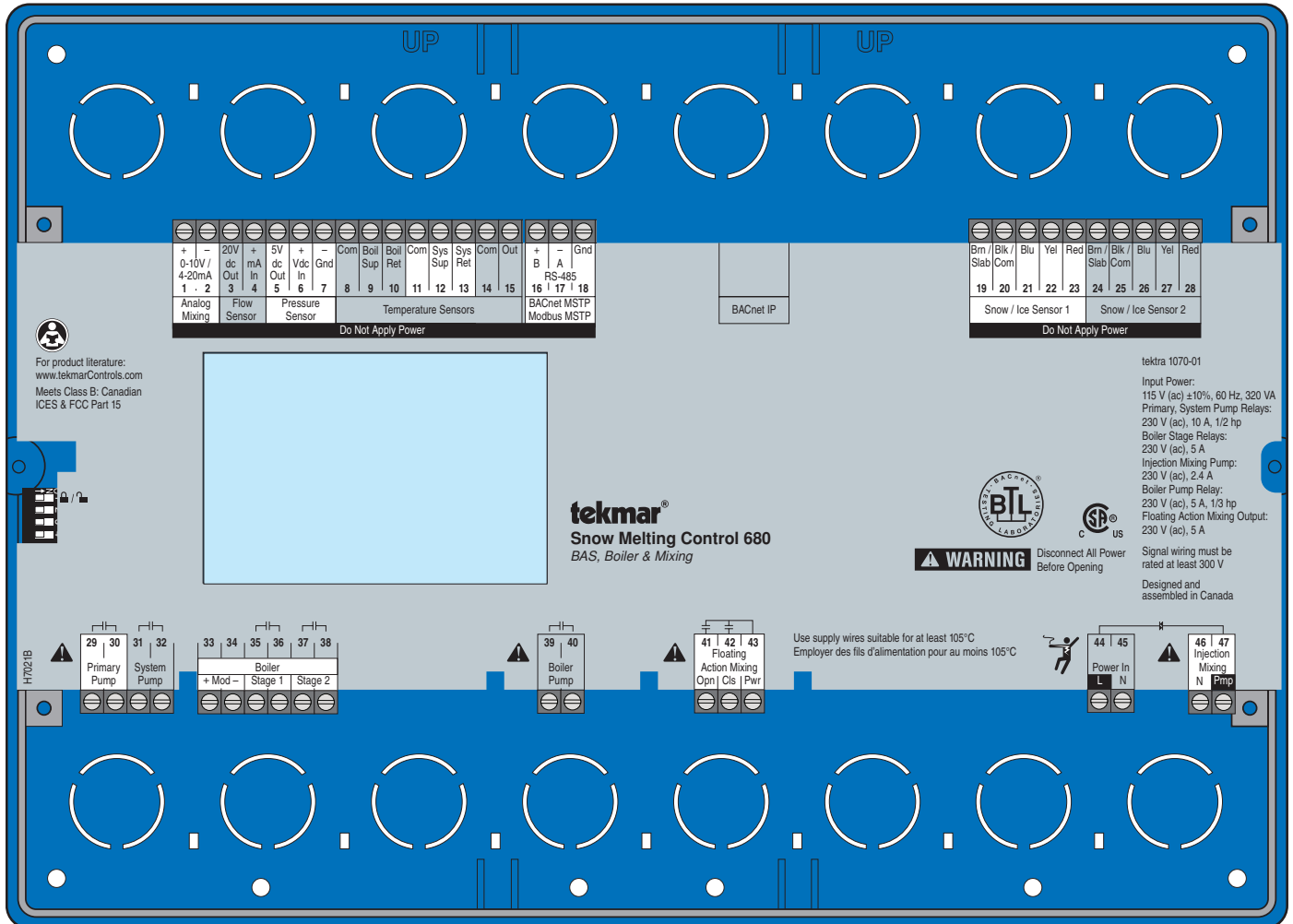




## Introduction

The Snow Melting Control 680 can communicate with a Building Automation System (BAS) using either BACnet® IP, BACnet® MSTP or Modbus® MSTP.

This manual provides information about control parameters that can be accessed by building automation or management systems that use BACnet or Modbus communication.



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## BACnet Protocol Implementation Conformance Statement (PICS)

**Vendor Name:** tekmar Control Systems Ltd.

**Vendor ID:** 585

**Product Name:** Snow Melting Control 680

**Product Model Number:** 680

**Application Software Version:** J1243F

**Firmware Revision:** J1243F

**BACnet Protocol Revision:** 10

**Product Description:**

The 680 is a control that operates an automatic snow melting system.

### BACnet Standardized Device Profile (Annex L)

BACnet Application Specific Controller (B-ASC)

### Supported BIBBs (Annex K)

Supported BIBBs (Annex K)	Name
DS-RP-B	Data Sharing-ReadProperty-B
DS-RPM-B	Data Sharing-ReadPropertyMultiple-B
DS-WP-B	Data Sharing-WriteProperty-B
DM-DDB-B	Device Management-Dynamic Device Binding-B
DM-DOB-B	Device Management-Dynamic Object Binding-B
DM-DCC-B	Device Management-Device Communication Control-B

\*DeviceCommunicationControl password is tekmar.

Segmentation Capability	Supported	Window Size
Able to transmit segmented messages	No	
Able to receive segmented messages	No	

Standard Object Types Supported	Creatable	Deletable
Analog Input	No	No
Analog Value	No	No
Binary Input	No	No
Binary Value	No	No

Data Link Layer	Supported
BACnet IP (Annex J)	Yes
BACnet MSTP	Yes

Device Address Binding	Supported
Static Device Address Binding	No

Network Security Options	Supported
Non-secure Device	

Character Set	Supported
ANSI X3.4	Yes

### BACnet-IP Connection

Use a top or back knock-out to bring a CAT-5E or CAT-6 wire into the wiring chamber. Connect the 680 to the BACnet-IP network switch using the RJ45 port on the top edge of the control board.

- Cable length must not exceed 150 ft. (45 m) for CAT-5E or 300 ft. (90 m) for CAT-6.
- If the cable was manually made, check continuity across each of the wires.

### BACnet-MSTP Connection

Use a top or back knock-out to bring a shielded twisted pair wire from the nearest BACnet RS485 connection point into the wiring chamber. Wire the A, B & G conductors from the BACnet point to the 680 A, B & Gnd terminals.

- Gnd should not be connected to the ground screws in the 680.
- If 120 Ω terminating resistors are installed, then biasing resistors located at the BACnet master are required.

## BACnet Analog Parameters

Analog Input Object = AI

Analog Value Object = AV

Read = R

Read/Write = R/W

Object ID	Name	Data Type	Read/Write	Units	Range/Value
<i>Analog Input Objects</i>					
0	Operation	AI	R	No Units (95)	0 = Off, 1 = Idle, 2 = Storm, 3 = Melt, 4 = Manual Override
1	Operation Status	AI	R	No Units (95)	0 = Normal, 1 = WWSD, 2 = CWSD, 3 = Timed Melting, 4 = Warming Up, 5 = Pending
2	Melt Time Remaining	AI	R	Hours (71)	0 to 24:00 hours
3	Additional Melt Time Remaining	AI	R	Hours (71)	0 to 6:00 hours
4	Outdoor Air Temperature	AI	R	°F (64)	-67 to 149°F
5	Slab 1 Temperature	AI	R	°F (64)	-58 to 167°F
6	Slab 2 Temperature	AI	R	°F (64)	-58 to 167°F
7	Coldest Slab Temperature	AI	R	°F (64)	-58 to 167°F
8	Slab Target Temperature	AI	R	°F (64)	20 to 120°F
9	Boiler Supply Temperature	AI	R	°F (64)	-31 to 266°F
10	Boiler Return Temperature	AI	R	°F (64)	-31 to 266°F
11	Boiler Target Temperature	AI	R	°F (64)	50 to 230°F
12	Boiler Output	AI	R	% (98)	0 to 100%
13	System Supply Temperature	AI	R	°F (64)	-31 to 266°F
14	System Return Temperature	AI	R	°F (64)	-31 to 266°F
15	Mix System Target Temperature	AI	R	°F (64)	50 to 230°F
16	Mix System Output	AI	R	% (98)	0 to 100%
17	PWM and Electric Heat Output	AI	R	% (98)	0 to 100%
18	System Flow Rate	AI	R	US GPM (89)	0 to 1000 GPM
19	System Pressure	AI	R	PSI (56)	0 to 300 psi
19	Melting Energy	AI	R	Therms (21)	0 to 65535 Therms
21	Melting Hours	AI	R	Hours (71)	0 to 65535 Hours
22	Heat Cycles	AI	R	No Units (95)	0 to 65535 Cycles
23	System Pump Run Time	AI	R	Hours (71)	0 to 65535 Hours
24	Primary Pump Run Time	AI	R	Hours (71)	0 to 65535 Hours
25	Boiler Pump Run Time	AI	R	Hours (71)	0 to 65535 Hours
26	Error Code	AI	R	No Units (95)	See Error Codes list
<i>Analog Value Objects</i>					
0	BAS Outdoor Air Temperature	AV	R/W	°F (64)	-67 to 149°F
1	Melt Setpoint	AV	R/W	°F (64)	32 to 95°F
2	Idle Setpoint	AV	R/W	°F (64)	20 to 95°F, 0 = off
3	Storm Setpoint	AV	R/W	°F (64)	20 to 95°F, 0 = off
4	Manual Melt Time	AV	R/W	Hours (71)	0:30 to 24:00 Hours
5	Add Melt Time	AV	R/W	Hours (71)	0:00 to 6:00 Hours
6	Storm Run Time	AV	R/W	Hours (71)	0:30 to 24:00 Hours
7	Snow/Ice Sensitivity 1	AV	R/W	No Units (95)	0 = Auto, 1 = Min, 2 = -2, 3 = -1, 4 = Mid, 5 = +1, 6 = +2, 7 = Max
8	Snow/Ice Sensitivity 2	AV	R/W	No Units (95)	0 = Auto, 1 = Min, 2 = -2, 3 = -1, 4 = Mid, 5 = +1, 6 = +2, 7 = Max
9	Warm Weather Shut Down	AV	R/W	°F (64)	32 to 95°F
10	Cold Weather Cut Out	AV	R/W	°F (64)	-30 to 50°F

## BACnet Binary Parameters

Binary Input Object = BI

Binary Value Object = BV

Read = R

Write = W

Object ID	Name	Data Type	Read / Write	Units	Range/Value
<i>Binary Input Objects</i>					
0	Slab 1 Water	BI	R	No Units (95)	0 = Dry, 1 = Wet
1	Slab 2 Water	BI	R	No Units (95)	0 = Dry, 1 = Wet
2	Combined Water Status	BI	R	No Units (95)	0 = Dry, 1 = Wet
3	System Pump	BI	R	No Units (95)	0 = Off, 1 = On
4	Primary Pump	BI	R	No Units (95)	0 = Off, 1 = On
5	Boiler Pump	BI	R	No Units (95)	0 = Off, 1 = On
6	Boiler Stage 1	BI	R	No Units (95)	0 = Off, 1 = On
7	Boiler Stage 2	BI	R	No Units (95)	0 = Off, 1 = On
<i>Binary Value Objects</i>					
0	Outdoor Sensor Enable	BV	R/W	No Units (95)	0 = Control to measure outdoor air temperature 1 = BAS to send outdoor air temperature
1	Melt/Stop Request	BV	R/W	No Units (95)	0 = Off, 1 = Melt
2	Storm/Stop Request	BV	R/W	No Units (95)	0 = Off, 1 = Storm
3	Idle Enable	BV	R/W	No Units (95)	0 = Idling disabled, 1 = Idling enabled
4	Storm Enable	BV	R/W	No Units (95)	0 = Storm disabled, 1 = Storm enabled
5	WWSD Enable	BV	R/W	No Units (95)	0 = WWSD disabled, 1 = WWSD enabled
6	CWCO Enable	BV	R/W	No Units (95)	0 = CWCO disabled, 1 = CWCO enabled

Refer to the *Installation & Operation Manual 680\_D* for additional information.

### Troubleshooting

#### If there is no communication, check the following:

- Check the ethernet cable. Cable length must not exceed 150 ft. (45 m) for CAT-5E or 300 ft. (90 m) for CAT-6.
- If the cable was manually made, check continuity across each of the wires.

#### If there is intermittent communication, check the following:

- Check the ethernet cable. Cable length must not exceed 150 ft. (45 m) for CAT-5E or 300 ft. (90 m) for CAT-6.

## Modbus Specification

Communication Protocol	Modbus over RS-485
Physical Layer	RS-485 two-wire plus signal ground
Baud Rate	9600, 19200, 38400, 768000 (default: 9600 bps)
Recommended Cable	18 AWG shielded, twisted pair (STP)
Transmission Mode	RTU or ASCII (default: RTU)
Maximum Cable Length	76800 bps: 580 ft. (177 m) 57600 bps: 1,158 ft. (353 m) 19200, 9600 bps: 3,280 ft. (1,000 m) 3,280 ft (1,000 m) for all baud rates if 120 Ohm terminating resistors used
Start Bit	1 bit
Data Length	8 bits for RTU mode 7 bits for ASCII mode
Parity	None (2 stop bits) Even (1 stop bit) Odd (1 stop bit) (default: Even)
Addressing	1 to 247 (default: 1)

## Modbus Connection

Use a top or back knock-out to bring a shielded twisted pair wire from the nearest Modbus RS485 connection point into the wiring chamber. Wire the A, B & G conductors from the Modbus point to the 680 A, B & Gnd terminals.

Gnd should not be connected to the ground screws in the 680.

## Modbus Troubleshooting

### If there is no communication, check the following:

- Check that the polarity on the Modbus A & B terminals is correct.
- Check that Modbus GND terminal is securely connected.
- Check that the baud rate is the same on both devices.

### If the communication is intermittent, check the following:

- Check that the communication cable is of the twisted pair type.
- Reliable communication depends on the cable length and baud rate used. Long cable length may require a lower baud rate.

## Modbus Parameters

Read = R

Read/Write = R/W

Register	Parameter Name	Read/Write	Units	Type	Format	Range
<i>Input Registers (Starts at 40,000)</i>						
1	Model	R	Enum	Input	U16	680
2	Firmware Revision	R	Enum	Input	U16	SVN revision
3	Application Version	R	Enum	Input	U16	Software (A= 1, B = 2, ... Z = 26)
4	Error Code	R	Enum	Input	U16	See Error Codes list
5	Operation	R	Enum	Input	U16	0 = Off, 1 = Idle, 2 = Storm, 3 = Melt
6	Operation Status	R	Enum	Input	U16	0 = Normal, 1 = WWSD, 2 = CWSD, 3 = Timed Melting, 4 = Warming Up, 5 = Pending
7	Manual Melt Time Remaining	R	Minutes	Input	U16	0 to 1440 minutes
8	Additional Melt Time Remaining	R	Minutes	Input	U16	0 to 360 minutes
9	Outdoor Air Temperature	R	°F	Input	S16	-67 to 149°F
10	Slab 1 Temperature	R	°F	Input	S16	-58 to 167°F
11	Slab 1 Water	R	Enum	Input	U16	0 = Dry, 1 = Wet
12	Slab 2 Temperature	R	°F	Input	S16	-58 to 167°F
13	Slab 2 Water	R	Enum	Input	U16	0 = Dry, 1 = Wet
14	Coldest Slab Temperature	R	°F	Input	S16	-58 to 167°F
15	Slab Target Temperature	R	°F	Input	S16	20 to 120°F
16	Combined Water Status	R	Enum	Input	U16	0 = Dry, 1 = Wet
17	Boiler Supply	R	°F	Input	S16	-31 to 266°F
18	Boiler Return	R	°F	Input	S16	-31 to 266°F
19	Boiler Target	R	°F	Input	S16	50 to 230°F
20	Boiler Output	R	%	Input	U16	0 to 100%
21	System Supply	R	°F	Input	S16	-31 to 266°F
22	System Return	R	°F	Input	S16	-31 to 266°F
23	Mix System Target	R	°F	Input	S16	50 to 230°F
24	Mix System Output	R	%	Input	U16	0 to 100%
25	System Pump	R	Enum	Input	U16	0 = Off, 1 = On
26	Primary Pump	R	Enum	Input	U16	0 = Off, 1 = On
27	Boiler Pump	R	Enum	Input	U16	0 = Off, 1 = On
28	System Flow Rate	R	GPM	Input	U16	0 to 1000 US GPM
29	System Pressure	R	PSI	Input	U16	0 to 300 psi
30	PWM and Electric Heat Output	R	%	Input	U16	0 to 100%
31	Melting Energy (low word)	R	Therms	Input	U16	0 to 65535
32	Melting Energy (high word)	R	Therms	Input	U16	0 to 65535

## Modbus Parameters

Read = R

Read/Write = R/W

33	Melting Hours (low word)	R	Hours	Input	U16	0 to 65535
34	Melting Hours (high word)	R	Hours	Input	U16	0 to 65535
35	Heat Cycles (low word)	R	Enum	Input	U16	0 to 65535
36	Heat Cycles (high word)	R	Enum	Input	U16	0 to 65535
37	System Pump Run Time (low word)	R	Hours	Input	U16	0 to 65535
38	System Pump Run Time (high word)	R	Hours	Input	U16	0 to 65535
39	Primary Pump Run Time (low word)	R	Hours	Input	U16	0 to 65535
40	Primary Pump Run Time (high word)	R	Hours	Input	U16	0 to 65535
41	Boiler Pump Run Time (low word)	R	Hours	Input	U16	0 to 65535
42	Boiler Pump Run Time (high word)	R	Hours	Input	U16	0 to 65535
<i>Holding Registers (Starts at 30,000)</i>						
1	Outdoor Sensor Enable	R/W	Enum	Holding	U16	0 = Control to measure outdoor air temperature, 1 = BAS to send outdoor air temperature
2	BAS Outdoor Temperature	R/W	°F	Holding	S16	-67 to 149°F
3	Melt Setpoint	R/W	°F	Holding	U16	32 to 95°F
4	Idle Enable	R/W	Enum	Holding	U16	0 = Idling disabled, 1 = Idling enabled
5	Idle Setpoint	R/W	°F	Holding	U16	20 to 95°F
6	Storm Enable	R/W	Enum	Holding	U16	0 = Storm disabled, 1 = Storm enabled
7	Storm Setpoint	R/W	°F	Holding	U16	20 to 95°F
8	Manual Melt Time	R/W	Hours	Holding	U16	30 to 1440 minutes
9	Add Melt Time	R/W	Hours	Holding	U16	0 to 360 minutes
10	Storm Run Time	R/W	Hours	Holding	U16	30 to 1440 minutes
11	Snow/Ice Sensitivity 1	R/W	Enum	Holding	U16	0 = Auto, 1 = Min, 2 = -2, 3 = -1, 4 = Mid, 5 = +1, 6 = +2, 7 = Max
12	Snow/Ice Sensitivity 2	R/W	Enum	Holding	U16	0 = Auto, 1 = Min, 2 = -2, 3 = -1, 4 = Mid, 5 = +1, 6 = +2, 7 = Max
13	Warm Weather Shut Down Enable	R/W	Enum	Holding	U16	0 = WWSD disabled 1 = Manual WWSD setting
14	Warm Weather Shut Down Temperature	R/W	°F	Holding	S16	32 to 95°F
15	Cold Weather Cut Out Enable	R/W	Enum	Holding	U16	0 = CWCO disabled 1 = Manual CWCO setting
16	Cold Weather Cut Out	R/W	°F	Holding	S16	-30 to 50°F
17	Melt/Stop Request	R/W	Enum	Holding	U16	0 = Off, 1 = Melt
18	Storm/Stop Request	R/W	Enum	Holding	U16	0 = Off, 1 = Storm

## Error Codes (for BACnet and Modbus)

Code	Description
0	No error
1	Setpoint Menu Memory Error
1	Setup System Menu Memory Error
1	Setup Boiler Menu Memory Error
1	Mixing Menu Memory Error
1	BAS Menu Memory Error
2	Low Pressure Alert
3	Max Melt Days Error
4	Outdoor Sensor Open Circuit Error
4	Outdoor Sensor Short Circuit Error
5	Boiler Supply Sensor Open Circuit Error
5	Boiler Supply Sensor Short Circuit Error
6	Boiler Return Sensor Open Circuit Error
6	Boiler Return Sensor Short Circuit Error
7	System Supply Sensor Open Circuit Error
7	System Supply Sensor Short Circuit Error
8	System Return Sensor Open Circuit Error
8	System Return Sensor Short Circuit Error

Code	Description
9	Slab Sensor 1 Open Circuit Error
9	Slab Sensor 1 Short Circuit Error
10	Snow Sensor 1 Yellow Wire Open Circuit Error
11	Snow Sensor 1 Blue Wire Open Circuit Error
11	Snow Sensor 1 Blue Wire Short Circuit Error
12	Snow Sensor 1 Brown Wire Open Circuit Error
12	Snow Sensor 1 Brown Wire Short Circuit Error
13	Snow/Ice Sensor 1 Error
13	Snow Sensor 1 Error
14	Slab Sensor 2 Open Circuit Error
14	Slab Sensor 2 Short Circuit Error
15	Snow Sensor 2 Yellow Wire Open Circuit Error
16	Snow Sensor 2 Blue Wire Open Circuit Error
16	Snow Sensor 2 Blue Wire Short Circuit Error
17	Snow Sensor 2 Brown Wire Open Circuit Error
17	Snow Sensor 2 Brown Wire Short Circuit Error
18	Snow/Ice Sensor 2 Error
18	Snow Sensor 2 Error

Detailed information on how to correct the error code is included in the *Installation and Operation Manual 680\_D* available at [tekmarControls.com](http://tekmarControls.com).