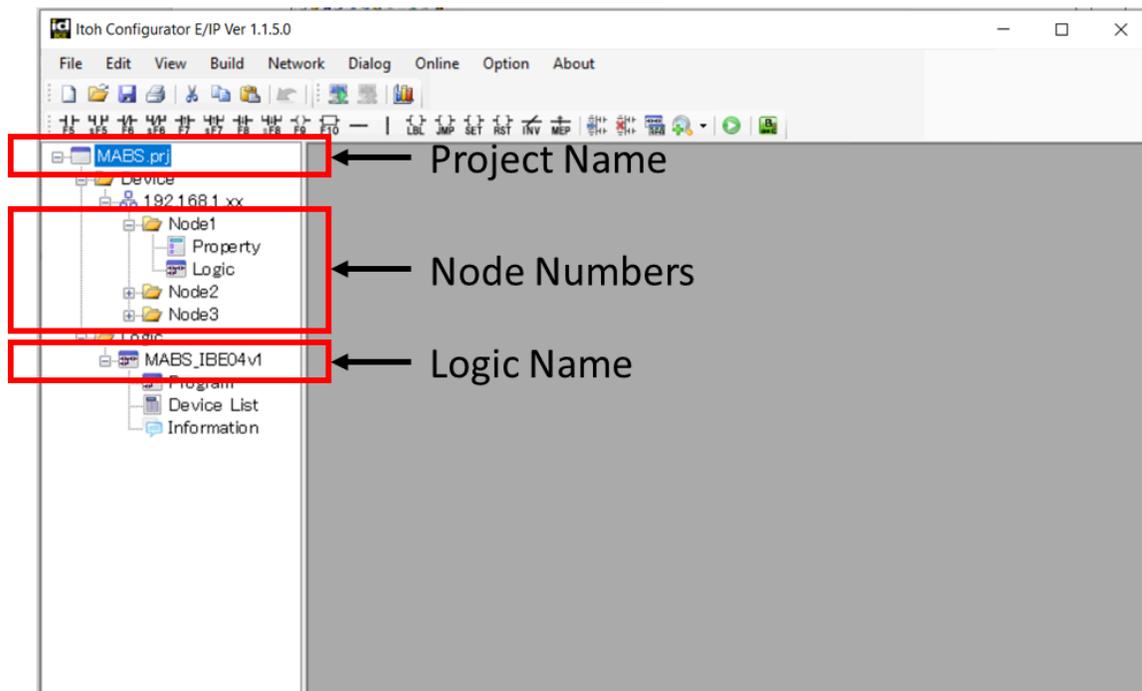
PULSE COUNTER SETTINGS (CONT):

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 (hardware 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_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

Buttons: 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.

Property Setting

Select Address: 192.168.1.1

Logic: MABS_IBEO4v1

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

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

Timer Setting (10msec)				Timer Setting (100msec)			
T0	0.00	sec	Rotate_CW_Delay	T32	0.0	sec	100msec Timer_0
T1	0.00	sec	Rotate_CCW_Delay	T33	0.0	sec	100msec Timer_1
T2	0.00	sec	Rotate_Straight_Dly	T34	0.0	sec	100msec Timer_2
T3	0.00	sec	10msec Timer_3	T35	0.0	sec	100msec Timer_3
T4	0.00	sec	10msec Timer_4	T36	0.0	sec	100msec Timer_4
T5	0.00	sec	10msec Timer_5	T37	0.0	sec	100msec Timer_5
T6	0.00	sec	10msec Timer_6	T38	0.0	sec	100msec Timer_6
T7	0.00	sec	10msec Timer_7	T39	0.0	sec	100msec Timer_7
T8	0.00	sec	10msec Timer_8	T40	0.0	sec	100msec Timer_8
T9	0.00	sec	10msec Timer_9	T41	0.0	sec	100msec Timer_9
T10	0.00	sec	10msec Timer_10	T42	0.0	sec	100msec Timer_10
T11	0.00	sec	10msec Timer_11	T43	0.0	sec	100msec Timer_11
T12	0.00	sec	10msec Timer_12	T44	0.0	sec	100msec Timer_12
T13	0.00	sec	10msec Timer_13	T45	0.0	sec	100msec Timer_13
T14	0.00	sec	10msec Timer_14	T46	0.0	sec	100msec Timer_14
T15	0.00	sec	10msec Timer_15	T47	0.0	sec	100msec Timer_15
T16	0.00	sec	10msec Timer_16	T48	0.0	sec	100msec Timer_16
T17	0.00	sec	10msec Timer_17	T49	0.0	sec	100msec Timer_17
T18	0.00	sec	10msec Timer_18	T50	0.0	sec	100msec Timer_18
T19	0.00	sec	10msec Timer_19	T51	0.0	sec	100msec Timer_19
T20	0.00	sec	10msec Timer_20	T52	0.0	sec	100msec Timer_20
T21	0.00	sec	10msec Timer_21	T53	0.0	sec	100msec Timer_21
T22	0.00	sec	10msec Timer_22	T54	0.0	sec	100msec Timer_22
T23	0.00	sec	10msec Timer_23	T55	0.0	sec	100msec Timer_23
T24	0.00	sec	10msec Timer_24	T56	0.0	sec	100msec Timer_24
T25	0.00	sec	10msec Timer_25	T57	0.0	sec	100msec Timer_25
T26	0.00	sec	10msec Timer_26	T58	0.0	sec	100msec Timer_26
T27	0.00	sec	10msec Timer_27	T59	0.0	sec	100msec Timer_27
T28	0.00	sec	10msec Timer_28	T60	0.0	sec	100msec Timer_28

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.

Property Setting

Select Address: 192.168.1.1

Logic: MABS_IBE04v1

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

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

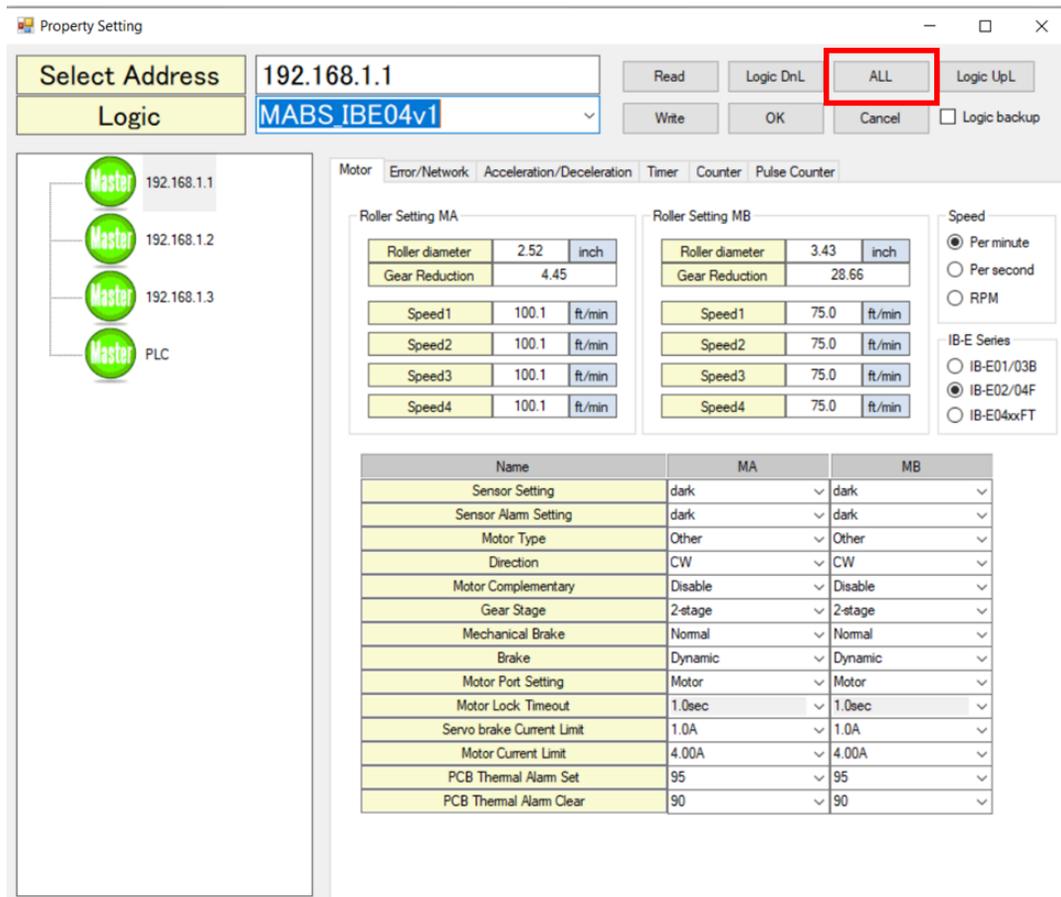
PULSE COUNTER SETTINGS (CONT):

- 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

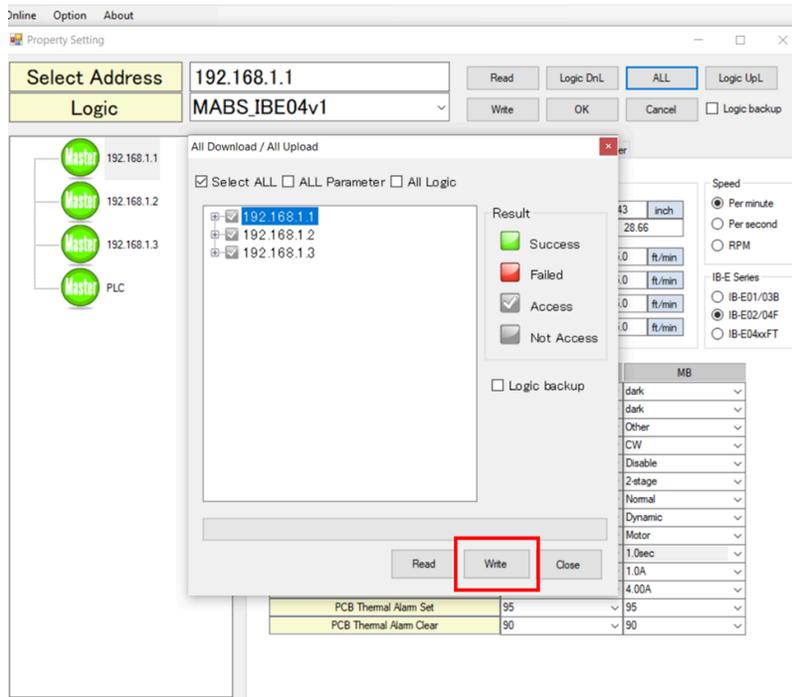
DOWNLOADING THE PROJECT (HARDWARE AND NETWORK CONTROL):

- 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.

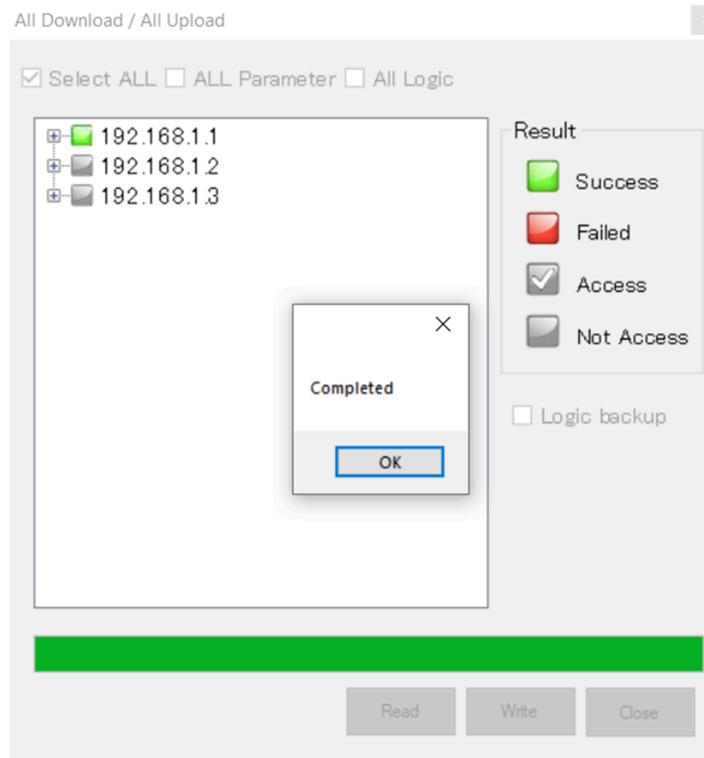


Supplemental Operating Instructions

- 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:

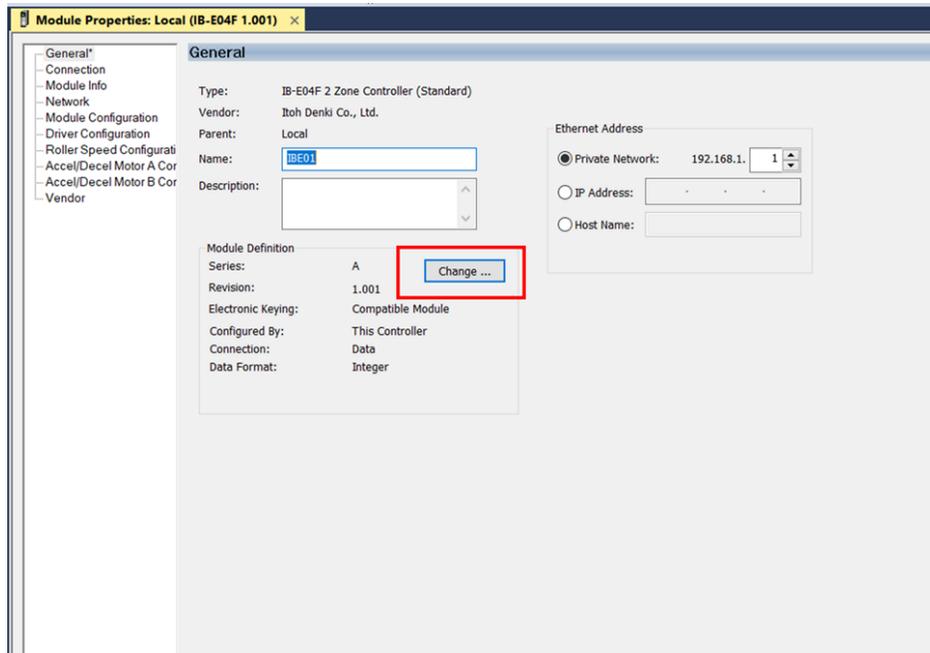
- Apply a signal to Sensor A SEN to run the transfer balls.
- Apply a signal to Sensor A ALM to change the direction of the transfer balls. This signal should be applied before the transfer ball run signal is applied.
- Apply a signal to RemoteIN1 to rotate the transfer balls to the clockwise (CW) divert 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:

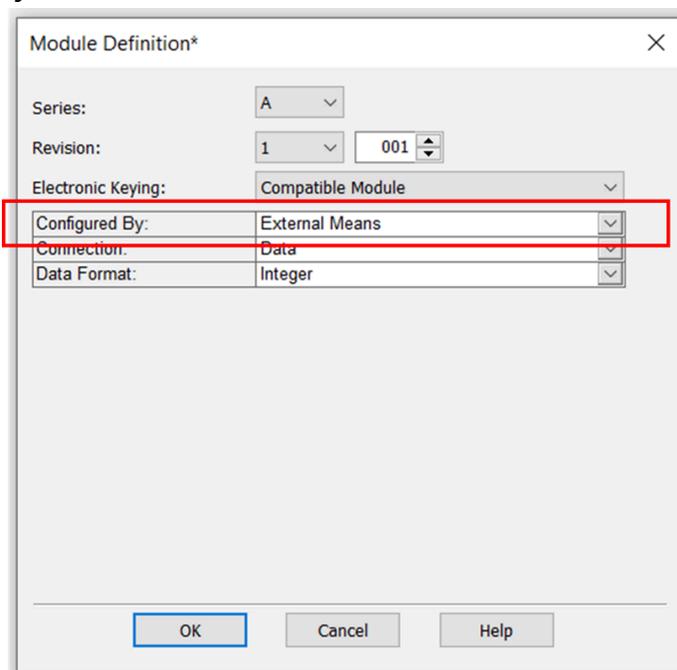
- PLC Tags: The tags listed in this document refer to the Module Defined tags created when an IB-E04F is added to a Rockwell Automation ControlLogix or CompactLogix PLC project using Studio 5000 software. For non-Rockwell Automation PLCs, refer to the IB-E04F manual: <https://itohdenki.com/wp-content/uploads/IB-E-Manual.pdf>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

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. ****