



**Title:**

E2 To i-Controller REV.112 With Expansion (208V 20-30 Ton) Conversion

## Overview

The i-Controller is compact and versatile FLō unit controller. This adaptable platform uses the latest technology and provides many benefits over previous designs. To make the most of these advancements in hardware and control strategies, an onsite hardware replacement of the previously installed controls must be performed.

This document describes the steps required to upgrade an Emerson E2 rack controller and MF88AO configuration.

Before you begin the upgrade, locate the Emerson E2 refrigeration controller and the Multi-Flex 88AO, IO (MF88AO) boards located in the FLō unit

The i-Controller upgrade will involve these steps:

1. Install an isolated 24VAC transformer in the unit's control cabinet.
2. Replace the digital bypass damper actuator with a modulating analog bypass actuator.
3. Replace the existing 3-wire CO2 sensor with a new 4-wire CO2 sensor and cable.
4. Install an isolation relay in units equipped with Heat Reclaim. *\*Does not apply to Reheat units.*
5. Install the i-Controller hardware, Visograph display and rewire connections.
6. Set time, date and verify system operation using the Visograph display.

**NOTE:** A separate dew point sensor will need to be installed in the space for control of the antisweat heaters wired to the protocol. Please contact CD Controls for this part.

**CAUTION:** Make sure the power to the FLō unit is turned off and internal electrical circuits is NOT energized.

In addition to a standard tool set, having the items in Table 1 will aid in the ease of installation.

TOOLS LIST	
Cordless Drill	Drill Bit Set
Multi-Meter	Adjustable Wrench
Wire Strippers	Wire Crimpers
Temperature Gauge	Psychrometer
Socket Set – Standard	Cell Phone
5/8” Self-Tapping Sheetmetal Screws	
18AWG Stranded Insulated Wire	
Fork Wire Connectors	
Butt Splice Wire Connectors	
Quick Disconnect Wire Connectors	
Small Electronic Size Screw Drivers	
4-Conductor Shielded Twisted Wire Belden 8729 or Equivalent (For CO2 Sensor)	

Table 1. Tools List



# Installation Guide

IN-IC1-10

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## Flō Supplied Parts

The parts contained in the Flō supplied parts kit are provided specifically for the Flō unit on this site. These parts will be used to upgrade the existing E2 controller and IO boards to the i-Controller unit controller.

The parts contained within this kit are not inclusive of the miscellaneous items in the tools list located on page one. *See Table 1.*

Contact Flō Technical Support if you have questions or concerns.

Phone: 888-598-1198 Opt. 1

E-Mail: [techsupport@systemsflo.com](mailto:techsupport@systemsflo.com)

Part Description	Part Number	Flō Unit with E2 & (2) MF88AO Boards with VAV or ERV
i-Controller Unit Controller	PTCS8188101	1
DIN Rail	PTCSP91730	1
DIN Rail End Cap	PTCSV66150	2
i-Controller Visograph	PTCS8189002	1
Visograph Mounting Bracket	PTCS184068001	1
i-Controller Expansion Board	PTCS8187003	1
4-Wire Duct Mount CO2 Sensor	PTCSV57760	1
Upgrade Document	IN-IC1-10	1

*Table 2. Flō Supplied Parts List*

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1

## Install a 24VAC (50VA) Isolated Transformer (*NOT GROUNDED*)

Install the 24VAC i-Controller isolation transformer in the low-voltage area of the control cabinet. Securely fasten the transformer to the backplate of the electrical cabinet and neatly dress all wires to/from the primary and secondary sides of the transformer. This dedicated transformer provides power only to the i-controller. Do not connect any other devices to this transformer.



Figure 1. Electrical Cabinet

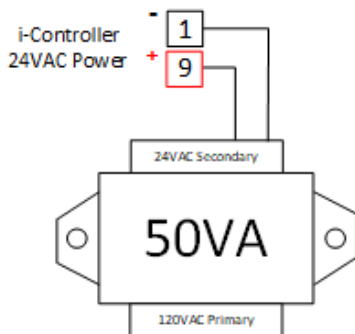


Figure 2. 24VAC Transformer

Figure 3. Damper Assembly and Actuators

2

## Replace the 3-Wire CO2 sensor

The CO2 sensor is in the return air section of the FLō unit. Pull a new 4-conductor cable and replace the previously installed 3-wire CO2 sensor with a new 4-wire sensor. The CO2 sensors in the images below may differ from the one in the unit.



Figure 4. CO2 sensor located inside unit

3

## Refrigeration Heat Reclaim Units - Install an Isolation Relay

For units equipped with heat reclaim, an isolation relay is required for controlling the heat reclaim valve. This relay limits the voltage and prevents damage to the control boards. If the unit is not equipped with heat reclaim, do not install the isolation relay.

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### 4 Install the i-Controller and Visograph Display

Prior to installing the i-Controller, take note of the I/O wires and labelling connected to the 88AO board. If existing wires are not long enough to reach the i-Controller I/O points, you will need to extend them as necessary.

The i-Controller mounts onto a DIN rail. Secure the DIN rail to the back plate of the low-voltage section in the unit control cabinet.

All input sensors on the MF88AO board are located on input points 1 - 8. Each input on the MF88AO board will have a white signal wire (connected to Signal Ground (SG)) and black common (C) wire connected to the 0V point.

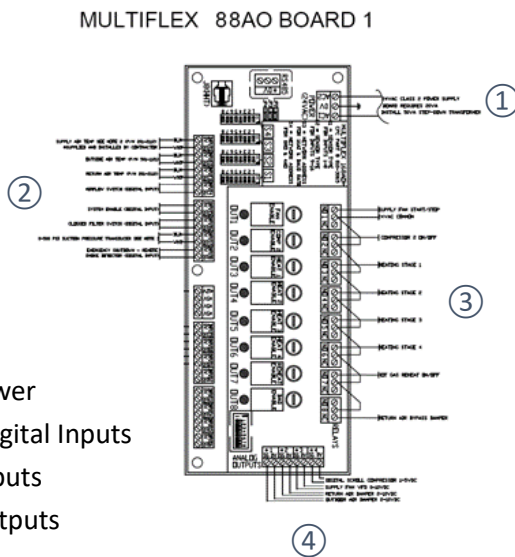


Figure 5. Emerson Multi-Flex 88AO board

### 4.1 Multi-Flex and i-Controller Inputs

Emerson MF88AO input connectors reference 0V and signal connections for each input.

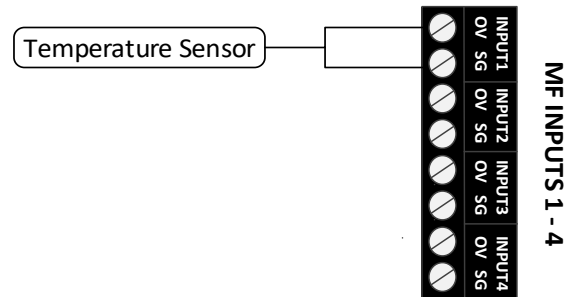


Figure 6. MF88AO Input Connector

i-Controller input connectors reference signal points and share a common for a bank of inputs.

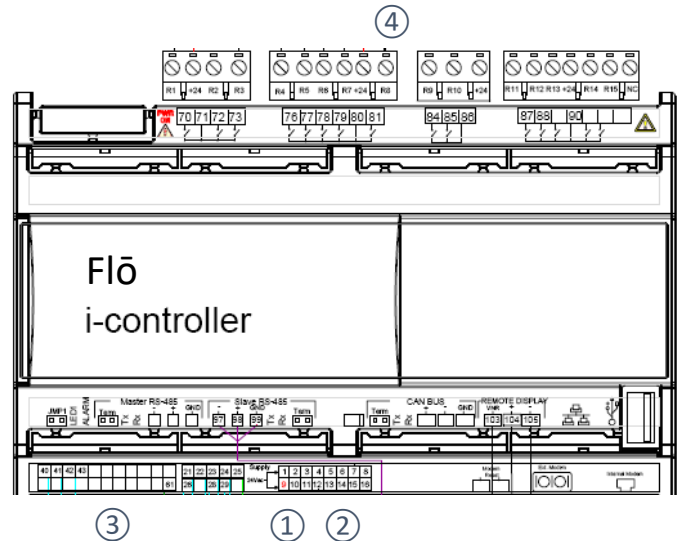


Figure 7. Flō i-Controller

1. 24VAC Power (Point 9 and 1)
2. Analog Inputs
3. Digital Inputs
4. Digital Outputs

The corresponding i-Controller points for each input's signal and common wire are listed in Table 3. The System Enable input will not be used; remove or capped it off. Make each connection as listed in Table 3.

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**NOTE:** Ensure that the suction pressure transducer is wired directly to the i-Controller. The suction transducer must not be connected to the IDCM (points P1, P2, P3).

## 4.2 Input Wiring – Sensor Commons

Connect a common ground wire from the (Common Source Terminal Block) CSTB1 to point 61 on the i-Controller.

**NOTE:** Install the common sensor connections on the correct i-Controller terminal. There is a dedicated common for each sensor type.

**Point 7** - The single common for temperature sensors.

Connect all temperature sensor commons (highlighted in blue) to point 7 on the i-Controller. Use a permanent pigtail to make multiple connections if necessary.

**Point 8** - The single common for powered sensors.

Connect all powered sensor commons (highlighted in green) to point 8 on the i-controller. Use a permanent pigtail to make multiple connections if necessary.

**Point 61** - The single common for digital sensors.

Connect all digital sensor commons (highlighted in gray) to point 61 on the i-Controller. Use a permanent pigtail to make multiple connections if necessary.

**NOTE:** Once all connections are complete, using a multimeter, verify no continuity exists between and through points 7, 8 and 61.

Using a multimeter set to the ohm measurement, check for shorts within the analog sensor connections on point 7 and 8. A reading of “OL” indicates there are no earth grounds on these points. If a reading close to “0” is measured, there is a short. Stop and trace backward to determine which sensor common on point 7 or 8 is causing short to ground and remove it. If 8 shows a ground, remove CO2 sensor from base and recheck. If the grounding no longer exists, ensure that the CO2 sensor is wired correctly, then reinstall and move to the next step.

**WARNING:** Shorting any input common to earth ground will damage the i-Controller.

MF88AO Boards	Input Description	i-Controller Pin #
See Wiring Diagram in Unit	Supply Air Temperature SG	2
	Supply Air Temperature OV	7
	Space Temperature SG	3
	Space Temperature OV	7
	Space Humidity SG	4
	Space Humidity OV	8
	Airflow Switch SG	41
	Airflow Switch OV	61*
See Wiring Diagram in Unit	Outside Air Temperature SG	6
	Outside Air Temperature OV	7
	Smoke Detector SG	40
	Smoke Detector OV	61*
	Suction Pressure Comp 1 SG	5
	Suction Pressure Comp 1 OV	8
	Clogged Filter SG	42
	Clogged Filter OV	61*
See Wiring Diagram in Unit	Discharge Pressure Comp 1 SG	13
	Discharge Pressure Comp 1 OV	8
	CO2 SG	10
	CO2 OV	8
	Return Temperature SG	12
	Return Temperature OV	7
	System Enable	Do Not Use Cap Off
<b>+ 12V</b>	Humidity Sensor Power	16
<b>+ 5V</b>	Transducer Power	15
<b>i-Controller Expansion (If Applicable)</b>		
See Wiring Diagram in Unit	Office Temperature SG	10
	Office Temperature OV	7
	Breakroom Temperature SG	6
	Breakroom Temperature OV	7

Table 3. Input Conversion Table

- \* Digital Sensors
- Temperature Sensors
- Powered Sensors

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### 4.3 Analog Output Wiring

The MF88AO board has four analog outputs. Each output will have a white signal wire connected to SG point and black common wire connected to the 0V point. *See Figure 5.* I-Controller point 21 – 30 are the analog outputs for devices requiring an analog 0-10V run signal. *See Figure 7.*

**Point 25** - The analog output common for analog output connections.

Connect all analog output commons (highlighted in blue) to point 25 on the i-Controller. Use a permanent pigtail to make multiple connections if necessary. Analog outputs require an external 24VAC power source. Connect i-Controller point 28 to CSTB1 (-24VAC) and i-Controller point 29 to CSTB1 (+24 VAC).

Table 4 shows the MF88AO and i-Controller analog output points for each signal and common wire.

MF88AO Point	Analog Output Description	i-Controller Pin #
See Wiring Diagram in Unit	Outside Air Damper SG	21
	Outside Air Damper 0V	25
	Return Air Damper SG	22
	Return Air Damper 0V	25
	VFD SG	24
	VFD 0V	25
	Digital Compressor 1 SG	23
	Digital Compressor 1 0V	25
	Bypass Air Damper SG	26
Bypass Air Damper 0V	25	
<b>i-Controller Expansion (If Applicable)</b>		
See Wiring Diagram in Unit	VAV Damper SG	21
	VAV Damper 0V	25
	VAV Fan Speed SG	24
	VAV Fan Speed 0V	25

Table 4. Analog Output Conversion Table

\*The new bypass air damper actuator connections will be: Control Signal point 26, Common point 25 and +24VAC from CSTB1.

### 4.4 Relay Output Wiring

MF88AO has eight relay outputs. *See Figure 5.* Each output terminal has a normally open (NO) signal and a +24VAC common (C) wire connection.

Remove and discard the MF88AO +24VAC common connect (a new one will be installed from CSTB1). Install a new +24VAC power wire between CSTB1 and the i-Controller common connection points 71, 80, 86 and 90. This will provide +24VAC power for the i-Controller outputs.

After the +24VAC common connections are terminated, using Table 5, transfer each control signal point to the corresponding i-Controller output point located on pins 70 - 93. *See Figure 7.* Transfer one signal wire at a time from the old controller to the new point location on the i-Controller.

Table 5 shows the MF88AO relay outputs and i-Controller digital output points for each control and common wire.

MF88AO Point	Relay Outputs	i-Controller Pin #
See Wiring Diagram in Unit	Supply Fan 1 (NO)	70
	Compressor 2 (NO)	79
	Heat Combustion (NO)	72
	Heat Stage 1 (NO)	73
	Heat Stage 2 (NO)	76
	Heat Stage 3 (NO)	77
	Heat Stage 4 (NO)	78
	Reheat/Heat Reclaim (NO)	81
	Condenser Fan 1 (NO)	85
	Condenser Fan 2 (NO)	87
	Condenser Fan 3 (NO)	88
	+24VAC	71, 80, 86, 90
	<b>i-Controller Expansion (If Applicable)</b>	
See Wiring Diagram in Unit	VAV Fan (NO)	76
	VAV Heat (NO)	73
	ERV Wheel	77
	ERV Power Exhaust	78
	ERV Bypass	79
	ERV Store Exhaust	81
	+24VAC	61, 64

Table 5. Relay to Digital Output Conversion Table



## 5 Visograph Installation

The Visograph display mounts to the control cabinet and is used to interface directly with the i-Controller. Mount the Visograph and connect it to the i-Controller port. See *Figure 8*.

### VisoGraph Remote Display

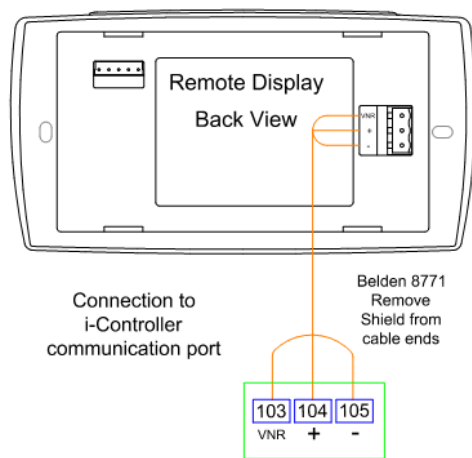


Figure 8. Visograph Connections

## 6 IO Connections and System Operation

Once all connections are complete, set time, date and verify system operation.

### 6.1 Set Time and Date

From the **Main Menu**, press **T5**, (**Network Info**).

Press and verify the time is correct. If the correct time is not displayed, set the time.

Use the to navigate to the hour or minute fields.

With a field highlighted, press ; the value will begin blinking.

While the highlighted value is blinking, use the , set the value. Press a second time to accept changes.

The controller will automatically reboot after the date and or time has been changed.

### 6.2 Verify i-Controller Inputs

Using the Visograph display, navigate to the input status screens. Verify all sensors are wired and reading correctly.

From the Main Menu of the i-Controller Visograph display, use the function keys (T1-T8) and arrow keys to navigate to the input status screens. Verify all installed sensors are present and displaying accurate values.

**NOTE:** Visograph screens in (Figure 9 – 12) do not represent actual values. These images are only for illustration purposes.

From the **Main Menu**.

Press and hold down **T7**. While holding **T7** down, depress **T1**. This key combination unlocks the **Field Technician Options** screen.

Press **T6** to navigate to the IO Status screen. Press **T1** to access the Input Status screen. Press to view additional pages.

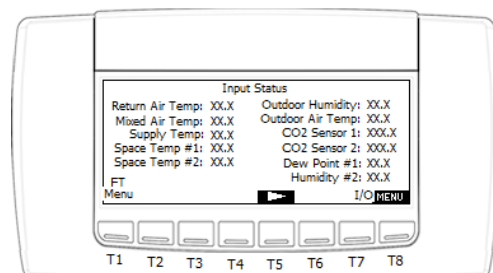


Figure 9. i-Controller Input Status Screen Page 1

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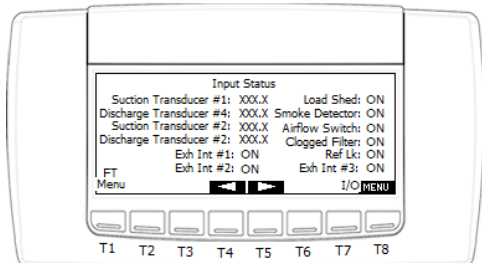


Figure 10. i-Controller Input Status Screen Page 2

### 6.3 Sensor Offsets

If a sensor does not exactly reflect the measured value in the conditioned space, a sensor offset may be entered the controller.

From the **Main Menu**.

Press and hold down **T7**. While holding **T7** down, depress **T1 (Sensor Offsets)**.

Press to view additional pages.

Enter the offset(s) as necessary. Do not exceed  $\pm 3^{\circ}\text{F}$  for a temperatures sensor,  $\pm 2^{\circ}\text{F}$  for a dewpoint sensor or  $\pm 3\%$  for a humidity sensor.

### 6.4 Verify i-Controller Outputs

Using the Visograph display, navigate to the output status screens. Verify all outputs are wired and reading correctly.

From the Main Menu of the i-Controller Visograph display, use the function keys (T1-T8) and arrow keys to navigate to the output status screens. Verify all installed outputs are wired and displaying accurate values.

From the **Main Menu**.

Press and hold down **T7**. While holding **T7** down, depress **T1**. This key combination unlocks the **Field Technician Options** screen.

Press **T6** to navigate to the IO Status screen. Press **T2** to access the Output Status screen. Press to view additional pages.

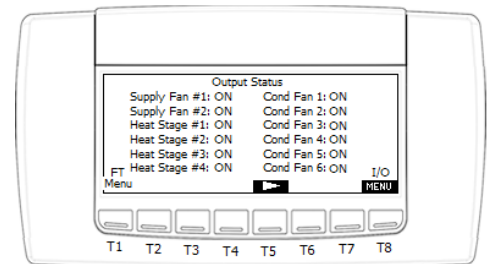


Figure 11. i-Controller Output Status Screen Page 1

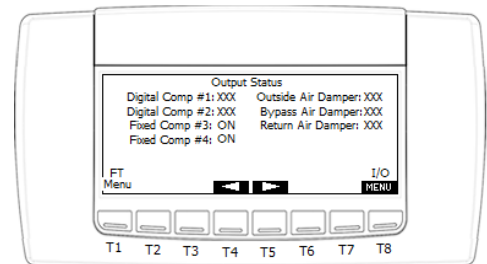


Figure 12. i-Controller Output Status Screen Page 2

Analog Outputs are found at the bottom section of the Output Status page two.

### 6.5 Verify System Operation

After sensors are installed and calibrated, verify the system operation.



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## 6.6 Dehumidification Test Mode

From the Main Menu, press and hold down **T7**, while holding **T7** down, depress **T1 (Field Technician Options)**.

From the Field Technician Options screen, press **T2 (Test Modes)**. Press **T2 (Other Test Modes)**.

Use to navigate to the **Dehumidification Test Mode Off** and press .

When the "OFF" value begins blinking, press the to change the value to "ON", then press .

Wait **10-minutes**, then terminate Dehumidification.

Terminate *Dehumidification* Test Mode (**OFF**)

From the Field Technician Options screen, press **T2 (Test Modes)**. Press **T2 (Other Test Modes)**.

Use to navigate to the **Dehumidification Test Mode "ON"**, then press .

When the "ON" value begins blinking, press to change the value to "OFF", then press .

Dehumidification mode is now turned "**OFF**".

## 6.6 Heating Test Mode

From the Field Technician Options screen, press **T2 (Test Modes)**. Press **T2 (Other Test Modes)**.

Use to navigate to the **Heat Test Mode Off** and press .

When the "OFF" value begins blinking, press the to change the value to "ON" and press .

Wait **10-minutes**, then terminate Heating.

Terminate *Heating* Mode (**OFF**)

From the Field Technician Options screen, press **T2 (Test Modes)**. Press **T2 (Other Test Modes)**.

Use and to navigate to the **Heating Test Mode On** and press .

When the "ON" value begins blinking, press the to change the value to "OFF", then press .

Heating mode is now turned "**OFF**".

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
MODES OF OPEATION	SUPPLY FAN	COMP(S)	COND FAN(S)	RECLAIM	HEATING	OUTDOOR AIR DAMPER	RETURN AIR DAMPER	BYPASS AIR DAMPER	INDICATE PASS or FAIL
DEHUM	ON	ON	ON	N/A	OFF	OPEN*	OPEN**	OPEN	
HEATING	ON	OFF	OFF	N/A	ON	OPEN*	OPEN	OPEN**	
* Damper will be in the OPEN position (typically 20 - 30% - OPEN 0.5" – 1.50").									
** This damper will be OPEN to its minimum position.									

Table 6. Output State Based on Operational Mode