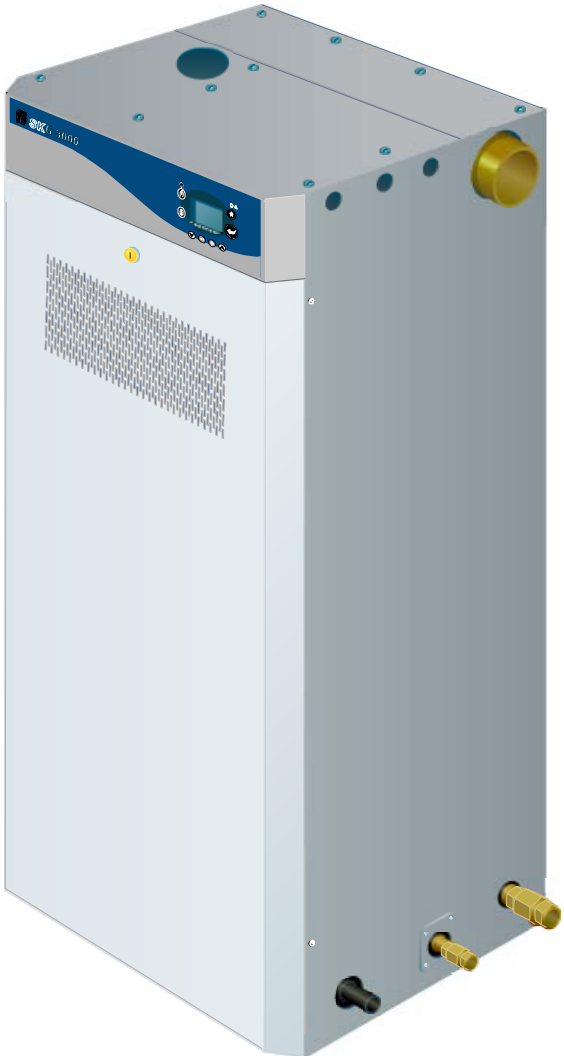
neptronic®

Gas Fired Humidifier
SKG Series

BACnet® Communication Module
User Guide



BACnet™

SKG-BACNET – Rev.: 060803

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Other related documents:

1. Installation instructions
2. Start up check list
3. Wiring diagram
4. Service and troubleshooting guide

Introduction

This document provides a Users Guide for using the NEP PIC Communications Module for SKG Humidifiers (NEPICSKG). This product provides a BACnet ® network interface between BACnet client devices and NEP SKG Humidifier Series devices, specifically for SKG models. NEPICSKG uses the BACnet Master Slave/Token Passing (MS/TP) protocol at the BACnet MAC layer.

This document assumes you're familiar with BACnet and BACnet terminology.

BACnet® Requirements

Performance

The NEPICSKG uses a synchronous implementation for BACnet messages. Each BACnet confirmed service request is answered as quickly as possible without using Reply Postponed. In particular, MS/TP implementation performs within Tusage_delay of 15ms in order to assure Tusage_timeout values within 20ms.

Support for MS/TP

The NEPICSKG supports a Full Master Node state machine for MS/TP. Max_Master and the MS/TP MAC address shall be configurable through WriteProperty service to the device object. A default MAC address of 254 shall be recognized when a configuration dip switch is set to configure mode. Two other dip switches shall determine MS/TP baud rate 9600, 19200, 38400, and 76800. When in the configure mode WriteProperty service requests may be directed to MAC address 254 using the wildcard Device instance (4194303 decimal/0x3FFFFF hex) as a means of configuring all other parameters for the device. Also, when in the configuration mode the MS/TP MAC address and the Device Instance shall be configurable through the Unit's Keypad.

BIBB Support

The NEPICSKG generally behaves as a B-ASC type profile server. The following specific BIBBs are supported per their relevant definitions in Annex K to BACnet:

DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B

Object Support (in general)

The NEPICSKG supports a table-based fixed list of BACnet-visible values which appear as Present_Values of various BACnet standard object types, in addition to a Device object.

Alarms

Although the NEPICSKG supports the ability to indicate various alarm conditions through value changes in properties of several of its objects, it **does not** generate BACnet Event Notifications.

Device Object

The following table lists all the BACnet properties supported for the device object. *W?* indicates if the property is writable using the BACnet WriteProperty service.

Device

property	*value*	*W?*
Object_Identifier	*programmable where the instance part of the Object_Identifier is in the range of 0-4194302*. The device instance must be unique system-wide. The default value for the device instance=153000 (Vendor_Identifier*1000)	W
Object_Name	*programmable up to 32 characters*. The device name must be unique system-wide. The default value= "NEPSKGHumidifier153000" where 153000 is the Vendor_Identifier*1000	W
Object_Type	8	
System_Status	*always operational*	
Vendor_Identifier	always 153	
Vendor_Name	always “National Environmental Products Ltd	
Model_Name	“SKG3” for example	
Status_Flags	If the *fault* bit is set, it indicates that the Present_Value is unavailable and is unreliable	
Firmware_Revision	currently “1.00”	
Application_Software_Version	currently “1.00”	
Protocol_Version	always 1	
Protocol_Revision	always 2	
Max_APDU_Length_Accepted	always 107	
Segmentation_Supported	always none	
APDU_Timeout	always 0	
Number_of_APDU_Retries	always 0	
Protocol_Services_Supported	always 0x00 0x09 0x40 0x00 0xE0 (i.e. a bitstring in BACnet order	
Protocol_Object_Types_Supported	always 0xB4 0x84 0x10 0x00 (i.e. a bitstring in BACnet order	
Object_List	per the standard. Because of restrictions on the size of the transmit buffers, the entire Object_List cannot be returned at once, rather the Object_List must be read, one-at-a-time	
Local_Time	per *the standard*, if the unit supports a RTC	
Local_Date	per *the standard*, if the unit supports a RTC	
Device_Address_Binding	always empty	
Max_Master	*programmable in the range of 0-127*. Default value=127	W
Max_Info_Frames	always 1	
Proprietary property #1000	*programmable*. This proprietary property represents the MS/TP MAC address in the range of (0-254). Values 128 to 254 represent MS/TP non-token-passing slave devices. Default value=0	W

Objects

A complete list of all BACnet objects for the NEPICSKG are listed in the following section. There are a total of between 94 and 199 BACnet objects per NEPICSKG consisting of the following types:

Common for all SKG Models:

- 1 Device
- 1 Analog Input (AI)
- 28 Analog Values (AV)
- 18 Binary Inputs (BI)
- 6 Binary Values (BV)
- 6 Multistate Values (MSV)

For each Tank (minimum 1, maximum 4):

- 9 Analog Inputs (AI)
- Analog Values (AV)
- 6 Binary Inputs (BI)
- 16 Binary Values (BV)
- 1 Multistate Input (MSI)

So, the number of objects vs. the number of Tanks are listed in the following table:

Number of Tanks	*Number of Objects*
1	95
2	130
3	165
4	200

The Device Object has already been described. The following tables list all the BACnet properties supported for each object type. Most of the properties are locked in. The exceptions are Present_Values, which represent the dynamic operating values of the device, and the Status_Flags, Event_States and Reliabilitys which reflect the availability of the Present_Values. Unless otherwise specified, properties are not changeable.

Analog Inputs

property	*value*	*W?*
Object_Identifier	see *Object Table*	
Object_Name	see *Object Table*	
Object_Type	0	
Present_Value	see *Object Table*	
Max_Present_Value	see *Object Table*	
Min_Present_Value	see *Object T*able	
Description	see *Object Table*	
Status_Flags	If the *fault* bit is set, it indicates that the Present_Value is unavailable and is unreliable	
Event_State	If the *fault* bit of the Status_Flags is set, this property's value is fault, otherwise it's *normal*	
Reliability	If the *fault* bit of the Status_Flags is set, this property's value is unreliable_other, otherwise it's no_fault_detected	
Out_of_Service	Always *false*	
Units	see *Object Table*	

Analog Values

property	*value*	*W?*
Object_Identifier	see *Object Table*	
Object_Name	see *Object Table*	
Object_Type	2	
Present_Value	see *Object Table*	W
Max_Present_Value	see *Object Table*	
Min_Present_Value	see *Object Table*	
Description	see *Object Table*	
Status_Flags	If the *fault* bit is set, it indicates that the Present_Value is unavailable and is unreliable	
Event_State	If the *fault* bit of the Status_Flags is set, this property's value is fault, otherwise it's normal	
Reliability	If the *fault* bit of the Status_Flags is set, this property's value is unreliable_other, otherwise it's no_fault_detected	
Out_of_Service	Always *false*	
Units	see *Object Table*	

Binary Inputs

property	*value*	*W?*
Object_Identifier	see *Object Table*	
Object_Name	see *Object Table*	
Object_Type	3	
Present_Value	see *Object Table*	
Description	see *Object Table*	
Status_Flags	If the *fault* bit is set, it indicates that the Present_Value is unavailable and is unreliable	
Event_State	If the *fault* bit of the Status_Flags is set, this property's value is *fault*, otherwise it's *normal*	
Reliability	If the *fault* bit of the Status_Flags is set, this property's value is *unreliable_other*, otherwise it's *no_fault_detected*	
Out_of_Service	Always *normal*	
Polarity	see *Object Table*	
Active_Text	see *Object Table*	
Inactive_Text	see *Object Table*	

Binary Values

property	*value*	*W?*
Object_Identifier	see *Object Table*	
Object_Name	see *Object Table*	
Object_Type	5	
Present_Value	see *Object Table*	W
Description	see *Object Table*	
Status_Flags	If the *fault* bit is set, it indicates that the Present_Value is unavailable and is unreliable	
Event_State	If the *fault* bit of the Status_Flags is set, this property's value is *fault*, otherwise it's *normal*	
Reliability	If the *fault* bit of the Status_Flags is set, this property's value is *unreliable_other*, otherwise it's *no_fault_detected*	
Out_of_Service	Always *normal*	
Polarity	see *Object Table*	
Active_Text	see *Object Table*	
Inactive_Text	see *Object Table*	

Multistate Inputs

property	*value*	*W?*
Object_Identifier	see *Object Table*	
Object_Name	see *Object Table*	
Object_Type	13	
Present_Value	see *Object Table*	
Description	see *Object Table*	
Status_Flags	If the *fault* bit is set, it indicates that the Present_Value is unavailable and is unreliable	
Event_State	If the *fault* bit of the Status_Flags is set, this property's value is *fault*, otherwise it's *normal*	
Reliability	If the *fault* bit of the Status_Flags is set, this property's value is *unreliable_other*, otherwise it's *no_fault_detected*	
Out_of_Service	Always *normal*	
Number_of_States	see *Object Table*	

Multistate Values

property	*value*	*W?*
Object_Identifier	see *Object Table*	
Object_Name	see *Object Table*	
Object_Type	19	
Present_Value	see *Object Table*	W
Description	see *Object Table*	
Status_Flags	If the *fault* bit is set, it indicates that the Present_Value is unavailable and is unreliable	
Event_State	If the *fault* bit of the Status_Flags is set, this property's value is *fault*, otherwise it's *normal*	
Reliability	If the *fault* bit of the Status_Flags is set, this property's value is *unreliable_other*, otherwise it's *no_fault_detected*	
Out_of_Service	Always *normal*	
Number_of_States	see *Object Table*	

SKG Humidifier Object Table

The SKG Humidifier use the following BACnet object table. The *type* is the BACnet Object type, the *instance* is the BACnet Object instance. *W?* indicates whether the Present_Value property is writable. Together the *type* and *instance* form the BACnet Object_Identifier for an object according to the following C-language algorithm:

- object_identifier=(unsigned long)((unsigned long)type<<22)+instance

Object instances are assigned according to the following scheme:

- The Object instance for the Device Object is 153000 by default. This value can be reprogrammed from between 0 and 4194302 as needed to insure uniqueness system-wide
- For the Properties that are Common for all SKG Models, the Object instances range from 1 to 99 as needed.
- For the Tank Properties, the Object instances range from 101 to 199 for Tank 1, 201 to 299 for Tank 2, 301 to 399 for Tank 3 and 401 to 499 for Tank 4 as needed.

Common for all SKG Models:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AI	1	Humidity_Out	Humidity Output	0-100 %RH	

type	inst	Object_Name	Description	range of Present_Value	W?
AV	1	Humidity_Demand	Humidity Demand	0-100 %RH	W
AV	2	Room_Humidity	Room Humidity	0-100 %RH	W
AV	3	Room_Humidity_Off	Room Humidity offset	±0-10.0 %RH	W
AV	4	Duct_Humidity	Duct Humidity	0-100 %RH	W
AV	5	Duct_Humidity_Off	Duct Humidity offset	±0-10.0 %RH	W
AV	6	Outside_Temp	Outside Temperature	-40 - 40 °C or -40 - 104 °F	W
AV	7	Lock_On_Capacity	Lock On capacity	10-100%	W
AV	8	Max_Output_Limit	Maximum output limit	10-100%	W
AV	9	Drain_Delay	Drain Delay	1-100Hrs	W
AV	10	Service_Delay	Service Delay	1-5000Hrs	W
AV	11	End_Season_Delay	End of season delay	1-250Hrs	W
AV	12	PID_Loop_KP	PID Loop gain KP	0-255	W
AV	13	PID_Loop_KI	PID Loop gain KI	0-255	W
AV	14	PID_Loop_KD	PID Loop gain KD	0-255	W
AV	15	Ctl_Band	Control band	0-20.0% (0..200)	W
AV	16	Ctl_SP	Control set point	0-100%RH	W
AV	17	Extern_SP_Min	External setpoint minimum	0-100%RH	W
AV	18	Extern_SP_Max	External setpoint maximum	0-100%RH	W
AV	19	Duct_Hum_HiLim_SP	Duct hum. high limit set point	50-100%RH	W
AV	20	Min_ON_Time_Fan	Minimum ON time for fan	2-20 minutes	W
AV	21	Min_H2O_Temp	Min. water temp. in ON mode	50-90 °C or 122-194 °F (0 -> Mode is Off)	W
AV	22	Antifreeze_Temp	Anti-freeze mode temperature	7-12 °C or 44-54 °F (0 -> Mode is Off)	W
AV	23	Analog_Ctl_In_Lo	Analog Control input Lo Limit	0-10.00VDC	W
AV	24	Analog_Ctl_In_Hi	Analog Control input Hi Limit	0-10.00VDC	W
AV	25	Analog_Hum_In_Lo	Analog Humidity input Lo Limit	0-10.00VDC	W
AV	26	Analog_Hum_In_Hi	Analog Humidity input Hi Limit	0-10.00VDC	W
AV	27	Analog_Duct_In_Lo	Analog Duct input Lo Limit	0-10.00VDC	W
AV	28	Analog_Duct_In_Hi	Analog Duct input Hi Limit	0-10.00VDC	W

SKG Humidifier Object Table

Common for all SKG Models:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
-	-	-	Actual Operating Status	-	
BI	1	Power_Status	Power Status	0=OFF, 1=ON	
BI	2	Humidity_Demand	Humidity Demand	0=NO, 1=YES	
BI	3	Manual_Drain	Manual Drain	0=NO, 1=YES	
BI	4	Alrm_Not_Critical	Alarm not critical (unit running)	0=NO, 1=YES	
BI	5	Alarm_Critical	Alarm critical (unit not running)	0=NO, 1=YES	
BI	6	End_of_Season_Dly	End of Season Delay	0=NO, 1=YES	
-	-	-	Misc. Input Status	-	
BI	7	Fan_Proof_Status	Fan proof Status	0=OFF, 1=ON	
BI	8	HiLimit_Status	Hi-Limit Status	0=OFF, 1=ON	
BI	9	Interlock	Interlock	0=OFF, 1=ON	
BI	10	Thermal_Fuse_Ext	Thermal fuse (external 24VAC)	0=OFF, 1=ON	
BI	11	Thermal_Fuse_Int	Thermal fuse (internal 24VDC)	0=OFF, 1=ON	
--	--	--	Alarm main board:	-	
BI	12	Interlock_In_Open	Interlock input open	0=Normal, 1=Alarm	
BI	13	High_Hum_In_Duct	High humidity level in the duct	0=Normal, 1=Alarm	
BI	14	Input_Voltage_Low	Input voltage too low	0=Normal, 1=Alarm	
BI	15	Thermal_Fuse_Open	Thermal Fuse open (24VAC)	0=Normal, 1=Alarm	
BI	16	Slave_Comm_Lost	Comm lost with slave board	0=Normal, 1=Alarm	
BI	17	Hum_Clean_Start	Humidifier started cleaning period	0=Normal, 1=Alarm	
BI	18	Hum_Ex_Svc_Time	Humidifier exceeded service time	0=Normal, 1=Alarm	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
--	--	--	System Options:	-	
BV	1	Temperature_Unit	Temperature Unit	0=Celcius, 1=Fahrenheit	W
BV	2	Outside_Temp_Comp	Outside Temp. Compensation	0=OFF, 1=ON	W
BV	3	Alarm_Beep	Alarm Beep	0=OFF, 1=ON	W
-	-	-	Analog Control Input Type	-	
BV	4	Demand_SP_Type	Demand/Set point type	0=Voltage, 1=Current	W
BV	5	Humidity_In_Type	Humidity input type	0=Voltage, 1=Current	W
BV	6	HiLim_Hum_In_Type	Hi-limit humidity input type	0=Voltage, 1=Current	W

SKG Humidifier Object Table

Common for all SKG Models:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
MSV	1	Ctl_Mode	Control Mode	1=Demand from analog input 1 (default) 2=Internal PID loop calculation 3=Demand from remote communication port (e.g. BACnet)	W
MSV	2	Operation_Mode	Operation Mode	1=Set unit Off 2=Set unit On 3=Set unit in drain mode	W
MSV	3	Unit_Display_Lang	Unit Display Language	1=English (Default) 2=French 3=Spanish	W
MSV	4	SP_Source	Setpoint Source	1=Local analog input 1 2=Local Internal digital value 3=Remote from communication port (e.g. BACnet)	W
MSV	5	Room_Hum_Source	Room Humidity Source	1=Local analog input 2 (default) 2=Remote from communication port (e.g. BACnet)	
MSV	6	Duct_Hum_Source	Duct Humidity Source	1=Not used 2=Local analog input 3 3=Remote from communication port (e.g. BACnet)	W

SKG Humidifier Object Table

For tank 1:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AI	101	Water_Temp1	Water Temperature 1	0-260 °C or 32-500 °F	
AI	102	Chimney_Temp1	Chimney Temperature 1	0-260 °C or 32-500 °F	
AI	103	Water_Level1	Water level 1	0-120%	
AI	104	Burner_Demand1	Burner Demand 1	0.0 - 100.0%	
AI	105	Op_Timer_Total1	Operation Timer 1 (Total time)	1-1677215Hrs	
AI	106	Op_Timer1	Operation Timer 1	1-5000Hrs	
AI	107	Delay_Autodrain1	Delay until Auto-drain 1	1-100Hrs	
AI	108	Foam_Probe_Sensr1	Foam Probe Sensor 1	0-255	
AI	109	Burner_Fan_Speed1	Burner Fan Speed 1	0-1000Hz	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AV	101	Water_Temp_Off1	Water Temperature offset 1	±0-20 °C or ±0-40 °F	W
AV	102	Chimney_Temp_Off1	Chimney Temperature offset 1	±0-20 °C or ±0-40 °F	W
AV	103	Water_Level_Off1	Water Level offset 1	±0-20%	W

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
--	--	--	Alarm 1:	-	
BV	101	OverTemp_Cont_ON1	Over temperature contact ON 1	0=Normal, 1=Alarm	W
BV	102	Bad_Fill_Tank1	Defective filling tank 1	0=Normal, 1=Alarm	W
BV	103	Bad_Refill_Tank1	Defective refill tank 1(too long)	0=Normal, 1=Alarm	W
BV	104	Bad_Drain_Tank1	Defective draining tank 1	0=Normal, 1=Alarm	W
BV	105	Bad_Burner_Fan1	Defective Burner Fan 1	0=Normal, 1=Alarm	W
BV	106	Bad_Burner_Gas1	Defective Burner Gas 1(Locked)	0=Normal, 1=Alarm	W
BV	107	Input_Volt_Low1	Input voltage 1 too low	0=Normal, 1=Alarm	W
BV	108	Power_Fuse_Open1	Power Fuse 1 open (24VAC)	0=Normal, 1=Alarm	W
--	--	--	Alarm 2:	-	
BV	109	Tank_Sens_Bad1	Tank sensor 1 defective	0=Normal, 1=Alarm	W
BV	110	Chim_Sens_Bad1	Chimney sensor 1 defective	0=Normal, 1=Alarm	W
BV	111	H2OLvl_Prb_Bad1	Water level probe 1 defect	0=Normal, 1=Alarm	W
BV	112	Foam_Sens_ON1	Foam Sensor 1 ON	0=Normal, 1=Alarm	W
BV	113	OverFlow_DripPan1	Over Flow, Drip Pan 1	0=Normal, 1=Alarm	W
BV	114	Tank_Temp_Low1	Tank temper. 1 Too low (freeze)	0=Normal, 1=Alarm	W
BV	115	Tank_Temp_Hi1	Tank temperature 1 too high	0=Normal, 1=Alarm	W
BV	116	Chimney_Temp_Hi1	Chimney temperature 1 too high	0=Normal, 1=Alarm	W

SKG Humidifier Object Table

For tank 1:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
-	-	-	Operating Status Flags:	-	
BI	101	Burner_Valve1	Burner Valve 1	0=OFF, 1=ON	
BI	102	Burner_Fan1	Burner Fan 1	0=OFF, 1=ON	
BI	103	Fill_Tank1	Fill Tank 1	0=OFF, 1=ON	
BI	104	Drain_Tank1	Drain Tank 1	0=OFF, 1=ON	
BI	105	Water_Level_OK1	Water Level 1 Okay	0=OFF, 1=ON	
BI	106	Modulation Stat1	Modulation Status 1	0=OFF, 1=ON	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
MSI	101	Unit_Size1	Unit Size 1	1-100Lbs/Hr or 2-150Lbs/Hr 3-175Lbs/Hr 4-200Lbs/Hr	

For tank 2:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AI	201	Water_Temp2	Water Temperature 2	0-260 °C or 32-500 °F	
AI	202	Chimney_Temp2	Chimney Temperature 2	0-260 °C or 32-500 °F	
AI	203	Water_Level2	Water level 2	0-120%	
AI	204	Burner_Demand2	Burner Demand 2	0.0 - 100.0%	
AI	205	Op_Timer_Total2	Operation Timer 2 (Total time)	1-1677215Hrs	
AI	206	Op_Timer2	Operation Timer 2	1-5000Hrs	
AI	207	Delay_Autodrain2	Delay until Auto-drain 2	1-100Hrs	
AI	208	Foam_Probe_Sensr2	Foam Probe Sensor 2	0-255	
AI	209	Burner_Fan_Speed2	Burner Fan Speed 2	0-1000Hz	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AV	201	Water_Temp_Off2	Water Temperature offset 2	±0-20 °C or ±0-40 °F	W
AV	202	Chimney_Temp_Off2	Chimney Temperature offset 2	±0-20 °C or ±0-40 °F	W
AV	203	Water_Level_Off2	Water Level offset 2	±0-20%	W

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
--	--	--	Alarm 1:	-	
BV	201	OverTemp_Cont_ON2	Over temperature contact ON 2	0=Normal, 1=Alarm	W
BV	202	Bad_Fill_Tank2	Defective filling tank 2	0=Normal, 1=Alarm	W
BV	203	Bad_Refill_Tank2	Defective refill tank 2(too long)	0=Normal, 1=Alarm	W
BV	204	Bad_Drain_Tank2	Defective draining tank 2	0=Normal, 1=Alarm	W
BV	205	Bad_Burner_Fan2	Defective Burner Fan 2	0=Normal, 1=Alarm	W
BV	206	Bad_Burner_Gas2	Defective Burner Gas 2(Locked)	0=Normal, 1=Alarm	W
BV	207	Input_Volt_Low2	Input voltage 2 too low	0=Normal, 1=Alarm	W
BV	208	Power_Fuse_Open2	Power Fuse 2 open (24VAC)	0=Normal, 1=Alarm	W
--	--	--	Alarm 2:	-	
BV	209	Tank_Sens_Bad2	Tank sensor 2 defective	0=Normal, 1=Alarm	W
BV	210	Chim_Sens_Bad2	Chimney sensor 2 defective	0=Normal, 1=Alarm	W
BV	211	H2OLvl_Prb_Bad2	Water level probe 2 defect	0=Normal, 1=Alarm	W
BV	212	Foam_Sens_ON2	Foam Sensor 2 ON	0=Normal, 1=Alarm	W
BV	213	OverFlow_DripPan2	Over Flow, Drip Pan 2	0=Normal, 1=Alarm	W
BV	214	Tank_Temp_Low2	Tank temper. 2 Too low (freeze)	0=Normal, 1=Alarm	W
BV	215	Tank_Temp_Hi2	Tank temperature 2 too high	0=Normal, 1=Alarm	W
BV	216	Chimney_Temp_Hi2	Chimney temperature 2 too high	0=Normal, 1=Alarm	W

For tank 2:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
-	-	-	Operating Status Flags:	-	
BI	201	Burner_Valve2	Burner Valve 2	0=OFF, 1=ON	
BI	202	Burner_Fan2	Burner Fan 2	0=OFF, 1=ON	
BI	203	Fill_Tank2	Fill Tank 2	0=OFF, 1=ON	
BI	204	Drain_Tank2	Drain Tank 2	0=OFF, 1=ON	
BI	205	Water_Level_OK2	Water Level 2 Okay	0=OFF, 1=ON	
BI	206	Modulation Stat2	Modulation Status 2	0=OFF, 1=ON	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
MSI	201	Unit_Size2	Unit Size 2	1-100Lbs/Hr or 2-150Lbs/Hr 3-175Lbs/Hr 4-200Lbs/Hr	

For tank 3:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AI	301	Water_Temp3	Water Temperature 3	0-260 °C or 32-500 °F	
AI	302	Chimney_Temp3	Chimney Temperature 3	0-260 °C or 32-500 °F	
AI	303	Water_Level3	Water level 3	0-120%	
AI	304	Burner_Demand3	Burner Demand 3	0.0 - 100.0%	
AI	305	Op_Timer_Total3	Operation Timer 3 (Total time)	1-1677215Hrs	
AI	306	Op_Timer3	Operation Timer 3	1-5000Hrs	
AI	307	Delay_Autodrain3	Delay until Auto-drain 3	1-100Hrs	
AI	308	Foam_Probe_Sensr3	Foam Probe Sensor 3	0-255	
AI	309	Burner_Fan_Speed3	Burner Fan Speed 3	0-1000Hz	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AV	301	Water_Temp_Off3	Water Temperature offset 3	±0-20 °C or ±0-40 °F	W
AV	302	Chimney_Temp_Off3	Chimney Temperature offset 3	±0-20 °C or ±0-40 °F	W
AV	303	Water_Level_Off3	Water Level offset 3	±0-20%	W

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
--	--	--	Alarm 1:	-	
BV	301	OverTemp_Cont_ON3	Over temperature contact ON 3	0=Normal, 1=Alarm	W
BV	302	Bad_Fill_Tank3	Defective filling tank 3	0=Normal, 1=Alarm	W
BV	303	Bad_Refill_Tank3	Defective refill tank 3(too long)	0=Normal, 1=Alarm	W
BV	304	Bad_Drain_Tank3	Defective draining tank 3	0=Normal, 1=Alarm	W
BV	305	Bad_Burner_Fan3	Defective Burner Fan 3	0=Normal, 1=Alarm	W
BV	306	Bad_Burner_Gas3	Defective Burner Gas 3(Locked)	0=Normal, 1=Alarm	W
BV	307	Input_Volt_Low3	Input voltage 3 too low	0=Normal, 1=Alarm	W
BV	308	Power_Fuse_Open3	Power Fuse 3 open (34VAC)	0=Normal, 1=Alarm	W
--	--	--	Alarm 3:	-	
BV	309	Tank_Sens_Bad3	Tank sensor 3 defective	0=Normal, 1=Alarm	W
BV	310	Chim_Sens_Bad3	Chimney sensor 3 defective	0=Normal, 1=Alarm	W
BV	311	H3OLvl_Prb_Bad3	Water level probe 3 defect	0=Normal, 1=Alarm	W
BV	312	Foam_Sens_ON3	Foam Sensor 3 ON	0=Normal, 1=Alarm	W
BV	313	OverFlow_DripPan3	Over Flow, Drip Pan 3	0=Normal, 1=Alarm	W
BV	314	Tank_Temp_Low3	Tank temper. 3 Too low (freeze)	0=Normal, 1=Alarm	W
BV	315	Tank_Temp_Hi3	Tank temperature 3 too high	0=Normal, 1=Alarm	W
BV	316	Chimney_Temp_Hi3	Chimney temperature 3 too high	0=Normal, 1=Alarm	W

For tank 3:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
-	-	-	Operating Status Flags:	-	
BI	301	Burner_Valve3	Burner Valve 3	0=OFF, 1=ON	
BI	302	Burner_Fan3	Burner Fan 3	0=OFF, 1=ON	
BI	303	Fill_Tank3	Fill Tank 3	0=OFF, 1=ON	
BI	304	Drain_Tank3	Drain Tank 3	0=OFF, 1=ON	
BI	305	Water_Level_OK3	Water Level 3 Okay	0=OFF, 1=ON	
BI	306	Modulation Stat3	Modulation Status 3	0=OFF, 1=ON	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
MSI	301	Unit_Size3	Unit Size 3	1-100Lbs/Hr or 2-150Lbs/Hr 3-175Lbs/Hr 4-200Lbs/Hr	

For tank 4:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AI	401	Water_Temp4	Water Temperature 4	0-260 °C or 32-500 °F	
AI	402	Chimney_Temp4	Chimney Temperature 4	0-260 °C or 32-500 °F	
AI	403	Water_Level4	Water level 4	0-120%	
AI	404	Burner_Demand4	Burner Demand 4	0.0 - 100.0%	
AI	405	Op_Timer_Total4	Operation Timer 4 (Total time)	1-1677215Hrs	
AI	406	Op_Timer4	Operation Timer 4	1-5000Hrs	
AI	407	Delay_Autodrain4	Delay until Auto-drain 4	1-100Hrs	
AI	408	Foam_Probe_Sensr4	Foam Probe Sensor 4	0-255	
AI	409	Burner_Fan_Speed4	Burner Fan Speed 4	0-1000Hz	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
AV	401	Water_Temp_Off4	Water Temperature offset 4	±0-20 °C or ±0-40 °F	W
AV	402	Chimney_Temp_Off4	Chimney Temperature offset 4	±0-20 °C or ±0-40 °F	W
AV	403	Water_Level_Off4	Water Level offset 4	±0-20%	W

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
--	--	--	Alarm 1:	-	
BV	401	OverTemp_Cont_ON4	Over temperature contact ON 4	0=Normal, 1=Alarm	W
BV	402	Bad_Fill_Tank4	Defective filling tank 4	0=Normal, 1=Alarm	W
BV	403	Bad_Refill_Tank4	Defective refill tank 4(too long)	0=Normal, 1=Alarm	W
BV	404	Bad_Drain_Tank4	Defective draining tank 4	0=Normal, 1=Alarm	W
BV	405	Bad_Burner_Fan4	Defective Burner Fan 4	0=Normal, 1=Alarm	W
BV	406	Bad_Burner_Gas4	Defective Burner Gas 4(Locked)	0=Normal, 1=Alarm	W
BV	407	Input_Volt_Low4	Input voltage 4 too low	0=Normal, 1=Alarm	W
BV	408	Power_Fuse_Open4	Power Fuse 4 open (44VAC)	0=Normal, 1=Alarm	W
--	--	--	Alarm 4:	-	
BV	409	Tank_Sens_Bad4	Tank sensor 4 defective	0=Normal, 1=Alarm	W
BV	410	Chim_Sens_Bad4	Chimney sensor 4 defective	0=Normal, 1=Alarm	W
BV	411	H4OLvl_Prb_Bad4	Water level probe 4 defect	0=Normal, 1=Alarm	W
BV	412	Foam_Sens_ON4	Foam Sensor 4 ON	0=Normal, 1=Alarm	W
BV	414	OverFlow_DripPan4	Over Flow, Drip Pan 4	0=Normal, 1=Alarm	W
BV	414	Tank_Temp_Low4	Tank temper. 4 Too low (freeze)	0=Normal, 1=Alarm	W
BV	415	Tank_Temp_Hi4	Tank temperature 4 too high	0=Normal, 1=Alarm	W
BV	416	Chimney_Temp_Hi4	Chimney temperature 4 too high	0=Normal, 1=Alarm	W

For tank 4:

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
-	-	-	Operating Status Flags:	-	
BI	401	Burner_Valve4	Burner Valve 4	0=OFF, 1=ON	
BI	402	Burner_Fan4	Burner Fan 4	0=OFF, 1=ON	
BI	403	Fill_Tank4	Fill Tank 4	0=OFF, 1=ON	
BI	404	Drain_Tank4	Drain Tank 4	0=OFF, 1=ON	
BI	405	Water_Level_OK4	Water Level 4 Okay	0=OFF, 1=ON	
BI	406	Modulation Stat4	Modulation Status 4	0=OFF, 1=ON	

type	*inst*	*Object_Name*	*Description*	*range of Present_Value*	*W?*
MSI	401	Unit_Size4	Unit Size 4	1-100Lbs/Hr or 2-150Lbs/Hr 3-175Lbs/Hr 4-200Lbs/Hr	

Mode

Normally the NEPICSKG is in the operational mode. The NEPICSKG can be placed in the configuration mode at any time by throwing a single dip switch.

mode	*Switch 1*
operational	OFF
configuration	ON

The difference between configuration mode and operational mode is explained in detail later in this section. The NEPICSKG can be put into and out of the configuration mode at any time. When the unit detects a change in the position of switch 1, it automatically restarts itself in the appropriate mode.

Baud Rate

The baud rate for the BACnet MS/TP is configurable through a pair of dip switches. The following table identifies the baud rates used according to the switch settings:

baud rate	*Switch 2*	*Switch 3*
9600	OFF	OFF
19200	ON	OFF
38400	OFF	ON
76800	ON	ON

Please note, that you ***must*** restart the unit in order for a change of baud rate to take effect.

Configurable BACnet Properties

The following four BACnet properties are configurable and in fact most likely will need to be changed to guarantee uniqueness of each device in a BACnet system:

Device Object.Object_Identifier *
Device Object.Object_Name
Device Object.Max_Master
Device Object.*proprietary property #1000* (which will be called *MSTP_MACaddress* for the remainder of this section)

* Note: Because the Device's Object_Identifier is a combination of the Device Object_Type (8) and the Device_Instance (0-4194302) it's decimal or hexadecimal representation tends to be incomprehensible. Even the simple/easy-to-understand Device_Instance=1000 has an equivalent Object_Identifier of 0x020003E8 hexadecimal or 33555432 decimal. So, while it's the device's Object_Identifier property that can be changed using a BACnet WriteProperty service, this document will talk mostly about Device_Instances.

Getting Started

The four configurable BACnet Device Object properties have two sets of "default" settings, the factory setting and the configuration mode setting and are identified in the following table:

property	*factory value*	*configuration mode value*
Device_Instance	153000*	153000*
Object_Name	"NEPSKGHumidifier153000"	"NEPSKGHumidifier153000"
Max_Master	127	127
MSTP_MACaddress	0	254

* Note: These values are NEP's BACnet Vendor_Identifier*1000.

Prior to the first time the NEPICSKG is powered on, you'll have to know two things:

What's the baud rate of the MS/TP network?
Is there already an MS/TP unit on that network with the MAC address=0 and the Device Instance=153000?

Once the answer to Question 1 is known, the dip switches 2 and 3 must be set up accordingly.

If the answer to Question 2 is no (there is no MS/TP MAC address 0), then you can start up the NEPICSKG with the dip switch 1 in the OFF (operational) position. In this mode, the factory settings are in effect and the NEPICSKG will be MS/TP token-passing master with a MAC address=0 and Device Instance=153000.

If the answer to Question 2 is yes (there already is an MS/TP MAC address 0 and/or there already is a Device Instance 153000), then you will need to start up the NEPICSKG with the dip switch 1 in the ON (configuration) position. In this mode, the configuration mode settings are in effect and the NEPICSKG will be MS/TP non-token-passing slave with a MAC address 254.
Configuring in the Operational Mode
The NEPICSKG can be configured from a BACnet client device using the BACnet WriteProperty service at any time, while in the operational mode. In other words, the Device_Instance, Object_Name, Max_Master and *MSTP_MACaddress* can be changed "hot" with the changes taking effect immediately and without having to restart the NEPICSKG.

Configuring in the Configuration Mode

If the NEPICSKG is put into the configuration mode while it is “hot”, the NEPICSKG will be automatically reset with the Device_Instance, Object_Name, Max_Master and *MSTP_MACaddress* all containing the *configuration mode values*. In this mode, the NEPICSKG will not act as an MS/TP token-passer and will be silent until it is addressed by a BACnet client. As a side effect, it will also not be able to respond to BACnet WhoIs services with Iam services, so BACnet clients will not be able to find out its Device_Instance automatically. In the configuration mode, any of the above properties can be changed by using either the default Device_Instance or the wild card Device_Instance (4194303 decimal or 0x3FFFFF hex). Use of the wild card Device_Instance obviates the need to know the NEPICSKG’s real Device_Instance in case it conflicts with another Device in the system. While in the configuration mode, only the Device Object is available to BACnet clients through the ReadProperty and Write Property services. All other objects (i.e. AI’s, etc) are not available.

As an alternative to using the BACnet WriteProperty service to change the Device_Instance and/or the *MSTP_MACaddress*, the SK300’s keypad can be used to change those two properties, but only while in the configuration mode.

Changes to the Device Object, whether made by using the WriteProperty of the keypad, do not take effect until the NEPICSKG is restarted in the operational mode.

Selecting the MS/TP MAC address and Max_Master
Some care must be taken in setting the MS/TP MAC address and Max_Master property.

First, the MAC address must be unique on the entire MS/TP network. However, having a unique MAC address and a high baud rate does not guarantee efficient operation of the NEPICSKG (or other MS/TP units for that matter) on the MS/TP network. Some MAC address and Max_Master combinations are more efficient than others. BACnet requires token-passing units to occasionally “poll” for other masters based on the value of MAC address and Max_Master. So, a “poor” combination of MAC addresses and Max_Masters can lead to slow networks in which there’s a lot of wasted time polling for masters that are not present and never will be. In fact, unless there are 126 other units on the MS/TP network, the default Max-Master=127 is most likely a poor choice for the NEPICSKG. Having said that, Max-Master=127 has been chosen as the default to insure that any master, specifically a BACnet client, can be found when the NEPICSKG is first started.

So, considering the following simple two-unit examples:

Example 1:

- MAC=0. Max_Master=127
- MAC=1, Max_Master=127

This example is slow and inefficient because both Max_Master=127. Everytime either unit is required to find another master units it has to poll 126 units until it finds the right one to pass the token to.

Example 2:

- MAC=0. Max_Master=5
- MAC=5, Max_Master=5

This example is better but is still slower than it could be. The Max_Master is set to the most efficient value, however because of the gap between the two MAC addresses, each unit must poll 4 units until it finds the right one to pass the token to.

Example 3:

- MAC=0. Max_Master=1
- MAC=2, Max_Master=2

This example is actually an incorrect configuration, in that MAC=0 will never find MAC=2 because it will never poll for the master MAC address=2.

Example 4:

- MAC=0. Max_Master=1
- MAC=1, Max_Master=1

This example is the most efficient, since each unit must poll only 1 other unit until it finds the right one to pass the token to.

As a general guideline, the most efficient set up for an MS/TP network is one in which the units are consecutively numbered starting at MAC address 0 and all have Max_Master=the maximum MAC address in the system. If consecutive numbering is not possible, then the next most efficient set up is one in which all units have have Max_Master=the maximum MAC address in the system.

Personal notes

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