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Installation and Operating Instructions

BACnet MSTP Interface
Integra 1630 digital metering system

Introduction

Integra 1630 options include a BACnet MSTP module for connection via RS485 to SCADA or Building Automation and Management systems running BACnet MSTP clients. The Integra 1630 acts as a server device and waits to receive requests from a BACnet client that must conform to the BACnet MSTP Protocol within the command set defined below. For details on the protocol see the BACnet organisation website: http://www.bacnet.org/

The Integra BACnet MSTP option module supports half duplex communication, initially at 38400baud, no parity 1 stop bit. The module is fitted with a three-way screw terminal block to daisy-chain the BACnet communications cable. Standard RS485 communications cable should be used.

Note that with this interface option fitted, there are no other external communication protocols available and pulsed relay outputs are not fitted.

Communication Parameters

The front panel of the Integra provides access to the set up sequence of the meter. In the set-up menu there are settings for baud rate, parity and slave address. The communication parameters of an Integra 1630 fitted with the BACnet MSTP option refer to the internal communication within the meter. Do not modify these settings or the BACnet MSTP interface will cease to provide valid readings.

For reference these values are factory set to:

Modbus Address:	1
Baud Rate:	9600
Parity:	no parity 1 stop bit

BACnet Address Assignment

The MAC address of the Integra must be unique and appropriate for the network to which it is attached. The MAC address used will depend upon the local network and should be determined by the network administrator.

The Integra BACnet MSTP MAC address is factory set to 1. If attaching two or more Integra to a BACnet MSTP network the MAC addresses will need to be changed so that they are all unique. When connecting to a BACnet MSTP network with other device already attached and working, the MAC address may need to be changed if one of the other units shared the MAC address. The network administrator should know which addresses are free and can be assigned to the Integra. The user can change the MAC address from the factory default as described in section entitled “Changing the MAC Address” later in this document.

Once the client device has built its network table it is possible to start communicating with the Integra. The client system requires information as to which queries the Integra supports and the meaning of each return value. This information is available on the Integra Protocol Implementation Compliance Statement (PICS) sheet below. Alternatively, the client may gather the information from the Integra itself, using a BACnet ReadObject command. This returns the instance number of each supported object within the Integra.

The object table of the Integra is split into two sections, the first section lists all the “Analogue Value” objects within the Integra. Analogue Value objects may be read or written to and they are analogous to Holding Registers in Modbus. Each Analogue Value object is assigned an instance number which can be used by BACnet to read and write to it.

The second section lists all the “Analogue Inputs” within the Integra. Analogue Inputs are read only and are analogous to Modbus Input Registers. Again, each Analogue Input object is assigned an instance number which can be used by BACnet to read and write to it.

Supported Queries

This guide only includes the BACnet/MSTP query types which are supported by the Integra 1630. The only relevant query types are those that read values from or write values to the Integra.

To read a parameter from the Integra, a “ReadProperty” query is required, with the object set to either “Analogue Input” or “Analogue Value” depending on what is required. The instance number is set according to the parameter to be read and the property identifier set to “Present Value”. This query will obtain the most recent value for the Integra parameter.

To write to an Integra parameter, the value to be written is presented to a “WriteProperty” query is with the object set to “Analogue Value” with the instance number is set according to the parameter to be read and the property identifier set to “Present Value”. This query will set the “Present Value” property of the Integra parameter to the new value.

BACnet systems should not attempt to address parameters whose instance value is not defined. Some parameters are reserved for factory use and selecting these may give unpredictable results.

Protocol Implementation Conformance Statement (PICS)

Date	June 12th 2012
Vendors Name	TE Electronics UK Limited
Product Name	Integra 1630 Digital Metering System
Product Model Number(s)	CI-BACnet
Application Software Version	001.000.09
Firmware Version	1.0
BACnet Protocol Version	1.10
Product Description	The Integra 1630 is a multi function digital metering instrument offering measurement, display and communication of many electrical parameters. The Integra 1630 is programmable via a simple configuration menu structure
BACnet Standardized Device Profile (Annex L)	BACnet Application Specific Controller (B-ASC)
BACnet Interoperability Building Blocks Supported (Annex K)	DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B
Segmentation Capability:	Not supported

Standard Object Types Supported

No dynamic Object creation or deletion supported. No proprietary object types but some proprietary properties and engineering units.

Device Object	
Optional Properties Supported	None
Proprietary Properties Supported	BAUD RATE (property Identifier 9600)
Writable Properties	BAUD RATE
Property Range Restrictions	9600, 19200, 38400
Analogue Input Object	
Optional Properties Supported	Description
Writable Properties	None
Property Range Restrictions	n/a
Analogue Value Object	
Optional Properties Supported	Description
Writable Properties	Present Value
Property Range Restrictions	Refer to Analogue Value Objects Section
Data Link Layer Options	MS/TP slave (Clause 9) baud rate(s): 9600, 19200, 38400
Device Address Binding	
Networking Options	None
Character Set Supported	ANSI X3.4

Analogue Input Objects

The measurement parameters of the Integra meter are represented in the BACnet world as Analogue Input values. The following table outlines what is available from each Analogue Input instance.

Instance Number	Name	Description	Units
0	**V1**	**Phase 1 line to Neutral Voltage**	**Volts**
1	**V2**	**Phase 2 line to Neutral Voltage**	**Volts**
2	**V3**	**Phase 3 line to Neutral Voltage**	**Volts**
3	**I1**	**Phase 1 current**	**Amperes**
4	**I2**	**Phase 2 current**	**Amperes**
5	**I3**	**Phase 3 current**	**Amperes**
6	**W1**	**Phase 1 power**	**Watts**

Instance Number	Name	Description	Units
7	W2	Phase 2 power	Watts
8	W3	Phase 3 power	Watts
9	VA1	Phase 1 volt-amperes	Volt-amperes
10	VA2	Phase 2 volt-amperes	Volt-amperes
11	VA3	Phase 3 volt-amperes	Volt-amperes
12	VAr1	Phase 1 volt-amperes reactive	Volt-amperes Reactive
13	Var2	Phase 2 volt-amperes reactive	Volt-amperes Reactive
14	Var3	Phase 3 volt-amperes reactive	Volt-amperes Reactive
15	PF1	Phase 1 power factor	
16	PF2	Phase 1 power factor	
17	PF3	Phase 1 power factor	
18	PA1	Phase 1 phase angle	Degrees
19	PA2	Phase 2 phase angle	Degrees
20	PA3	Phase 3 phase angle	Degrees
21	V Avg	Average voltage	Volts
22	I Avg	Average line current	Amperes
23	I Sum	Sum of line current	Amperes
24	W Sum	Total system power	Watts
25	VA Sum	Total system VA	Volt-Amperes
26	VAr Sum	Total system VAr	Volt-Amperes Reactive
27	PF Avg	Average system Power Factor	
28	PA Avg	Average system Phase Angle	Degrees
29	Frequency	Frequency of supply voltages	Hertz
30	Import Wh	Import Watt hours since reset	Watt-hours
31	Export Wh	Export Watt hours since reset	Watt-hours
32	Import VArh	Import VAr hours since reset	Volt-Amperes Reactive hours
33	Export VArh	Export VAr hours since reset	Volt-Amperes Reactive hours
34	VAh	VA hours	Volt-Amperes hours*
35	W Dmd Imp	Total system Watt demand (import)	Watts
36	Max. W Dmd	Max. total system Watt demand Import	Watts
37	VA Dmd	Total system VA demand	Volt-Amperes
38	Max. VA Dmd	Maximum total system VA demand	Volt-Ampere
39	I Dmd	System current demand	Amperes
40	Max I Dmd	Maximum system current demand	Amperes
41	VL1-L2	Line 1 to line 2 voltage	Volts
42	VL2-L3	Line 2 to line 3 voltage	Volts
43	VL3-L1	Line 3 to line 1 voltage	Volts
44	V L-L Avg	Average line to line voltage	Volts
45	In	Neutral current	Amperes
46	THD V1	Phase 1 line to neutral voltage THD	Percent (%)
47	THD V2	Phase 2 line to neutral voltage THD	Percent (%)
48	THD V3	Phase 3 line to neutral voltage THD	Percent (%)
49	THD I1	Phase 1 current THD	Percent (%)
50	THD I2	Phase 2 current THD	Percent (%)
51	THD I3	Phase 3 current THD	Percent (%)
52	THD V Avg	Average voltage THD	Percent (%)
53	THD I Avg	Average line current THD	Percent (%)
54	Hours Run	Hours Run	Hours

Instance Number	Name	Description	Units
55	**+L/-C PF**	**Total System Power Factor**	
56	**I1 Dmd**	**Phase 1 current demand**	**Amperes**
57	**I2 Dmd**	**Phase 2 current demand**	**Amperes**
58	**I3 Dmd**	**Phase 3 current demand**	**Amperes**
59	**Max I1 Dmd**	**Maximum phase 1 current demand**	**Amperes**
60	**Max I2 Dmd**	**Maximum phase 2 current demand**	**Amperes**
61	**Max I3 Dmd**	**Maximum phase 3 current demand**	**Amperes**

Note: The BACnet standard does not specify an enumerated value for some of the engineering units used for some instances of Analogue Input Objects. The following table identifies the parameters and the non-standard enumerations used (The system administrator may be able to set up the system to identify these special codes and report the correct text for the associated units :

Proprietary Units	Enumerated Value within BACnet	Used With
Volt-Ampere hours	257 (0x101)	VA Hours (Analogue Input Instance number 34)

Analogue Value Objects

The configuration and user setting parameters of the Integra meter are represented in the BACnet world as Analogue Input values. The following table outlines what is available from each Analogue Value object instance. Some parameters are read only and can't be changed. Some writeable values may only accept a limit set of values or maybe password protected.

Instance	Name	Description	Units
0	Dmd Time	Demand Time – Write 0 to reset demand period Mode: Read/Write	minutes
1	Dmd Period	Demand time (in minutes) supported by the instrument. Other values ignored. Range: 8, 15, 20, 30, 60 Mode: Read/Write	minutes
2	Sys Volts	System Voltage – In a PT/VT connected system represents the PT/VT primary voltage. In a direct connect system this parameter should be set the same as the secondary voltage. Range: 1V to 400kV Mode: Read/Write (Protected)	Volts
3	Sys Current	System Current – represents the CT primary current Range: 1A to 9999A Mode: Read/Write (Protected)	Amperes
4	Sys Type	System Type – the system mode the instrument is operating in Range: 1 (1ph2w), 2 (3ph3w), 3 (3ph4w) Mode: Read/Write (Protected)	
5	Relay Pulse Width	The width of the relay pulse in multiples of 20 ms. Only pulse widths of 3 (60ms), 5 (100ms) or 10 (200ms) are supported. Mode: Read/Write	
6	Energy Reset	Write 0 to reset the energy readings other values will be ignored. Reading will always return zero. Mode: Read/Write	
7	Relay Pulse Divisor	A rate adjustment of the relay output. For example, a pulse rate of 1 used with the parameter 'import kWh' would cause the relay to pulse at a rate of 1 kWh import. The rate is automatically limited to 2 pulses/second at 144% of rated power Range: 1, 10, 100, 1000 Mode: Read/Write	
8	Password	Entering the correct password value will 'unlock' the writing of some of the other analogue value objects. Range: 0000 to 9999 Mode: Read/Write	

Instance	Name	Description	Units
9	Sys Power	The maximum system power based on the values of system current, system voltage and the system type of the instrument. Mode: Read	Watts
10	Hi Serial	0 to 16,777,215 The high order digits of the instruments serial number. Mode: Read	
11	Lo Serial	The low order digits of the instruments serial number Range: 0 to 16,777,215 Mode: Read	
12	Max Pulse Relay Setups	The number of relay outputs supported by the instrument. For BACnet MSTP this value is meaningless as Relay Outputs are not supported. Range:1 or 2 Mode: Read	
13	Selected Relay	The number of the relay selected for editing/review in analogue value object number 15. For BACnet MSTP this value is meaningless as Relay Outputs are not supported. Range: 1 to 2 Mode: Read/Write	
14	Selected Energy Param	The parameter selected for tracking by the pulsed relay specified in analogue value object number 14. Range: 0 (Disabled), 37 (Import kWh sum) , 38 (Export kWh sum), 39 (Import kVArh sum), 40 (Export kVArh sum), 41 (kVAh sum) Mode: Read/Write	
15	Hrs Run Reset	Write 0 to clear the hours run counter Mode: Read/Write	
16	Hrs Run VA	The proportion of the rated VA that is necessary for the hours run parameter to start accumulating time. A value of 0.1 would represent 10% of rated VA. A value of 0.0 will cause the hours run counter to operate continuously whilst power to the instrument is provided. 0.0 to 0.5 in steps on 0.002 Mode: Read/Write	
17	Secondary Volts	Indicates the voltage on the VT secondary when the voltage on the VT primary is equal to the value of System Volts. The value of this register can be set to between the minimum and maximum instrument input voltage. Range: Min Vin to Max Vin Mode: Read/Write (Protected)	Volts
18	Max Energy Count	Controls the number of digits the energy counters can use before they roll over (i.e. reset to zero). The display can only show 7 digits. Range: 6, 7 or 8 (digits) Mode: Read/Write (Protected)	
19	BACnet Baud Rate	Controls the speed of communications over the BACnet MS/TP link. Reading provides the Baud Rate presently in use. Writing changes the Baud Rate. Only values of 9600, 19200 and 38400 are accepted and the unit has to be power cycled for the rate change to take effect.	

Changing the MAC Address

Valid MAC addresses are in the range 0 to 127. They can be set-up or changed by adjusting the DIP switch setting on the rear of the Integra 1630 meter.

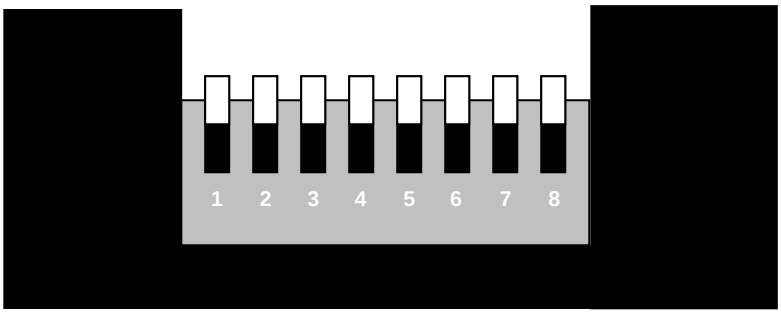

Figure 1: MAC Address Switches

Each switch is numbers '1' to '8' and is moved to the down position to activate the switch. The diagram above shows the switches in the 'all-off' position.

The first seven switches are used to allocate the MAC address. Each of these switches represents a power of two and the sum of the active switches is the MAC address setting.

Switch	1	2	3	4	5	6	7
Value	1	2	4	8	16	32	64

Table 1: MAC Address Switch Values

For example, if switches 1, 3 and 5 were activated, the MAC address would be 21 (1+4+16), with all seven switches activated the MAC address would be 127 (1+2+4+8+16+32+64).

The eighth switch has a special function. This selects the method by which the Device Identifier for the Integra will be decided:

With the switch in the 'on' position, the Device Identifier will be read from non-volatile memory on board the Integra.

With the switch in the 'off' position, the Device Identifier will be set to the value of the MAC address switches.

Changing the Device Information

There are two elements that the user can change at the 'Device Object' level, the 'Object Name' and the 'Object Identifier'.

To change the 'Object Name' property, issue a write property service call which writes a character string to the property.

To change the 'Object Identifier' property, issue a write property service call which writes a positive integer value to the property.

Note: Changing these properties may cause some systems to loose contact with the Integra until another BACnet 'discovery' cycle is initiated by the BACnet controller.

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