FLŌ ENERGY SOLUTIONS	Technical Guide	CN-IC1-06
Title:	BACnet i-Controller Integration Specification REV.201	

Overview

The Flō i-Controller has the capability to communicate with Building Management Systems (BMS) over Modbus or BACnet protocols. Set points, occupancy, and some site-specific parameters can be sent from the BMS to the i-Controller as an "Input" for control customization. Unit status parameters can be mapped as "Outputs" to the BMS from the i-Controller to provide real-time status of the Flō unit.

The following sections explain the available Inputs and Outputs, along with associated rules and configuration parameters. For unit operation details, refer to CN-IC1-04 i-Controller (6-70 Ton) MPU Generic Sequence Of Operations REV.201.

NOTE: This integration specification is only applicable for Flō units equipped with i-Controller Revision 201 or greater.

Inputs

This section describes the values that can be sent to the i-Controller from the BMS for control customization.

Initializing Inputs

For the i-Controller to operate from the set points, occupancy, etc. sent from a BMS, a continuous check is made to ensure a successful communication exists between the i-Controller and the BMS. To prove communication, the program looks for a value equal or greater than 0 over Analog Value 62 for BACnet.

Every BMS transfer should include an update of this register with a value greater than or equal to 0. If this value is not updated within 90s of the last transfer, the i-Controller will revert to standalone control.

BACnet Inputs

Instance Number	Network Variables	Eng Units	Acceptable Range	BACnet Type	Read/Write
End User Settings					
62	Building Controller Online (Send Value >= 0 to controller)	-	>=0	Analog Value	Write
23	Occ Cool Set Point	˚F	60 - 85˚F	Analog Value	Write
24	Unocc Cool Set Point	˚F	60 - 85˚F	Analog Value	Write
21	Occ Heat Set Point	˚F	50 - 80˚F	Analog Value	Write
22	Unocc Heat Set Point	˚F	50 - 80˚F	Analog Value	Write
32	Occ Dew Point Set Point	˚F	48 - 60˚F	Analog Value	Write
33	Unocc Dew Point Set Point	˚F	48 - 60˚F	Analog Value	Write
82	VAV Heating Temperature Set Point	˚F	50 - 80˚F	Analog Value	Write
80	VAV Cooling Temperature Set Point	˚F	60 - 85˚F	Analog Value	Write
83	VAV 2 Heating Temperature Set Point	˚F	50 - 80˚F	Analog Value	Write
81	VAV 2 Cooling Temperature Set Point	˚F	60 - 85˚F	Analog Value	Write
0	Occupied / Unoccupied (True if Occupied)	-	-	Binary Value	Write
58	Enable/Disable* (True if CES Unit Enabled)	-	-	Binary Value	Write
41	Outdoor Air Temperature	˚F	≠ 0˚F	Analog Value	Write
42	Outdoor Humidity	% RH	≠ 0.0%	Analog Value	Write
74	Exhaust Fan 1 Interlock	-	-	Binary Value	Write
75	Exhaust Fan 2 Interlock	-	-	Binary Value	Write
76	Exhaust Fan 3 Interlock	-	-	Binary Value	Write
72	Load Shed Input	-	-	Binary Value	Write

End User Settings - Continued					
121	Exhaust Fan Minimum Speed %	%	0-100%	Analog Value	Write
122	Exhaust Fan Maximum Speed %	%	0-100%	Analog Value	Write

*The Flō Unit Enable/Disable variable can be used to disable the Flō unit via the BMS. The value will be "TRUE" by default, but can be sent a "FALSE" value to disable the Flō unit.

Outputs

This section describes the values that can be mapped from the i-Controller to the BMS to view status of the Flō unit operation.

NOTE: All Network Variables do not pertain to all Flō units. Refer to the "Unit Type Applicability" column to determine if the Network Variable should be included for a specific unit. The "Design Options" section provides detailed information about the configuration of the Flō unit, and can be used to determine if a feature is included for Network Variables with an "Unit Type Applicability" noted as "OPTION."

BACnet Outputs

Inst #	Network Variables	Eng Units	BACnet Type	Read/ Write	Unit Type Applicability	Description
Operation Mode						
61	Current Mode	-	Analog Value	Read	ALL	1: FanOnly, 2: Heating Only, 3: Cooling Only, 4: Dehum Only, 5: Dehum + Heat, 6: Dehum + Cool, 7: Pre-Emptive Ramp Up, 8: Shutdown; 9: Net Disable
Physical Inputs						
27	Space Temp	˚F	Analog Value	Read	ALL	Average Space Temperature
25	Space Dewpoint	˚F	Analog Value	Read	ALL	Calculated or Measured Space Dew Point
2	Return Air Temp	˚F	Analog Value	Read	ALL	Temperature of Air in Return Duct
1	Outdoor Air Temp	˚F	Analog Value	Read	ALL	Outdoor Air Temperature
14	Outdoor Air Dewpoint	˚F	Analog Value	Read	OPTION	Calculated Outdoor Air Dewpoint
0	Supply Air Temp	˚F	Analog Value	Read	ALL	Temperature of Air in Supply Duct
9	Suction Pressure Transducer 1	psi	Analog Value	Read	ALL	Suction pressure reading for Compressor 1
10	Discharge Pressure Transducer 1	psi	Analog Value	Read	ALL	Discharge pressure reading for Compressor 1

Physical Inputs - *Continued*						
45	Suction Pressure Transducer 2	psi	Analog Value	Read	10 - 70 TON	Suction pressure reading for Compressor 2
46	Discharge Pressure Transducer 2	psi	Analog Value	Read	10 - 70 TON	Discharge pressure reading for Compressor 2
118	Suction Pressure Transducer 3	psi	Analog Value	Read	31 - 70 TON	Suction pressure reading for Compressor 3
54	Discharge Pressure Transducer 3	psi	Analog Value	Read	31 - 70 TON	Discharge pressure reading for Compressor 3
53	Suction Pressure Transducer 4	psi	Analog Value	Read	31 - 70 TON	Suction pressure reading for Compressor 4
55	Discharge Pressure Transducer 4	psi	Analog Value	Read	31 - 70 TON	Discharge pressure reading for Compressor 4
5	Reheat/Reclaim Inlet Temp 1	˚F	Analog Value	Read	OPTION	Temperature reading from inlet pipe of reheat/reclaim coil (if equipped)
69	Reheat/Reclaim Inlet Temp 2	˚F	Analog Value	Read	OPTION	Temperature reading from inlet pipe of reheat/reclaim coil 2 (if equipped)
3	CO2 Level	ppm	Analog Value	Read	OPTION	Current CO2 level reading from CO2 sensor
25	Airflow Switch	-	Binary Value	Read	ALL	True if airflow switch is closed and fan proof is made
4	Outdoor Humidity	%RH	Analog Value	Read	OPTION	Outdoor %RH
12	Indoor Humidity	%RH	Analog Value	Read	OPTION	Indoor %RH
70	Phase Amperage	A	Analog Value	Read	OPTION	Amperage reading from one leg of the input power
84	VAV Zone 1 - 1st Temperature	˚F	Analog Value	Read	OPTION	Temperature 1 for VAV Zone 1
85	VAV Zone 1 - 2nd Temperature	˚F	Analog Value	Read	OPTION	Temperature 2 for VAV Zone 1
86	VAV Zone 2 Temperature	˚F	Analog Value	Read	OPTION	Temperature for VAV Zone 2
95	Hydronic HW Entering Temperature	˚F	Analog Value	Read	HYDRONIC	Hydronic Heating Entering Hot Water Temperature
96	Hydronic HW Leaving Temperature	˚F	Analog Value	Read	HYDRONIC	Hydronic Heating Leaving Hot Water Temperature
93	Hydronic HW Flow Proof	-	Binary Value	Read	HYDRONIC	Hydronic Heating Water Flow Proof
99	Entering Water Temp A	°F	Analog Value	Read	WATER SOURCE	Entering Water Temperature for water condenser A
100	Leaving Water Temp A	°F	Analog Value	Read	WATER SOURCE	Leaving Water Temperature for water condenser A
101	Entering Water Temp B	°F	Analog Value	Read	WATER SOURCE	Entering Water Temperature for water condenser B
102	Leaving Water Temp B	°F	Analog Value	Read	WATER SOURCE	Leaving Water Temperature for water condenser B
95	Water Flow Switch A	-	Binary Value	Read	WATER SOURCE	Water Flow Switch for water condenser A
96	Water Flow Switch B	-	Binary Value	Read	WATER SOURCE	Water Flow Switch for water condenser B

Alarms						
16	Clogged Filter Alarm	-	Binary Value	Read	ALL	True if a clogged filter is detected
14	Fan Fail Alarm	-	Binary Value	Read	ALL	True if supply fan has failed to start
64	Phase Loss Alarm	-	Binary Value	Read	ALL	True if the phase monitor detects a voltage above the acceptable limit
49	Drain Pan Overflow Alarm	-	Binary Value	Read	ALL	True if the drain pan level has exceeded the acceptable limit
65	Refrigerant Leak Alarm	-	Binary Value	Read	OPTION	True if a signal was received from the refrigeration system indicating a leak
13	Heat Alarm	-	Binary Value	Read	OPTION	True heating module is not functioning properly (if equipped)
84	Reheat/Reclaim Proof	-	Binary Value	Read	OPTION	True if proof of reheat or reclaim operation is made (if equipped)
106	Reheat/Reclaim Proof 2	-	Binary Value	Read	OPTION	True if proof of reheat or reclaim coil 2 operation is made (if equipped)
63	Compressor 1 Status	-	Analog Value	Read	ALL	0: OK; 1: Compressor High Discharge Trip; 2: Compressor Proof Alarm, 3: Low Suction Pressure Alarm, 4:High Discharge Pressure Alarm, 5: High Suction Pressure Alarm, 6: Suction Pressure Transducer Error, 7: Discharge Pressure Transducer Error, 8: Gradual Compressor Shutdown, 9: Instant Compressor Shutdown, 10: Entering Water Temp Shutdown, 11: No Condenser Flow, 12: Outdoor Air Compressor Lockout, 13: EconMode LockOut
64	Compressor 2 Status	-	Analog Value	Read	10 - 70 TON	0: OK; 1: Compressor High Discharge Trip; 2: Compressor Proof Alarm, 3: Low Suction Pressure Alarm, 4:High Discharge Pressure Alarm, 5: High Suction Pressure Alarm, 6: Suction Pressure Transducer Error, 7: Discharge Pressure Transducer Error, 8: Gradual Compressor Shutdown, 9: Instant Compressor Shutdown, 10: Entering Water Temp Shutdown, 11: No Condenser Flow, 12: Outdoor Air Compressor Lockout, 13: EconMode LockOut

Alarms - *Continued*						
65	Compressor 3 Status	-	Analog Value	Read	31 - 70 TON	0: OK; 1: Compressor High Discharge Trip; 2: Compressor Proof Alarm, 3: Low Suction Pressure Alarm, 4:High Discharge Pressure Alarm, 5: High Suction Pressure Alarm, 6: Suction Pressure Transducer Error, 7: Discharge Pressure Transducer Error, 8: Gradual Compressor Shutdown, 9: Instant Compressor Shutdown, 10: Entering Water Temp Shutdown, 11: No Condenser Flow, 12: Outdoor Air Compressor Lockout, 13: EconMode LockOut
66	Compressor 4 Status	-	Analog Value	Read	31 - 70 TON	0: OK; 1: Compressor High Discharge Trip; 2: Compressor Proof Alarm, 3: Low Suction Pressure Alarm, 4:High Discharge Pressure Alarm, 5: High Suction Pressure Alarm, 6: Suction Pressure Transducer Error, 7: Discharge Pressure Transducer Error, 8: Gradual Compressor Shutdown, 9: Instant Compressor Shutdown, 10: Entering Water Temp Shutdown, 11: No Condenser Flow, 12: Outdoor Air Compressor Lockout, 13: EconMode LockOut
15	Smoke Alarm	-	Binary Value	Read	ALL	True if alarm is active (smoke detector has been tripped)
77	CO2 Alarm	-	Binary Value	Read	OPTION	True if alarm is active (CO2 level has exceeded upper limit)
67	Expansion 1 Fault	-	Binary Value	Read	ALL	True if Expansion card 1 is expected but not communicating
68	Expansion 2 Fault	-	Binary Value	Read	ALL	True if Expansion card 2 is expected but not communicating
59	Sensor Failures	-	Binary Value	Read	ALL	True if a sensor failure exists
98	Hydronic Heating Alarm	-	Analog Value	Read	HYDRONIC	Hydronic Heating Status Alarm: 1: OK, 2: Flow Proof Alarm, 3: Entering Water Temp Alarm
100	High Entering Water Temperature A	-	Binary Value	Read	WATER SOURCE	True if water condenser A entering water temperature is too high
101	Low Entering Water Temperature A	-	Binary Value	Read	WATER SOURCE	True if water condenser A entering water temperature is too low
102	High Entering Water Temperature B	-	Binary Value	Read	WATER SOURCE	True if water condenser B entering water temperature is too high
103	Low Entering Water Temperature B	-	Binary Value	Read	WATER SOURCE	True if water condenser B entering water temperature is too low
104	Water Flow Alarm A	-	Binary Value	Read	WATER SOURCE	True if no water flow is detected in condenser A
105	Water Flow Alarm B	-	Binary Value	Read	WATER SOURCE	True if no water flow is detected in condenser B

Physical Outputs						
20	Supply Fan Speed	%	Analog Value	Read	ALL	Current VFD Operating %
67	Compressor 1 Status	%	Analog Value	Read	ALL	Digital Compressor 1 Operating %
69	Fixed Compressor 2 Status	-	Binary Value	Read	10 - 70 TON	True if Fixed Compressor 2 is on
68	Compressor 2 Status	%	Analog Value	Read	31 - 70 TON	Digital Compressor 2 Operating %
70	Compressor 3 Status	-	Binary Value	Read	31 - 70 TON	True if Fixed Compressor 3 is on
71	Compressor 4 Status	-	Binary Value	Read	31 - 70 TON	True if Fixed Compressor 4 is on
16	RA Damper	%	Analog Value	Read	ALL	Return Air Damper % Open
17	BA Damper	%	Analog Value	Read	ALL	Bypass Air Damper % Open
15	OA Damper	%	Analog Value	Read	ALL	Outdoor Air Damper % Open
10	Condenser Fan 2	-	Binary Value	Read	25 - 70 TON	True if condenser fan 2 is on
31	Condenser Fan 5	-	Binary Value	Read	31 - 70 TON	True if condenser fan 5 is on
51	Suction Pressure SP Gp 1	psi	Analog Value	Read	ALL	Suction Pressure Set Point for Suction Group 1
52	Suction Pressure SP Gp 2	psi	Analog Value	Read	31 - 70 TON	Suction Pressure Set Point for Suction Group 2
78	Reheat/Reclaim 1	-	Binary Value	Read	OPTION	True if reheat or reclaim 1 is active (if equipped)
79	Reheat/Reclaim 2	-	Binary Value	Read	OPTION	True if reheat or reclaim 2 is active (if equipped)
56	% Heat Capacity	%	Analog Value	Read	OPTION	% of total heating capacity that is currently active (if equipped)
31	% Compressor Capacity	%	Analog Value	Read	ALL	% of total compressor capacity that is currently active
86	VAV Booster Fan	-	Binary Value	Read	OPTION	True if VAV Booster Fan is ON
87	VAV Fan	-	Binary Value	Read	OPTION	True if VAV Fan is enabled
87	VAV Fan Speed	%	Analog Value	Read	OPTION	VAV Fan Speed 0-100%
88	VAV Damper	%	Analog Value	Read	OPTION	VAV Damper % Open
88	VAV Booster Fan 2	-	Binary Value	Read	OPTION	True if VAV Booster Fan 2 is ON
89	VAV Fan 2	-	Binary Value	Read	OPTION	True if VAV Fan 2 is enabled
89	VAV Fan Speed 2	%	Analog Value	Read	OPTION	VAV Fan Speed 2 0-100%
90	VAV Damper 2	%	Analog Value	Read	OPTION	VAV Damper 2 % Open

Physical Outputs - *Continued*						
46	ERV Wheel	-	Binary Value	Read	OPTION	ERV Wheel Enable
47	ERV Power Exhaust	-	Binary Value	Read	OPTION	ERV Power Exhaust Enable
80	ERV Bypass	-	Binary Value	Read	OPTION	True if ERV Bypass is open
90	ERV Store Exhaust	-	Binary Value	Read	OPTION	ERV Store Exhaust Fan Enable
45	Exhaust Interlock 1	-	Binary Value	Read	OPTION	True if Exhaust Interlock 1 is ON
107	Exhaust Interlock 2	-	Binary Value	Read	OPTION	True if Exhaust Interlock 2 is ON
108	Exhaust Interlock 3	-	Binary Value	Read	OPTION	True if Exhaust Interlock 3 is ON
97	Hydronic Hot Water Valve	%	Analog Value	Read	HYDRONIC	Percent opening of Hydronic Heating Coil Valve
92	Hydronic Hot Water Enable	-	Binary Value	Read	HYDRONIC	Hydronic Hot Water Mode Enable
94	Hydronic Hot Water Pump	-	Binary Value	Read	HYDRONIC	Hydronic Hot Water Pump Enable
103	Water Condenser Valve A	%	Analog Value	Read	WATER SOURCE	Water Condenser Valve A Open Position 0-100%
104	Water Condenser Valve B	%	Analog Value	Read	WATER SOURCE	Water Condenser Valve B Open Position 0-100%
97	Reversing Valve	-	Binary Value	Read	WATER SOURCE	Reversing Valve Position - true is heating, false is cooling
119	Discharge Pressure SP Gp 1	psi	Analog Value	Read	HEAT PUMP	Discharge Pressure Set Point for Suction Group 1 during heating
120	Discharge Pressure SP Gp 2	psi	Analog Value	Read	HEAT PUMP	Discharge Pressure Set Point for Suction Group 2 during heating
109	Water Condenser A Pressure	psi	Analog Value	Read	WATER SOURCE	Effective pressure used to modulate water condenser valve A
111	Water Condenser A Pressure SP	psi	Analog Value	Read	WATER SOURCE	Pressure setpoint to modulate condenser valve A
110	Water Condenser B Pressure	psi	Analog Value	Read	WATER SOURCE	Effective pressure used to modulate water condenser valve B
112	Water Condenser B Pressure SP	psi	Analog Value	Read	WATER SOURCE	Pressure setpoint to modulate condenser valve B
123	Exhaust Fan Speed %	%	Analog Value	Read	OPTION	Current Exhaust Fan Percent Speed

Design Options/Parameters						
71	Max Outdoor Damper Position	%	Analog Value	Read	ALL	Max % opening of the Outdoor Air Damper including DCV requirements (if equipped)
36	Outdoor Damper CO2 Max Inc.	%	Analog Value	Read	OPTION	Additional % opening of the Outdoor Air Damper during a CO2 call
73	Max Return Damper Position	%	Analog Value	Read	ALL	Max % opening of the Return Air Damper throughout Cool/Heat/Fan Only modes
72	Min Return Damper Position	%	Analog Value	Read	ALL	Min % opening of the Return Air Damper throughout Dehum mode
74	Min Bypass Damper Position	%	Analog Value	Read	ALL	Min % opening of the Bypass Air Damper throughout Cool/Heat/Fan Only modes
85	RH/Dew Point Sensor	-	Binary Value	Read	ALL	True if RH sensor, False if Dewpoint Sensor
57	Number of Condenser Fans	#	Analog Value	Read	ALL	Total # of Condenser Fans included on the unit
34	Condenser Fan Control	-	Binary Value	Read	ALL	True if Condenser Fan Control is Enabled in the control sequence
59	Number of Heat Stages	#	Analog Value	Read	OPTION	Total # of Auxiliary Heat Stages included on the unit
60	Reheat/Reclaim	-	Binary Value	Read	OPTION	True if Reclaim, False if Reheat
73	Reheat/Reclaim Disable	-	Binary Value	Read	OPTION	True if neither Reheat or Reclaim coils are included on the unit
48	Auxiliary Heat Lockout	-	Binary Value	Read	OPTION	True if there is no auxiliary heating included in the CES unit
18	CO2 Sensor	-	Binary Value	Read	OPTION	True if a CO2 Sensor is included on the unit or used for control
58	Number of Compressors	#	Analog Value	Read	ALL	Total # of Compressors included on the unit
75	Number of Exhaust Interlocks	#	Analog Value	Read	OPTION	Total # of exhaust interlocks configured in unit control
91	VAV Option	-	Binary Value	Read	OPTION	True if VAV box control is included in the control sequence
91	VAVNum	#	Analog Value	Read	OPTION	Total # of VAV zones being controlled by the CES unit
83	ERV Option	-	Binary Value	Read	OPTION	True if an ERV is included on the unit
49	Program Revision Number	#	Analog Value	Read	ALL	Current firmware version loaded on the controller
113	Number of Water Condensers	#	Analog Value	Read	WATER SOURCE	# of water condensers present on the unit
98	Water Source	-	Binary Value	Read	WATER SOURCE	True if the unit uses water source condensers
99	Preheat Option	-	Binary Value	Read	OPTION	True if unit is equipped with pre-heat
116	Unit Type	#	Analog Value	Read	ALL	1 : SPU, 2 = MPU, 3 = WSHP, 4 = Split, 5 = MUA, 6 = HOU, 7 = Chilled Water <=40 Tom, 8= Chilled Water >= 50Ton
114	Min Condenser Valve Position	%	Analog Value	Read	WATER SOURCE	Minimum % opening f or water condenser valve during modulation
115	Max Condenser Valve Position	%	Analog Value	Read	WATER SOURCE	Maximum % opening f or water condenser valve during modulation
117	Condenser Valve OFF Position	%	Analog Value	Read	WATER SOURCE	Condenser valve % opening when no compressors are called for

Sensor Offsets						
76	Space Temp Offset	˚F*10	Analog Value	Read	ALL	Space temperature sensor calibration offset
77	Space Humidity Offset	%	Analog Value	Read	ALL	Space humidity sensor calibration offset
78	Supply Temp Offset	˚F*10	Analog Value	Read	ALL	Supply temperature sensor calibration offset
79	Return Air Temp Offset	˚F*10	Analog Value	Read	ALL	Return temperature sensor calibration offset
92	VAV Zone 1 Temp Offset	˚F*10	Analog Value	Read	OPTION	VAV zone 1 temperature sensor calibration offset
93	VAV Zone 1 2nd Temp Offset	˚F*10	Analog Value	Read	OPTION	VAV zone 1 second temperature sensor calibration offset
94	VAV Zone 2 Temp Offset	˚F*10	Analog Value	Read	OPTION	VAV zone 2 temperature sensor calibration offset