Power Quality and Revenue Meter
EM920 / EM920T

DNP3 Communications Protocol

Reference Guide

BG0485 Rev. A2

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For further information regarding a particular installation, operation or maintenance of equipment, contact the manufacturer or your local representative or distributor.

REVISION HISTORY

A1	June 2010	Initial release
A2	Aug 2014	Added uncompensated power/energy registers

Table of Contents

1 General

This document specifies a subset of the DNP3 communications protocol used to transfer data between a master computer station and the EM920. The document provides the complete information necessary to develop third-party communications software capable of communication with the EM920. Refer to the EM920 Installation Manual and EM920 Operation Manual for more information on communication connections and configuring communication parameters in your device.

2 DNP 3.0 Protocol Implementation

DNP3 (Distributed Network Protocol) is an open standard designed by Harris Control Division. DNP defines a command-response method of communicating digital information between a master and slave device. Detailed information regarding DNP3 is available in the “Basic 4 Document Set” which can be obtained from the DNP User Group.

2.1 Deviations from Standard

The EM920 implements Level 2 of the DNP3 communication protocol. The device does not support unsolicited requests or hardware collision avoidance.

The data link layer differs from the Basic 4 specifications because of the master-slave relationship between devices. When the device receives a request, no further requests can be sent until after the device makes the appropriate response.

2.2 DNP Implementation

The EM920, like most devices, allows retrieving regular analog and binary data from the device by executing directed (non-broadcast) Read requests.

Binary-Output-Status objects and Analog-Output-Status objects are sent with flags that always indicate ONLINE.

A Binary-Output-Status object that indicates the current state of a control digital point (relay) uses remote forced data as well as local forced data bits. The value of a state bit indicates the current state of the digital output point.

The EM920 executes the parameter clear function and demands resets using the Direct-Operate, SBO/Operate or Direct-Operate-No-Acknowledge command to specified points of the Control-Relay-Output-Block object.

Issuing the Direct-Operate, SBO/Operate or Direct-Operate-No-Acknowledge command to appropriative points of the Analog-Output-Block object can change the setup parameters. The device also supports the DNP functions Write, Cold-Restart and Delay Measurement.

Refer to Appendix A for specific requests and responses. Appendix B contains the standard DNP Device Profile Document.

The device attempts to respond with the same object variation and qualifier as those in the request. Exceptions to this rule include changing variation 0 to a specific variation and changing qualifier code 6 to 1.

If the device receives an invalid request, it sets the internal indication to the error code. The following internal indication bits are supported:

Octet Position	Bit Position	Description
0	0	Set when a request received with a broadcast destination address. Cleared after next response.
0	7	Device restart - set when the device powers up or after executing Cold Restart, cleared by writing zero to object 80.
0	4	Time-synchronization required from the master. Cleared when master sets the time.
0	5	Set when the device is in the Local state. Cleared when the device in the Remote state.
1	5	Set when the current configuration in the device is corrupted. May also be set as a result of the legal changes in the setup configuration whenever another setup is affected by the changes made. Cleared by writing zero to points 64-75 using object 12.

2.2.1 Class 0 Response

The EM920 DNP implementation supports a wide variety of messages. The most common method of getting static object information from the meter via DNP is to issue a read Class 0 request.

The EM920 allows you to configure the Class 0 response by assigning ranges of points to be polled via Class 0 requests (see Section 3.9, DNP Protocol setup).

2.2.2 Event Objects

The EM920 allows you to assign any static object point to a predefined object change event point for Class 1, Class 2 or Class 3 event polling. A total of 64 change event points are available. You can assign any of the Analog Input, Binary Input or Binary Counter static points to the corresponding change event point through the DNP Event setup (see Section 3.9). You can also link any point to Class 1, Class 2 or Class 3 object polling.

By default, a change event point index is the same as for the corresponding static object point. The EM920 gives you an option to re-map a static point index for the corresponding event point starting with index 0, separately for each object type - Analog Input, Binary Input or Binary Counter change events. For example, if the re-mapping option is active and you first assign static point AI:23 (1-sec frequency) to an event Class 1 point, the corresponding Analog Input change event point will be identified as point 0 in the Class 1 poll response.

Each point assigned to an event class can be separately enabled or disabled for scanning. Each point can also be linked to the common device Event log so that each change would be recorded to the Event log under common Setpoint #17.

The conditions for Analog Input change events can be specified by either an operating threshold, or a deadband, using one of the following three relations:

- Delta – a new event is generated when the absolute value of the difference between the last reported value of the point and its current value exceeds the specified deadband value;
- More than (Over) - a new event is generated when the point value rises over the specified threshold, and then when the point value returns below the threshold taking into consideration a predefined hysteresis;
- Less than (Under) - a new event is generated when the point value drops below the specified threshold, and then when the point value returns above the threshold taking into consideration a predefined hysteresis.

For Binary Counter and Binary Input change events, a Delta relation is only applicable.

The number of event points for each object type (Analog Input, Binary Input or Binary Counter) is limited through the DNP Options setup (see Section 3.9). Every time you change the number of points for any of the objects, the device clears all event buffers and links the default set of static points to each event object type.

The scan time rates for polling events of different types are as follows:

- 1 cycle for Binary Input points
- 200 ms for Binary Counter and Analog Input points

The memory consumption for keeping events depends on the event objects variation, or DNP object size. For each event object type and event class, the device uses a separate buffer. The maximum buffer size per DNP event object/event class is 512 bytes. The maximum number of events per class that the device can hold can be calculated as follows:

Maximum number of events = 512/(DNP Event Object Size + 1)

For example, the device can hold up to 512/12=40 measures of the 32-bit Analog change event with Time objects, or up to 512/8=64 measures of the 8-bit Binary change event with Time objects.

To disable change event objects, set to 0 all registers that define the number of the Analog Input, Binary Input and Binary Counter objects to generate events. In this case, the device will support only static objects.

2.2.3 Device Address

Each device on a DNP link must have a unique address. The EM920 allows a device address in the range of 0 to 65532 to be selected. The DNP master can use addresses 65533 to 65535 for broadcast requests. A broadcast request never generates a DNP response.

2.2.4 Transaction Timing

The EM920 response time to master requests is indicated in Table 2-1.

Table 2-1 Response Time

Baud Rate, bps	Response Time, ms		
	Min	Max	Typical
9600	13	15	13
19200	11	12	11
57600	9	10	9
115200	9	10	9

The Direct-Operate, SBO/Operate or Direct-Operate-No-Acknowledge requests for reset/clear registers and changing setpoints are immediately confirmed.

2.2.5 Scaling 16-bit Analog Inputs

Any of the variations 1 through 4 can be used with the Analog Input objects. Variations specified in Sections 3.1 and 3.5 show those that can be used to read a full-range value without a possible over-range error when no scaling is used to accommodate the value to the requested object size.

When over-range occurs, a positive value is reported as 32767 and a negative value as -32768, with the over-range bit in the flag octet being set to 1 if a variation 2 is requested. To avoid over-range errors when a variation 2 or 4 is required, a liner scaling may be used to scale 32-bit analog readings to 16-bit Analog Input objects (see Section 3.9, DNP Options setup). Scaling is enabled in the device by default.

When scaling is enabled, either analog input requested with variation 2 or 4 will be scaled to the range of -32768 to 32767 for bi-directional parameters (such as power and power factor), and to the range of 0 to 32767 for single-ended positive parameters (voltage, current, frequency, etc.). To get a true reading, the reverse conversion should be done using the following formula:

$$Y = ((X - DNP\_LO) \times (HI - LO)) / (DNP\_HI - DNP\_LO) + LO$$

where:

Y	-	True reading in engineering units
X	-	Raw input data in the range of DNP_LO – DNP_HI
LO, HI	-	Data low and high scales in engineering units (see Section 4 for data scales)
DNP_LO	-	DNP low conversion scale: DNP_LO = -32768 for a point with a negative LO scale DNP_LO = 0 for a point with a zero or positive LO scale
DNP_HI	-	DNP high conversion scale: DNP_HI = 32767

EXAMPLE

If you have read a value of 201 for point AI:3 that shows the I1 current (see Section 3.1) and the CT primary current is 200A (the high current scale is 2×200 = 400A), then the current reading in engineering units is as follows:

$$(201 - 0) \times (400 - 0)/(32767 - 0) + 0 = 2.45A$$

2.2.6 Scaling 16-bit Binary Counters

Binary counters are stored in the device in 32-bit integer format. Using 16-bit Binary Counter objects can cause over-range errors if the counter value exceeds 32767. Scaling binary counters (see DNP Options setup in Section 3.9) allows changing a binary counter unit from 1 to 1000 in powers of 10 to accommodate a 32-bit counter value to 16-bit object format. If the scaling unit is greater than 1, the counter value is reported being divided by the scaling unit. To get the actual value, multiply the counter reading by the selected scaling unit.

2.3 Password Protection

The EM920 has a password protection option allowing you to protect your setups, cumulative registers and logs from being changed or cleared through communications. You can disable or enable password protection through communications or via the front display. For details, refer to your instrument Installation and Operation Manual.

When password protection is enabled, the user password you set in your instrument should be written into the device authorization register (point AO:192) before another write request is issued. If the correct password is not supplied while password protection is enabled, the instrument will respond to all write requests with the exception response “Control operation not supported for this point”. It is recommended to clear the password register after you have completed your changes in order to activate password protection.

3 DNP Point Map

3.1 Analog Inputs - Basic Set

Object : Var.	Object : Point	Description	Options/Range[2]	Units[2]	Type	R/W	Notes
30:3	AI:0	V1/V12 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:1	V2/V23 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:2	V3/V31 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:3	I1 Current	0-Imax	U2	UINT32	R	
30:3	AI:4	I2 Current	0-Imax	U2	UINT32	R	
30:3	AI:5	I3 Current	0-Imax	U2	UINT32	R	
30:3	AI:6	kW L1	-Pmax-Pmax	U3	INT32	R	
30:3	AI:7	kW L2	-Pmax-Pmax	U3	INT32	R	
30:3	AI:8	kW L3	-Pmax-Pmax	U3	INT32	R	
30:3	AI:9	kvar L1	-Pmax-Pmax	U3	INT32	R	
30:3	AI:10	kvar L2	-Pmax-Pmax	U3	INT32	R	
30:3	AI:11	kvar L3	-Pmax-Pmax	U3	INT32	R	
30:3	AI:12	kVA L1	0-Pmax	U3	UINT32	R	
30:3	AI:13	kVA L2	0-Pmax	U3	UINT32	R	
30:3	AI:14	kVA L3	0-Pmax	U3	UINT32	R	
30:4	AI:15	Power factor L1	-1000-1000	×0.001	INT16	R	
30:4	AI:16	Power factor L2	-1000-1000	×0.001	INT16	R	
30:4	AI:17	Power factor L3	-1000-1000	×0.001	INT16	R	
30:4	AI:18	Total PF	-1000-1000	×0.001	INT16	R	
30:3	AI:19	Total kW	-Pmax-Pmax	U3	INT32	R	
30:3	AI:20	Total kvar	-Pmax-Pmax	U3	INT32	R	
30:3	AI:21	Total kVA	0-Pmax	U3	UINT32	R	
30:3	AI:22	In (neutral) Current	0-Imax	U4	UINT32	R	
30:4	AI:23	Frequency	0-Fmax	×0.01Hz	UINT16	R	
30:3	AI:24	Maximum kW import sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:25	kW import accumulated demand	0-Pmax	U3	UINT32	R	
30:3	AI:26	Maximum kVA sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:27	kVA accumulated demand	0-Pmax	U3	UINT32	R	
30:3	AI:28	I1 Maximum ampere demand	0-Imax	U2	UINT32	R	
30:3	AI:29	I2 Maximum ampere demand	0-Imax	U2	UINT32	R	
30:3	AI:30	I3 Maximum ampere demand	0-Imax	U2	UINT32	R	
30:3	AI:31	Present kW import sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:32	Present kVA sliding window demand	0-Pmax	U3	UINT32	R	
30:4	AI:33	PF (import) at Max. kVA sliding window demand	0-1000	×0.001	UINT16	R	
30:4	AI:34	V1/V12 Voltage THD	0-9999	×0.1%	UINT16	R	3
30:4	AI:35	V2/V23 Voltage THD	0-9999	×0.1%	UINT16	R	3

Object : Var.	Object : Point	Description	Options/Range[2]	Units[2]	Type	R/W	Notes
30:4	AI:36	V3/V31 Voltage THD	0-9999	×0.1%	UINT16	R	3
30:4	AI:37	I1 Current THD	0-9999	×0.1%	UINT16	R	3
30:4	AI:38	I2 Current THD	0-9999	×0.1%	UINT16	R	3
30:4	AI:39	I3 Current THD	0-9999	×0.1%	UINT16	R	3
30:4	AI:40	I1 Current TDD	0-1000	×0.1%	UINT16	R	3
30:4	AI:41	I2 Current TDD	0-1000	×0.1%	UINT16	R	3
30:4	AI:42	I3 Current TDD	0-1000	×0.1%	UINT16	R	3

NOTES:

1 When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

2 All analog input points except of harmonics are 1-second average values. For volts, amps and power scales and units, refer to Section 4 "Data Scales and Units". For analog input scaling formulas and examples, see Section 2.2.5, " Scaling Analog Input Objects".

3 On a 3-s interval.

3.2 Binary Inputs - Basic Set

Object : Var.	Object : Point	Description	Range	Units	Type	R/W	Notes
01:1	BI:0	Relay #1 status	0-1			R	
01:1	BI:1	Relay #2 status	0-1			R	
01:1	BI:2	Relay #3 status	0-1			R	
01:1	BI:3	Relay #4 status	0-1			R	
01:1	BI:4	Relay #5 status	0-1			R	
01:1	BI:5	Relay #6 status	0-1			R	
01:1	BI:6	Relay #7 status	0-1			R	
01:1	BI:16	Status input #1	0-1			R	
01:1	BI:17	Status input #2	0-1			R	
01:1	BI:18	Status input #3	0-1			R	
01:1	BI:19	Status input #4	0-1			R	
01:1	BI:20	Status input #5	0-1			R	
01:1	BI:21	Status input #6	0-1			R	
01:1	BI:22	Status input #7	0-1			R	
01:1	BI:23	Status input #8	0-1			R	
01:1	BI:24	Status input #9	0-1			R	
01:1	BI:25	Status input #10	0-1			R	
01:1	BI:48	Battery status	0-1			R	

3.3 Binary Counters - Basic Set

Object : Var.	Object : Point	Description	Range	Units	Type	R/W	Notes
20:5	BC:0	kWh import	0-999,999,999	0.1 kWh	UINT32	R	
20:5	BC:1	kWh export	0-999,999,999	0.1 kWh	UINT32	R	
20:5	BC:2	kvarh net	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:3	kVAh	0-999,999,999	0.1 kVAh	UINT32	R	
20:5	BC:4	kvarh import	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:5	kvarh export	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:6	kVAh import	0-999,999,999	0.1 kVAh	UINT32	R	
20:5	BC:7	kVAh export	0-999,999,999	0.1 kVAh	UINT32	R	
20:5	BC:8	kvarh Q1	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:9	kvarh Q2	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:10	kvarh Q3	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:11	kvarh Q4	0-999,999,999	0.1 kvarh	UINT32	R	

3.4 Frozen Binary Counters

Object : Var. [1]	Object : Point	Description	Range	Units	Type	R/W	Notes
		Total Energies – Basic Set					
21:var	FBC:0	kWh import	0-999,999,999	0.1 kWh	UINT32	R	
21:var	FBC:1	kWh export	0-999,999,999	0.1 kWh	UINT32	R	
21:var	FBC:2	kvarh net	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:3	kVAh	0-999,999,999	0.1 kVAh	UINT32	R	
21:var	FBC:4	kvarh import	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:5	kvarh export	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:6	kVAh import	0-999,999,999	0.1 kVAh	UINT32	R	
21:var	FBC:7	kVAh export	0-999,999,999	0.1 kVAh	UINT32	R	
21:var	FBC:8	kvarh Q1	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:9	kvarh Q2	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:10	kvarh Q3	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:11	kvarh Q4	0-999,999,999	0.1 kvarh	UINT32	R	
		Counters – Extended Set					
21:var	FBC:35328	Counter #1	0-999,999,999		UINT32	R	
21:var	FBC:35329	Counter #2	0-999,999,999		UINT32	R	
21:var	FBC:35330	Counter #3	0-999,999,999		UINT32	R	
21:var	FBC:35331	Counter #4	0-999,999,999		UINT32	R	
21:var	FBC:35332	Counter #5	0-999,999,999		UINT32	R	
21:var	FBC:35333	Counter #6	0-999,999,999		UINT32	R	
21:var	FBC:35334	Counter #7	0-999,999,999		UINT32	R	
21:var	FBC:35335	Counter #8	0-999,999,999		UINT32	R	

Object : Var. [1]	Object : Point	Description	Range	Units	Type	R/W	Notes
		Total Energies - Extended Set					
21:var	FBC:38656	kWh import	0-999,999,999	0.1 kWh	UINT32	R	
21:var	FBC:38657	kWh export	0-999,999,999	0.1 kWh	UINT32	R	
21:var	FBC:38658	Not used			UINT32	R	
21:var	FBC:38659	Not used			UINT32	R	
21:var	FBC:38660	kvarh import	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:38661	kvarh export	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:38662	Not used			UINT32	R	
21:var	FBC:38663	Not used			UINT32	R	
21:var	FBC:38664	kVAh total	0-999,999,999	0.1 kVAh	UINT32	R	
21:var	FBC:38665	Not used			UINT32	R	
21:var	FBC:38666	Not used			UINT32	R	
21:var	FBC:38667	kVAh import	0-999,999,999	0.1 kVAh	UINT32	R	
21:var	FBC:38668	kVAh export	0-999,999,999	0.1 kVAh	UINT32	R	
21:var	FBC:38669	Not used			UINT32	R	
21:var	FBC:38670	Not used			UINT32	R	
21:var	FBC:38671	Not used			UINT32	R	
21:var	FBC:38672	Not used			UINT32	R	
21:var	FBC:38673	Not used			UINT32	R	
21:var	FBC:38674	kvarh Q1	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:38675	kvarh Q2	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:38676	kvarh Q3	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:38677	kvarh Q4	0-999,999,999	0.1 kvarh	UINT32	R	
		Uncompensated Total Energies - Extended Set					
21:var	FBC:38016	kWh import	0-999,999,999	0.1 kWh	UINT32	R	
21:var	FBC:38017	kWh export	0-999,999,999	0.1 kWh	UINT32	R	
21:var	FBC:38018	kvarh import	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:38019	kvarh export	0-999,999,999	0.1 kvarh	UINT32	R	
21:var	FBC:38020	kVAh total	0-999,999,999	0.1 kVAh	UINT32	R	

NOTE

[1] For object variation, see DNP Options setup (see Section 3.9).

3.5 Analog Inputs, Binary Inputs and Counters – Extended Set

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
30:4	AI:32768	**None**	0		UINT16	R	
		Digital Inputs				R	
01:1	BI:34304	DI1	0-1			R	
01:1	BI:34305	DI2	0-1			R	
01:1	BI:34306	DI3	0-1			R	
01:1	BI:34307	DI4	0-1			R	
01:1	BI:34308	DI5	0-1			R	
01:1	BI:34309	DI6	0-1			R	
01:1	BI:34310	DI7	0-1			R	
01:1	BI:34311	DI8	0-1			R	
01:1	BI:34312	DI9	0-1			R	
01:1	BI:34313	DI10	0-1			R	
		Relay Outputs				R	
01:1	BI:34816	Relay #1	0-1			R	
01:1	BI:34817	Relay #2	0-1			R	
01:1	BI:34818	Relay #3	0-1			R	
01:1	BI:34819	Relay #4	0-1			R	
01:1	BI:34820	Relay #5	0-1			R	
01:1	BI:34821	Relay #6	0-1			R	
01:1	BI:34822	Relay #7	0-1			R	
		Counters					
20:5	BC:35328	Counter #1	0-999,999,999		UINT32	R	
20:5	BC:35329	Counter #2	0-999,999,999		UINT32	R	
20:5	BC:35330	Counter #3	0-999,999,999		UINT32	R	
20:5	BC:35331	Counter #4	0-999,999,999		UINT32	R	
20:5	BC:35332	Counter #5	0-999,999,999		UINT32	R	
20:5	BC:35333	Counter #6	0-999,999,999		UINT32	R	
20:5	BC:35334	Counter #7	0-999,999,999		UINT32	R	
20:5	BC:35335	Counter #8	0-999,999,999		UINT32	R	
		1-Cycle Phase Values					
30:3	AI:35840	V1/V12 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:35841	V2/V23 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:35842	V3/V31 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:35843	I1 Current	0-Imax	U4	UINT32	R	
30:3	AI:35844	I2 Current	0-Imax	U4	UINT32	R	
30:3	AI:35845	I3 Current	0-Imax	U4	UINT32	R	
30:3	AI:35846	kW L1	-Pmax-Pmax	U3	INT32	R	
30:3	AI:35847	kW L2	-Pmax-Pmax	U3	INT32	R	
30:3	AI:35848	kW L3	-Pmax-Pmax	U3	INT32	R	

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
30:3	AI:35849	kvar L1	-Pmax-Pmax	U3	INT32	R	
30:3	AI:35850	kvar L2	-Pmax-Pmax	U3	INT32	R	
30:3	AI:35851	kvar L3	-Pmax-Pmax	U3	INT32	R	
30:3	AI:35852	kVA L1	0-Pmax	U3	UINT32	R	
30:3	AI:35853	kVA L2	0-Pmax	U3	UINT32	R	
30:3	AI:35854	kVA L3	0-Pmax	U3	UINT32	R	
30:4	AI:35855	Power factor L1	-1000-1000	×0.001	INT16	R	
30:4	AI:35856	Power factor L2	-1000-1000	×0.001	INT16	R	
30:4	AI:35857	Power factor L3	-1000-1000	×0.001	INT16	R	
30:4	AI:35858	V1/V12 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:35859	V2/V23 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:35860	V3/V31 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:35861	I1 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:35862	I2 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:35863	I3 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:35864	I1 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:35865	I2 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:35866	I3 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:35867	I1 Current TDD	0-1000	×0.1%	UINT16	R	4
30:4	AI:35868	I2 Current TDD	0-1000	×0.1%	UINT16	R	4
30:4	AI:35869	I3 Current TDD	0-1000	×0.1%	UINT16	R	4
30:3	AI:35870	V12 Voltage	0-Vmax	U1	UINT32	R	
30:3	AI:35871	V23 Voltage	0-Vmax	U1	UINT32	R	
30:3	AI:35872	V31 Voltage	0-Vmax	U1	UINT32	R	
		1-Cycle Total Values					
30:3	AI:36608	Total kW	-Pmax-Pmax	U3	INT32	R	
30:3	AI:36609	Total kvar	-Pmax-Pmax	U3	INT32	R	
30:3	AI:36610	Total kVA	0-Pmax	U3	UINT32	R	
30:4	AI:36611	Total PF	-1000-1000	×0.001	INT16	R	
30:4	AI:36612	Total PF lag	0-1000	×0.001	UINT16	R	
30:4	AI:36613	Total PF lead	0-1000	×0.001	UINT16	R	
30:3	AI:36614	Total kW import	0-Pmax	U3	UINT32	R	
30:3	AI:36615	Total kW export	0-Pmax	U3	UINT32	R	
30:3	AI:36616	Total kvar import	0-Pmax	U3	UINT32	R	
30:3	AI:36617	Total kvar export	0-Pmax	U3	UINT32	R	
30:3	AI:36618	3-phase average L-N/L-L voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:36619	3-phase average L-L voltage	0-Vmax	U1	UINT32	R	
30:3	AI:36620	3-phase average current	0-Imax	U4	UINT32	R	
		1-Cycle Auxiliary Values					
30:3	AI:36864	I4 Current	0-I4max	U4	UINT32	R	
30:3	AI:36865	In (neutral) Current	0-Imax	U4	UINT32	R	
30:4	AI:36866	Frequency	0-Fmax	×0.01Hz	UINT16	R	
30:4	AI:36867	Voltage unbalance	0-3000	×0.1%	UINT16	R	

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
30:4	AI:36868	Current unbalance	0-3000	×0.1%	UINT16	R	
		1-Second Phase Values					
30:3	AI:37120	V1/V12 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:37121	V2/V23 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:37122	V3/V31 Voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:37123	I1 Current	0-Imax	U2	UINT32	R	
30:3	AI:37124	I2 Current	0-Imax	U2	UINT32	R	
30:3	AI:37125	I3 Current	0-Imax	U2	UINT32	R	
30:3	AI:37126	kW L1	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37127	kW L2	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37128	kW L3	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37129	kvar L1	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37130	kvar L2	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37131	kvar L3	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37132	kVA L1	0-Pmax	U3	UINT32	R	
30:3	AI:37133	kVA L2	0-Pmax	U3	UINT32	R	
30:3	AI:37134	kVA L3	0-Pmax	U3	UINT32	R	
30:4	AI:37135	Power factor L1	-1000-1000	×0.001	INT16	R	
30:4	AI:37136	Power factor L2	-1000-1000	×0.001	INT16	R	
30:4	AI:37137	Power factor L3	-1000-1000	×0.001	INT16	R	
30:4	AI:37138	V1/V12 Voltage THD	0-9999	×0.1%	UINT16	R	2, 5
30:4	AI:37139	V2/V23 Voltage THD	0-9999	×0.1%	UINT16	R	2, 5
30:4	AI:37140	V3/V31 Voltage THD	0-9999	×0.1%	UINT16	R	2, 5
30:4	AI:37141	I1 Current THD	0-9999	×0.1%	UINT16	R	5
30:4	AI:37142	I2 Current THD	0-9999	×0.1%	UINT16	R	5
30:4	AI:37143	I3 Current THD	0-9999	×0.1%	UINT16	R	5
30:4	AI:37144	I1 K-Factor	10-9999	×0.1	UINT16	R	5
30:4	AI:37145	I2 K-Factor	10-9999	×0.1	UINT16	R	5
30:4	AI:37146	I3 K-Factor	10-9999	×0.1	UINT16	R	5
30:4	AI:37147	I1 Current TDD	0-1000	×0.1%	UINT16	R	5
30:4	AI:37148	I2 Current TDD	0-1000	×0.1%	UINT16	R	5
30:4	AI:37149	I3 Current TDD	0-1000	×0.1%	UINT16	R	5
30:3	AI:37150	V12 Voltage	0-Vmax	U1	UINT32	R	
30:3	AI:37151	V23 Voltage	0-Vmax	U1	UINT32	R	
30:3	AI:37152	V31 Voltage	0-Vmax	U1	UINT32	R	
30:3	AI:37153	Not used	0		UINT32	R	
30:3	AI:37154	Not used	0		UINT32	R	
30:3	AI:37155	Not used	0		UINT32	R	
30:3	AI:37156	V1x Voltage	0-Vmax	U1	UINT32	R	Transient coprocessor V1 channel
30:3	AI:37157	V2x Voltage	0-Vmax	U1	UINT32	R	Transient coprocessor V2 channel
30:3	AI:37158	V3x Voltage	0-Vmax	U1	UINT32	R	Transient coprocessor V3 channel
		1-Second Total Values					
30:3	AI:37888	Total kW	-Pmax-Pmax	U3	INT32	R	

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
30:3	AI:37889	Total kvar	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37890	Total kVA	0-Pmax	U3	UINT32	R	
30:4	AI:37891	Total PF	-1000-1000	×0.001	INT16	R	
30:4	AI:37892	Total PF lag	0-1000	×0.001	UINT16	R	
30:4	AI:37893	Total PF lead	0-1000	×0.001	UINT16	R	
30:3	AI:37894	Total kW import	0-Pmax	U3	UINT32	R	
30:3	AI:37895	Total kW export	0-Pmax	U3	UINT32	R	
30:3	AI:37896	Total kvar import	0-Pmax	U3	UINT32	R	
30:3	AI:37897	Total kvar export	0-Pmax	U3	UINT32	R	
30:3	AI:37898	3-phase average L-N/L-L voltage	0-Vmax	U1	UINT32	R	1
30:3	AI:37899	3-phase average L-L voltage	0-Vmax	U1	UINT32	R	
30:3	AI:37900	3-phase average current	0-Imax	U2	UINT32	R	
30:3	AI:37901	Not used	0		UINT32	R	
30:3	AI:37902	Total kW Fe losses	-Pmax-Pmax	U3	UINT32	R	
30:3	AI:37903	Total kW Cu losses	-Pmax-Pmax	U3	UINT32	R	
30:3	AI:37904	Total kvar Fe losses	-Pmax-Pmax	U3	UINT32	R	
30:3	AI:37905	Total kvar Cu losses	-Pmax-Pmax	U3	UINT32	R	
30:3	AI:37906	Total kW uncompensated	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37907	Total kvar uncompensated	-Pmax-Pmax	U3	INT32	R	
30:3	AI:37908	Total kVA uncompensated	0-Pmax	U3	UINT32	R	
30:4	AI:37909	Total PF uncompensated	-1000-1000	×0.001	INT16	R	
		Uncompensated Total Energies					
20:5	BC:38016	kWh import	0-999,999,999	0.1 kWh	UINT32	R	
20:5	BC:38017	kWh export	0-999,999,999	0.1 kWh	UINT32	R	
20:5	BC:38018	kvarh import	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:38019	kvarh export	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:38020	kVAh total	0-999,999,999	0.1 kVAh	UINT32	R	
		1-Second Auxiliary Values					
30:3	AI:38144	I4 Current	0-I4max	U4	UINT32	R	
30:3	AI:38145	In (neutral) Current	0-Imax	U4	UINT32	R	
30:4	AI:38146	Frequency	0-Fmax	×0.01Hz	UINT16	R	
30:4	AI:38147	Voltage unbalance	0-3000	×0.1%	UINT16	R	
30:4	AI:38148	Current unbalance	0-3000	×0.1%	UINT16	R	
30:4	AI:38149	Not used	0		UINT16	R	
30:4	AI:38150	Not used	0		UINT16	R	
30:4	AI:38151	Not used	0		UINT16	R	
30:4	AI:38152	V4x (neutral-ground) voltage	0-Vmax	U1	UINT16	R	Transient coprocessor V4 channel
30:4	AI:38153	Internal temperature	-200.0 to 200.0	0.1ºC	UINT16	R	
		Present Volt, Ampere and Power Demands					
30:3	AI:38400	V1/V12 Volt demand	0-Vmax	U1	UINT32	R	2
30:3	AI:38401	V2/V23 Volt demand	0-Vmax	U1	UINT32	R	2
30:3	AI:38402	V3/V31 Volt demand	0-Vmax	U1	UINT32	R	2
30:3	AI:38403	I1 Ampere demand	0-Imax	U2	UINT32	R	

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
30:3	AI:38404	I2 Ampere demand	0-Imax	U2	UINT32	R	
30:3	AI:38405	I3 Ampere demand	0-Imax	U2	UINT32	R	
30:3	AI:38406	kW import block demand	0-Pmax	U3	UINT32	R	
30:3	AI:38407	kvar import block demand	0-Pmax	U3	UINT32	R	
30:3	AI:38408	kVA block demand	0-Pmax	U3	UINT32	R	
30:3	AI:38409	kW import sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:38410	kvar import sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:38411	kVA sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:38412	Not used			UINT32	R	
30:3	AI:38413	Not used			UINT32	R	
30:3	AI:38414	Not used			UINT32	R	
30:3	AI:38415	kW import accumulated demand	0-Pmax	U3	UINT32	R	
30:3	AI:38416	kvar import accumulated demand	0-Pmax	U3	UINT32	R	
30:3	AI:38417	kVA accumulated demand	0-Pmax	U3	UINT32	R	
30:3	AI:38418	kW import predicted sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:38419	kvar import predicted sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:38420	kVA predicted sliding window demand	0-Pmax	U3	UINT32	R	
30:4	AI:38421	PF (import) at Max. kVA sliding window demand	0-1000	×0.001	UINT16	R	
30:3	AI:38422	kW export block demand	0-Pmax	U3	UINT32	R	
30:3	AI:38423	kvar export block demand	0-Pmax	U3	UINT32	R	
30:3	AI:38424	kW export sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:38425	kvar export sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:38426	kW export accumulated demand	0-Pmax	U3	UINT32	R	
30:3	AI:38427	kvar export accumulated demand	0-Pmax	U3	UINT32	R	
30:3	AI:38428	kW export predicted sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:38429	kvar export predicted sliding window demand	0-Pmax	U3	UINT32	R	
		Total Energies					
20:5	BC:38656	kWh import	0-999,999,999	0.1 kWh	UINT32	R	
20:5	BC:38657	kWh export	0-999,999,999	0.1 kWh	UINT32	R	
20:5	BC:38658	Not used			UINT32	R	
20:5	BC:38659	Not used			UINT32	R	
20:5	BC:38660	kvarh import	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:38661	kvarh export	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:38662	Not used			UINT32	R	
20:5	BC:38663	Not used			UINT32	R	
20:5	BC:38664	kVAh total	0-999,999,999	0.1 kVAh	UINT32	R	
20:5	BC:38665	Not used			UINT32	R	
20:5	BC:38666	Not used			UINT32	R	
20:5	BC:38667	kVAh import	0-999,999,999	0.1 kVAh	UINT32	R	
20:5	BC:38668	kVAh export	0-999,999,999	0.1 kVAh	UINT32	R	
20:5	BC:38669	Not used			UINT32	R	
20:5	BC:38670	Not used			UINT32	R	
20:5	BC:38671	Not used			UINT32	R	

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
20:5	BC:38672	Not used			UINT32	R	
20:5	BC:38673	Not used			UINT32	R	
20:5	BC:38674	kvarh Q1	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:38675	kvarh Q2	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:38676	kvarh Q3	0-999,999,999	0.1 kvarh	UINT32	R	
20:5	BC:38677	kvarh Q4	0-999,999,999	0.1 kvarh	UINT32	R	
		V1/V12 Harmonic Distortion					2
30:4	AI:39168	H01 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4	AI:39169	H02 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4		...					
30:4	AI:39217	H50 Harmonic distortion	0-100.00	0.01%	UINT16	R	
		V2/V23 Harmonic Distortion					2
30:4	AI:39424	H01 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4	AI:39425	H02 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4		...					
30:4	AI:39473	H50 Harmonic distortion	0-100.00	0.01%	UINT16	R	
		V3/V31 Harmonic Distortion					2
30:4	AI:39680	H01 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4	AI:39681	H02 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4		...					
30:4	AI:39729	H50 Harmonic distortion	0-100.00	0.01%	UINT16	R	
		I1 Harmonic Distortion					
30:4	AI:39936	H01 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4	AI:39937	H02 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4		...					
30:4	AI:39985	H50 Harmonic distortion	0-100.00	0.01%	UINT16	R	
		I2 Harmonic Distortion					
30:4	AI:40192	H01 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4	AI:40193	H02 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4		...					
30:4	AI:40241	H50 Harmonic distortion	0-100.00	0.01%	UINT16	R	
		I3 Harmonic Distortion					
30:4	AI:40448	H01 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4	AI:40449	H02 Harmonic distortion	0-100.00	0.01%	UINT16	R	
30:4		...					
30:4	AI:40497	H50 Harmonic distortion	0-100.00	0.01%	UINT16	R	
		Fundamental Phase Values					4
30:3	AI:43264	V1/V12 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:43265	V2/V23 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:43266	V3/V31 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:43267	I1 Current	0-Imax	U4	UINT32	R	

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
30:3	AI:43268	I2 Current	0-Imax	U4	UINT32	R	
30:3	AI:43269	I3 Current	0-Imax	U4	UINT32	R	
30:3	AI:43270	kW L1	-Pmax-Pmax	U3	INT32	R	
30:3	AI:43271	kW L2	-Pmax-Pmax	U3	INT32	R	
30:3	AI:43272	kW L3	-Pmax-Pmax	U3	INT32	R	
30:3	AI:43273	kvar L1	-Pmax-Pmax	U3	INT32	R	
30:3	AI:43274	kvar L2	-Pmax-Pmax	U3	INT32	R	
30:3	AI:43275	kvar L3	-Pmax-Pmax	U3	INT32	R	
30:3	AI:43276	kVA L1	0-Pmax	U3	UINT32	R	
30:3	AI:43277	kVA L2	0-Pmax	U3	UINT32	R	
30:3	AI:43278	kVA L3	0-Pmax	U3	UINT32	R	
30:4	AI:43279	Power factor L1	-1000-1000	×0.001	INT16	R	
30:4	AI:43280	Power factor L2	-1000-1000	×0.001	INT16	R	
30:4	AI:43281	Power factor L3	-1000-1000	×0.001	INT16	R	
		Fundamental Total Values					4
30:3	AI:43520	Total fundamental kW	-Pmax-Pmax	U3	INT32	R	
30:3	AI:43521	Total fundamental kvar	-Pmax-Pmax	U3	INT32	R	
30:3	AI:43522	Total fundamental kVA	0-Pmax	U3	UINT32	R	
30:4	AI:43523	Total fundamental PF	-1000-1000	×0.001	INT16	R	
		Minimum 1-Cycle Phase Values					
30:3	AI:44032	V1/V12 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:44033	V2/V23 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:44034	V3/V31 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:44035	I1 Current	0-Imax	U4	UINT32	R	
30:3	AI:44036	I2 Current	0-Imax	U4	UINT32	R	
30:3	AI:44037	I3 Current	0-Imax	U4	UINT32	R	
30:3	AI:44038- AI:44049	Not used	0		INT32	R	
30:4	AI:44050	V1/V12 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:44051	V2/V23 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:44052	V3/V31 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:44053	I1 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:44054	I2 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:44055	I3 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:44056	I1 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:44057	I2 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:44058	I3 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:44059	I1 Current TDD	0-1000	×0.1%	UINT16	R	4
30:4	AI:44060	I2 Current TDD	0-1000	×0.1%	UINT16	R	4
30:4	AI:44061	I3 Current TDD	0-1000	×0.1%	UINT16	R	4
		Minimum 1-Cycle Total Values					
30:3	AI:44288	Total kW	-Pmax-Pmax	U3	INT32	R	
30:3	AI:44289	Total kvar	-Pmax-Pmax	U3	INT32	R	

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
30:3	AI:44290	Total kVA	0-Pmax	U3	UINT32	R	
30:4	AI:44291	Total PF	0-1000	×0.001	UINT16	R	Absolute value
		Minimum 1-Cycle Auxiliary Values					
30:3	AI:44544	I4 Current	0-I4max	U4	UINT32	R	
30:3	AI:44545	In Current	0-Imax	U4	UINT32	R	
30:4	AI:44546	Frequency	0-Fmax	×0.01Hz	UINT16	R	
		Maximum 1-Cycle Phase Values					
30:3	AI:46080	V1/V12 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:46081	V2/V23 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:46082	V3/V31 Voltage	0-Vmax	U1	UINT32	R	2
30:3	AI:46083	I1 Current	0-Imax	U4	UINT32	R	
30:3	AI:46084	I2 Current	0-Imax	U4	UINT32	R	
30:3	AI:46085	I3 Current	0-Imax	U4	UINT32	R	
30:3	AI:46086-AI:46097	Not used	0		INT32	R	
30:4	AI:46098	V1/V12 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:46099	V2/V23 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:46100	V3/V31 Voltage THD	0-9999	×0.1%	UINT16	R	2, 4
30:4	AI:46101	I1 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:46102	I2 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:46103	I3 Current THD	0-9999	×0.1%	UINT16	R	4
30:4	AI:46104	I1 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:46105	I2 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:46106	I3 K-Factor	10-9999	×0.1	UINT16	R	4
30:4	AI:46107	I1 Current TDD	0-1000	×0.1%	UINT16	R	4
30:4	AI:46108	I2 Current TDD	0-1000	×0.1%	UINT16	R	4
30:4	AI:46109	I3 Current TDD	0-1000	×0.1%	UINT16	R	4
		Maximum 1-Cycle Total Values					
30:3	AI:46336	Total kW	-Pmax-Pmax	U3	INT32	R	
30:3	AI:46337	Total kvar	-Pmax-Pmax	U3	INT32	R	
30:3	AI:46338	Total kVA	0-Pmax	U3	UINT32	R	
30:4	AI:46339	Total PF	0-1000	×0.001	UINT16	R	Absolute value
		Maximum 1-Cycle Auxiliary Values					
30:3	AI:46592	I4 Current	0-I4max	U4	UINT32	R	
30:3	AI:46593	In Current	0-Imax	U4	UINT32	R	
30:4	AI:46594	Frequency	0-Fmax	×0.01Hz	UINT16	R	
		Maximum Demands					
30:3	AI:46848	V1/V12 Maximum volt demand	0-Vmax	U1	UINT32	R	2
30:3	AI:46849	V2/V23 Maximum volt demand	0-Vmax	U1	UINT32	R	2
30:3	AI:46850	V3/V31 Maximum volt demand	0-Vmax	U1	UINT32	R	2
30:3	AI:46851	I1 Maximum ampere demand	0-Imax	U2	UINT32	R	
30:3	AI:46852	I2 Maximum ampere demand	0-Imax	U2	UINT32	R	
30:3	AI:46853	I3 Maximum ampere demand	0-Imax	U2	UINT32	R	

Object : Var.	Object : Point	Description	Options/Range[3]	Units[3]	Type	R/W	Notes
30:3	AI:46854	Not used			UINT32	R	
30:3	AI:46855	Not used			UINT32	R	
30:3	AI:46856	Not used			UINT32	R	
30:3	AI:46857	Maximum kW import sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:46858	Maximum kvar import sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:46859	Maximum kVA sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:46860	Not used			UINT32	R	
30:3	AI:46861	Not used			UINT32	R	
30:3	AI:46862	Not used			UINT32	R	
30:3	AI:46863	Maximum kW export sliding window demand	0-Pmax	U3	UINT32	R	
30:3	AI:46864	Maximum kvar export sliding window demand	0-Pmax	U3	UINT32	R	

NOTES:

1 When the 4LN3, 4LL3, 3LN3 or 3LL3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line.

2 When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

3 For volts, amps, power and frequency scales and units refer to Section 4 ”Data Scales and Units”. For analog input scaling formulas and examples, see Section 2.2.5, “ Scaling Analog Input Objects”.

4 On a 0.2-s interval.

5 On a 3-s interval.

3.6 Factory Device Settings and Identification

Object:Var.	Object:Point	Description	Options/Range	Units	Type	R/W	Notes
Device Identification							
30:3	AI:256	Device serial number	0-999999		UINT32	R	
30:4	AI:257	Device model ID	92000		UINT16	R	
30:4	AI:258-AI:261	Device model name	“EM920”		UINT32	R	Null-terminated string. Each four characters are packed into a 32-bit word.
30:3	AI:262-AI:265	Reserved			UINT32	R	
30:4	AI:266	Device firmware version number	2800-2899		UINT16	R	Two higher decimal digits = major version number, two lower decimal digits = minor version number
30:4	AI:267	Device firmware build number	1-99		UINT16	R	
30:4	AI:268	Transient coprocessor firmware version number	2900-2999		UINT16	R	
30:4	AI:269	Transient coprocessor firmware build number	1-99		UINT16	R	
30:4	AI:270	Boot loader version number			UINT16	R	Two higher decimal digits = major version number, two lower decimal digits = minor version number
30:4	AI:271	Boot loader build number	1-99		UINT16	R	
30:3	AI:272-AI:274	Reserved			UINT32	R	
Factory Device Settings							
30:4	AI:275	V1-V4 input range	480, 120 (option U)	V	UINT16	R	
30:4	AI:276	V1-V4 input overload	125	%	UINT16	R	
30:3	AI:277-AI:278	Reserved			UINT32	R	
30:4	AI:279	I1-I4 input range	1, 5	A	UINT16	R	
30:4	AI:280	I1-I4 input overload	200	%	UINT16	R	
30:4	AI:281-AI:288	Reserved			UINT16	R	
Port Identification							
30:4	AI:320	Current serial port number	0=COM1, 1=COM2, 2=COM3, 3=COM4		UINT16	R	

3.7 Device Control

Object : Var.	Object : Point	Description	Options/Range	Units	Type	R/W	Notes
Device Authorization Register							
40:1(read) 41:1(write)	AO:192	When write: 8-digit password. When read: 0 = access permitted, -1 = authorization required.	0/-1 (Read) 0-99999999(Write)			R/W	
Device Reset/Clear							
10:2(read) 12:1(write)	BO:0 CROB:0	Clear total energy registers	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:1 CROB:1	Clear total maximum demand registers (all demands)	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:2 CROB:2	Clear power demands	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:3 CROB:3	Clear volt/ampere/harmonic demands	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:4-11 CROB:4-11	Reserved	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:12 CROB:12	Clear pulse counters (all counters)	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:13 CROB:13	Clear pulse counter#1	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:14 CROB:14	Clear pulse counter#2	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:15 CROB:15	Clear pulse counter#3	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:16 CROB:16	Clear pulse counter#4	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:17 CROB:17	Clear pulse counter#5	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:18 CROB:18	Clear pulse counter#6	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:19 CROB:19	Clear pulse counter#7	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:20 CROB:20	Clear pulse counter#8	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
10:2(read) 12:1(write)	BO:21 CROB:21	Clear Min/Max log	0/1 = state OFF/ON			R W	Returns zero PULSE ON [1]
Remote Relay Control							
10:2(read) 12:1(write)	BO:80 CROB:80	Relay #1 Force operate/Force release/Normal	0/1 = state OFF/ON			R/W	[4]
10:2(read) 12:1(write)	BO:81 CROB:81	Relay #2 Force operate/Force release /Normal	0/1 = state OFF/ON			R/W	[4]
10:2(read)	BO:82	Relay #3 Force operate/Force release /Normal	0/1 = state OFF/ON			R/W	[4]

Object : Var.	Object : Point	Description	Options/Range	Units	Type	R/W	Notes
12:1(write)	CROB:82						
10:2(read) 12:1(write)	BO:83 CROB:83	Relay #4 Force operate/Force release /Normal	0/1 = state OFF/ON			R/W	4
10:2(read) 12:1(write)	BO:84 CROB:84	Relay #5 Force operate/Force release /Normal	0/1 = state OFF/ON			R/W	4
10:2(read) 12:1(write)	BO:85 CROB:85	Relay #6 Force operate/Force release /Normal	0/1 = state OFF/ON			R/W	4
10:2(read) 12:1(write)	BO:86 CROB:86	Relay #7 Force operate/Force release /Normal	0/1 = state OFF/ON			R/W	4
Device Diagnostics							
10:2(read) 12:1(write)	BO:128 CROB:128	Reserved	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:129 CROB:129	Permanent fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:130 CROB:130	RAM/Data error	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:131 CROB:131	CPU watchdog reset	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:132 CROB:132	Sampling fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:133 CROB:133	CPU exception	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:134 CROB:134	Reserved	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:135 CROB:135	Software watchdog reset	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:136 CROB:136	Power down	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:137 CROB:137	Device reset	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:138 CROB:138	Configuration reset	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:139 CROB:139	RTC fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:140 CROB:140	Configuration fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:141 CROB:141	Reserved	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:142 CROB:142	Expanded/Data FLASH memory fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:143 CROB:143	CPU EEPROM fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:144 CROB:144	Reserved	0/1 = state OFF/ON			R/W	2

Object : Var.	Object : Point	Description	Options/Range	Units	Type	R/W	Notes
10:2(read) 12:1(write)	BO:145 CROB:145	I/O board EEPROM fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:146 CROB:146	Transient coprocessor fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:147 CROB:147	Reserved	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:148 CROB:148	C Library error	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:149 CROB:149	RTOS Kernel error	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:150 CROB:150	Task error	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:151 CROB:151	Reserved	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:152 CROB:152	IRIG-B signal lost	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:153 CROB:153	IRIG-B time unlocked	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:154 CROB:154	Reserved	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:155 CROB:155	Magnetic interference	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:156 CROB:156	Reserved	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:157 CROB:157	Motion/tilt sensor	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:158 CROB:158	Circuit fault	0/1 = state OFF/ON			R/W	2
10:2(read) 12:1(write)	BO:159 CROB:159	Reserved	0/1 = state OFF/ON			R/W	2

NOTES:

1 The following restriction should be noted when using object 12 to control the listed points.

- The Count byte is ignored.
- The Control Code byte is checked:
  - Pulse On (1) is valid for all points; other codes are invalid and will be rejected.
- The On Time and Off Time fields are ignored.
- The status byte in the response will reflect the success or failure of the control operation:
  - Request Accepted (0) will be returned if the command was accepted;
  - Request not Accepted due to Formatting Errors (3) is returned if the Control Code byte was incorrectly formatted or if an invalid code was present in the command;
  - Control Operation not Supported for this Point (4) is returned if the Control Point was out of control.

[2] The alarm indication points indicate possible problems with the device hardware or setup configuration. The hardware problems are indicated by the appropriate points, which are set whenever the instrument fails self-test diagnostics, or in the event of loss of power. The dedicated binary point indicates the setup configuration problems, which is set when either configuration register is corrupted. In this event, the instrument will use the default configuration. The configuration corrupt bit may also be set as a result of the legal changes in the setup configuration since the instrument might implicitly change or clear other setups if they are affected by the changes made.

Issuing the Direct-Operate, SBO/Operate or Direct-Operate-No-Acknowledge command using the Control-Relay-Output-Block object (with the code operation Latch-Off) to points 64-75 can reset hardware fault points. The configuration corrupt status point is also reset automatically when you change setup either via the front panel or through communications.

The following restrictions should be noted when using Object 12 to control the listed points:

- The Count byte is ignored.
- The Control Code byte is checked:
  - Latch Off is valid for all points; other codes are invalid and will be rejected.
- The On Time and Off Time fields are ignored.
- The status byte in the response will reflect the success or failure of the control operation:
  - Request Accepted (0) is returned if the command was accepted;
  - Request not Accepted due to Formatting Errors (3) is returned if the Control Code byte was incorrectly formatted or if an invalid Code was present in the command.

[3] These self-check alarms are doubled with the corresponding internal indication bits.

[4] To manually operate a relay, use the Direct-Operate, SBO/Operate or Direct-Operate-No-Acknowledge command to point 80 or 81 of the Control-Relay-Output-Block object with the Control Code value Latch On. To manually release Relay #1, use the Direct-Operate, SBO/Operate or Direct-Operate-No-Acknowledge command to point 80 or 81 of the Control-Relay-Output-Block object with the Control Code value Latch Off.

To operate a relay in pulse mode with the Pulse On or Pulse Off control code, put the relay in pulse mode and select a required pulse polarity via the Relay Outputs setup (use the supplemental PAS software to change the relay properties). The actual pulse width will be taken from the On Time/Off Time fields of the Control-Relay-Output-Block object.

The following restrictions should be noted when using object 12 to control the listed points:

- The Count byte is ignored.
- The Control Code byte is checked:
  - Pulse On, Pulse Off, Latch On (Pulse On/Close) and Latch Off (Pulse On/Trip) are valid for all points; other codes are invalid and will be rejected;
  - Clear sub-field is valid; other sub-fields are ignored.
- The On Time specifies in ms the amount of time the digital point is to be turned on. The minimal value of the On Time is 500 ms and the actual value may differ from the specified value by up to 10 ms.
- The Off Time specifies in ms the amount of time the digital point is to be turned off. The minimal value of the Off Time is 500 ms and the actual value may differ from the specified value by up to 10 ms.
- The Status byte in the response reflects the success or failure of the control operation:
  - Request Accepted (0) will be return if the command was accepted;
  - Request not Accepted due to Formatting Errors (3) will be returned if the Control Code byte was incorrectly formatted or an invalid Code was present in the command;
  - Control Operation not Supported for this Point (4) will be returned if the Control Point was out of control.

3.8 Device Setup

Object:Var.	Object:Point	Description	Options/Range	Units	Type	R/W	Notes
Basic Setup							
40:2 (read) 41:2 (write)	AO:0	Wiring mode	F1		UINT16	R/W	
40:1 (read) 41:1 (write)	AO:1	PT ratio (primary to secondary ratio)	10-65000	×0.1	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:2	PT secondary (line-to-line) voltage	50-480	V	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:3-4	Reserved			UINT16	R	Read as 65535
40:2 (read) 41:2 (write)	AO:5	CT primary current	1-20000	A	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:6	Reserved			UINT16	R	Read as 65535
40:2 (read) 41:2 (write)	AO:7	I4 CT primary current	1-20000	A	UINT16	R/W	
40:1 (read)	AO:8-16	Reserved			UINT16	R	Read as 65535
40:2 (read) 41:2 (write)	AO:17	Nominal line frequency	50, 60	Hz	UINT16	R/W	
40:2 (read)	AO:18-23	Reserved			UINT16	R	Read as 65535
40:2 (read) 41:2 (write)	AO:24	I maximum demand load current	0-20000	A	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:25	I4 maximum demand load current	0-20000	A	UINT16	R/W	
40:2 (read)	AO:26-31	Reserved			UINT16	R	Read as 65535
Demand Setup							
40:2 (read) 41:2 (write)	AO:32	Power demand period (block interval)	1, 2, 3, 5, 10, 15, 30, 60	min	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:33	Number of demand periods in a sliding window	1-15		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:34	Demand synchronization source input	0 = device clock, 1-10 = DI1-DI10		UINT16	R/W	A DI input is considered a pulse or KYZ input. The pulse edge restarts the power demand accumulation interval.
40:2 (read)	AO:35-39	Reserved			UINT16	R/W	Read as 65535
40:2 (read) 41:2 (write)	AO:40	Volt demand period	0-9000	sec	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:41	Ampere demand period	0-9000	sec	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:42	Harmonic demand period	0-9000	sec	UINT16	R/W	
40:2 (read)	AO:43-47	Reserved			UINT16	R/W	Read as 65535

Object:Var.	Object:Point	Description	Options/Range	Units	Type	R/W	Notes
Device Options Setup							
40:2 (read) 41:2 (write)	AO:48	Power calculation mode	0 = using reactive power: S = f(P,Q), 1 = using non-active power: Q=f(S,P)		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:49	Energy roll value	2 = 100,000.0 kWh 3 = 1,000,000.0 kWh 4 = 10,000,000.0 kWh 5 = 100,000,000.0 kWh (default)		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:50	Reserved			UINT16	R/W	Read as 65535
40:2 (read) 41:2 (write)	AO:51	End of billing (TOU/Billing maximum demand reset) mode, bitmap	Bit 0 = 1 – automatic/monthly mode allowed Bit 1 = 1 - COM mode allowed Bit 2 = 1 - manual mode allowed		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:52	Tariff control	0 = via a calendar scheduler, 0x4000 = via communications, 0x0100-0x0109 = via tariff inputs DI1-DI10 (bits 0:2 denote the first digital input index used)		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:53	Number of tariffs	1-8 (does not have effect with a calendar tariff control option)		UINT16	R/W	
40:2 (read	AO:54	Reserved			UINT16	R/W	Read as 65535
40:2 (read) 41:2 (write)	AO:55	Energy LED test mode	0 = disabled, 1 = enabled		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:56	Energy LED pulse rate, Wh/impulse, varh/impulse (in secondary units)	1-40	×0.01 Wh/imp	UINT16	R/W	
40:2 (read	AO:57	Reserved			UINT16	R/W	Read as 65535
40:2 (read) 41:2 (write)	AO:58	Demand forgiveness delay	0-60	min	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:59	Minimum outage duration for demand forgiveness	0-900	s	UINT16	R/W	
40:2 (read)	AO:60-63	Reserved			UINT16	R/W	Read as 65535
Communication Ports Setup							
		COM1 Setup					
40:2 (read) 41:2 (write)	AO:112	Communication protocol	0 = Modbus RTU, 1 = Modbus ASCII, 2 = DNP3.0, 6 = IEC 62056-21, 7 = IEC 61850		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:113	Interface	0 = RS-232, 1 = RS-422, 2 = RS-485, 3 = Infrared, 8 = GSM/GPRS		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:114	Device address	Modbus: 1-247 DNP3.0: 0–65532		UINT16	R/W	
40:2 (read)	AO:115	Baud rate	3 = 1200 bps, 4 = 2400 bps, 5 =		UINT16	R/W	

Object:Var.	Object:Point	Description	Options/Range	Units	Type	R/W	Notes
41:2 (write)			4800 bps, 6 = 9600 bps, 7 = 19200 bps, 8 = 38400 bps, 9 = 57600 bps, 10 = 115200 bps				
40:2 (read) 41:2 (write)	AO:116	Data format	0 = 7 bits/even parity, 1 = 8 bits/no parity, 2 = 8 bits/even parity		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:117	CTS mode	0 = not used, 1 = wait for CTS before sending data		UINT16	R/W	N/A for COM1-COM3 (read as 65535)
40:2 (read) 41:2 (write)	AO:118	RTS mode	0 = not used, 1 = RTS is asserted during the transmission		UINT16	R/W	N/A for COM1-COM3 (read as 65535)
40:2 (read) 41:2 (write)	AO:119	Minimum delay before sending data	0-1000 (default = 5)	ms	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:120	Inter-character time-out	0-1000 (default = four-character time)	ms	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:121	Port direction	0 = slave (default), 1 = master		UINT16	R/W	
40:2 (read) 41:2 (write)	AO:122	Receive timeout (for a master port only)	500-30000	ms	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:123-127	Reserved			UINT16	R	Read as 65535
		COM2 Setup					
	AO:128-143	Point descriptions and ranges as for port COM1				R/W	
		COM3 Setup					
	AO:144-159	Point descriptions and ranges as for port COM1				R/W	
		COM4 Setup					
	AO:160-175	Point descriptions and ranges as for port COM1				R/W	

3.9 DNP Protocol Setup

Object:Var.	Object:Point	Description	Options/Range	Units	Type	R/W	Notes
DNP Options Setup							
40:2 (read) 41:2 (write)	AO:64	Default Binary Input Static object variation	F3 (default=0)		UINT16	R/W	1
40:2 (read) 41:2 (write)	AO:65	Default Binary Input Change object variation	F3 (default=1)		UINT16	R/W	1
40:2 (read) 41:2 (write)	AO:66	Default Binary Counter object variation	F3 (default=3)		UINT16	R/W	1
40:2 (read) 41:2 (write)	AO:67	Default Frozen Binary Counter object variation	F3 (default=4)		UINT16	R/W	1
40:2 (read)	AO:68	Reserved	Read as 65535		UINT32	R	
40:2 (read) 41:2 (write)	AO:69	Default Binary Counter Change Event object variation	F3 (default=2)		UINT16	R/W	1
40:2 (read) 41:2 (write)	AO:70	Default Analog Input object variation	F3 (default=3)		UINT16	R/W	1
40:2 (read)	AO:71	Reserved	Read as 65535		UINT32	R/W	
40:2 (read)	AO:72	Reserved	Read as 65535		UINT32	R/W	
40:2 (read) 41:2 (write)	AO:73	Default Analog Input Change Event object variation	F3 (default=2)		UINT16	R/W	1
40:2 (read) 41:2 (write)	AO:74	Re-mapping static point indices for event objects	0=disabled (default), 1=enabled		UINT16	R/W	
40:1 (read) 41:2 (write)	AO:75	16-bit BC scaling	0=×1 (default), 1=×10, 2=×100, 3=×1000		UINT16	R/W	6
40:1 (read) 41:2 (write)	AO:76	16-bit AI scaling	0=disabled, 1=enabled (default)		UINT16	R/W	3
40:2 (read) 41:2 (write)	AO:77	Number of points allocated for Analog Input change events	0 to 64 (default=32)		UINT16	R/W	2
40:2 (read) 41:2 (write)	AO:78	Number of points allocated for Binary Input change events	0 to 64 (default=0)		UINT16	R/W	2
40:2 (read) 41:2 (write)	AO:79	Number of points allocated for Binary Counter change events	0 to 64 (default=0)		UINT16	R/W	2
40:2 (read) 41:2 (write)	AO:80	Select/Operate Timeout	2 to 30 (default=10 sec)	sec	UINT16	R/W	4
40:2 (read) 41:2 (write)	AO:81	Multi Fragment Interval	50 to 500 (default=50 ms)	ms	UINT16	R/W	
40:1 (read)	AO:82-AO:84	Reserved	Read as 65535		UINT32	R	
40:2 (read) 41:2 (write)	AO:85	Time Sync Period	1 to 86400 (default=86400 sec) 0 = disable time requests	sec	UINT32	R/W	5
40:2 (read) 41:2 (write)	AO:86	Voltage scale, volts secondary	60 to 828V (default=144V)	V	UINT16	R/W	
40:2 (read) 41:2 (write)	AO:87	Current scale, amps secondary	100	×0.1A	UINT16	R/W	

Object:Var.	Object:Point	Description	Options/Range	Units	Type	R/W	Notes
DNP Events Setup							
40:1(read) 41:1(write)		Threshold/Deadband			UINT32	R/W	A hysteresis for the point return threshold is 0.05Hz for frequency and 2% of the operating threshold for other points
40:1(read) 41:1(write)		DNP point number	DNP point number available for the selected object		UINT32	R/W	
40:2(read) 41:2(write)		Event scan control field (bitmap)	Bits 0-1 - DNP Object: 0=none, 1=AI, 2=BI, 3=BC Bit 2 – Object change event scan: 0= event disabled, 1=enabled Bits 5-6 - DNP event poll class: 0=Class 1, 1=Class 2, 2=Class 3 Bit 7 - Event log on an event: 0=disabled, 1=enabled Bits 8-9 – Threshold/Deadband relation: 0=Delta, 1=more than (over threshold), 2=less than (under threshold)		UINT16	R/W	If Event log is enabled, the source of a DNP event will be recorded to the device Event log file as a general Setpoint #17.
	AO:896-AO:898	**DNP Event #1**					
	AO:899-AO:901	**DNP Event #2**					
		…					
	AO:1085-AO:1087	**DNP Event #64**					
DNP Class 0 Point Assignments							
40:1(read) 41:1(write)		DNP object and variation	F4		UINT32	R/W	
40:1(read) 41:1(write)		Start point number	Start point number for the selected object		UINT32	R/W	
40:2(read) 41:2(write)		Number of points in a range	0-128		UINT16	R/W	
	AO:1152-AO:1154	**DNP Class 0 Point Range 1**					
	AO:1155-AO:1157	**DNP Class 0 Point Range 2**					
		…					
	AO:1245-AO:1247	**DNP Class 0 Point Range 32**					

NOTES:

1 The default variation indicates the variation that is used for requests with qualifier code 06 (variation 0) when no specific variation is requested by a master station.

2 The sum of all points allocated for change event objects should not exceed 64. If no points are allocated for change events, the report-by-exception mode is not supported.

3 Scaling 16-bit AI objects (see Section 2.2.5) lets accommodate 32-bit analog input readings to 16-bit object format. Scaling is enabled by default. It is not applied to 32-bit AI objects (object 30, variations 1 and 3).

4 The Select Before Operate command causes the device to start a timer. The following Operate command must be sent before the value specified by the Select/Operate Timeout expires.

[5] The device requests time synchronization by bit 4 in the first octet of the internal indication word being set when the time specified by the Time Sync Period elapses. The master should synchronize the time in the device by writing the Time and Date object. The meter does not request time synchronization if the Time Sync Period is set to 0.

[6] Scaling 16-bit Binary Counters (see Section 2.2.6) allows changing a counter unit in powers of 10 to accommodate a 32-bit counter value to 16-bit BC object format.

4 Data Scales and Units

Code	Condition	Value	Range	Notes
Data Scales				
Vmax		Voltage scale × PT Ratio, V		2
Imax		Current Scale × CT Ratio [1], A		3
I4max		Current Scale × I4 CT Ratio [1], A		3
Pmax		Vmax × Imax × 2, W		4
Fmax		100 Hz		
AImin AImax	+/-1mA	AImin = -AI full scale × 2 AImax = AI full scale × 2		
	0-20mA	AImin = AI zero scale AImax = AI full scale		
	4-20mA	AImin = AI zero scale AImax = AI full scale		
	0-1mA	AImin = AI zero scale AImax = AI full scale		
Data Units				
U1	PT Ratio = 1	0.1 V		
	PT Ratio > 1	1 V		
U2		0.01 A	0 to 2×CT primary current	
U3	PT Ratio = 1	1 W/Var/VA		
	PT Ratio > 1	1 kW/kvar/kVA		
U4		0.01 A	0 to 10×CT primary current	

[1] CT Ratio = CT primary current/CT secondary current

[2] The default Voltage scale is 144V (120V +20%). You can change it via the Device Data Scale setup (see Section 3.1) or via the Device Options setup in PAS.

[3] The default Current scale is 2 × CT secondary current (2 × 1A or 2 × 5A depending on the order).

[4] Pmax is rounded to whole kilowatts. With PT=1.0, if Pmax is greater than 9,999,000 W, it is truncated to 9,999,000 W.

5 Data Formats

Format Code	Value	Description	Notes
Wiring Mode			
F1	0	3OP2 - 3-wire open delta using 2 CTs (2 element)	
	1	4LN3 - 4-wire WYE using 3 PTs (3 element), line-to-neutral voltage readings	
	2	3DIR2 - 3-wire direct connection using 2 CTs (2 element)	
	3	4LL3 - 4-wire WYE using 3 PTs (3 element), line-to-line voltage readings	
	4	3OP3 - 3-wire open delta using 3 CTs (2 1/2 element)	
	5	3LN3 - 4-wire WYE using 2 PTs (2 1/2 element), line-to-neutral voltage readings	
	6	3LL3 - 4-wire WYE using 2 PTs (2 1/2 element), line-to-line voltage readings	
DNP Object Variations			
F3		**Static Binary Input Objects**	
	0	Single-Bit Binary Input	
	1	Binary Input With Status	
		Binary Input Change Event Objects	
	0	Binary Input Change Without Time	
	1	Binary Input Change With Time	
		Static Binary Counters	
	0	32-bit Binary Counter	
	1	32-bit Binary Counter Without Flag	
	2	16-bit Binary Counter	
	3	16-bit Binary Counter Without Flag	
		Binary Counter Change Events	
	0	32-bit Counter Change Event Without Time	
	1	32-bit Counter Change Event With Time	
	2	16-bit Counter Change Event Without Time	
	3	16-bit Counter Change Event With Time	
		Frozen Binary Counters	
	0	32-bit Frozen Counter	
	1	32-bit Frozen Counter Without Flag	
	2	32-bit Frozen Counter With Time of Freeze	
	3	16-bit Frozen Counter	
	4	16-bit Frozen Counter Without Flag	
	5	16-bit Frozen Counter With Time of Freeze	
		Static Analog Input Objects	
	0	32-bit Analog Input	
	1	32-bit Analog Input Without Flag	
	2	16-bit Analog Input	
	3	16-bit Analog Input Without Flag	
		Analog Input Change Events	
	0	32-bit Analog Change Event Without Time	
	1	32-bit Analog Change Event With Time	
	2	16-bit Analog Change Event Without Time	
	3	16-bit Analog Change Event With Time	
DNP Class 0 Objects			
F4	0x1E01	Analog Input 30:01	
	0x1E02	Analog Input 30:02	
	0x1E03	Analog Input 30:03	
	0x1E04	Analog Input 30:04	
	0x2801	Analog Output 40:01	
	0x2802	Analog Output 40:02	
	0x0101	Binary Input 01:01	
	0x0102	Binary Input 01:02	
	0x1401	Binary Counter 20:01	
	0x0A01	Binary Output 10:01	
	0x0A01	Binary Output Status 10:02	
	0x1402	Binary Counter 20:02	
	0x1405	Binary Counter 20:05	
	0x1406	Binary Counter 20:06	
	0x1501	Frozen Counter 21:01	
	0x1502	Frozen Counter 21:02	

Format Code	Value	Description	Notes
	0x1505	Frozen Counter 21:05	
	0x1506	Frozen Counter 21:06	
	0x1509	Frozen Counter 21:09	
	0x150A	Frozen Counter 21:10	

APPENDIX A DNP Application Messages

The device is a DNP IED responding to external DNP Master requests. Table A-1 describes the EM920 application level responses to external requests, including object variations, functions, codes and qualifiers supported by the device. The object and formats are detailed in the DNP Basic 4 Documentation Set.

Table A-1 Application Responses

Object			Request		Response	
Object	**Variation**	**Description**	**Function Code**	**Qualifier Code**	**Function Code**	**Qualifier Code**
01	0	Single Bit Binary Input	1	B	129	01
01	1	Single Bit Binary Input	1	A	129	C
01	2	Binary Input with Status	1	A	129	C
02	0	Binary Input Change	1	06	129	17,28
02	1	Binary Input Change without Time	1	07,08	129	17,28
02	2	Binary Input Change with Time	1	07,08	129	17,28
10	0	Binary Output	1	B	129	01
10	1	Binary Output	1	A	129	C
10	2	Binary Output Status	1	A	129	C
12	1	Control Relay Output Block	3,4,5	A	129	C
12	1	Control Relay Output Block	6	A	None	N/A
20	0	Binary Counter	1, 7,9, 8,10	B B B	129 129 129	01 N/R N/A
20	1	32-bit Binary Counter	1	A	129	C
20	2	16-bit Binary Counter	1	A	129	C
20	5	32-bit Binary Counter without flag	1	A	129	C
20	6	16-bit Binary Counter without flag	1	A	129	C
21	0	Frozen Counter	1	B	129	01
21	1	32-bit Frozen Counter				
21	2	16-bit Frozen Counter				
21	5	32-bit Frozen Counter with time of freeze				
21	6	16-bit Frozen Counter with time of freeze				
21	9	32-bit Frozen Counter without flag				
21	10	16-bit Frozen Counter without flag				
22	0	Counter Change Event	1	06	129	17
22	1	32-bit Counter Change Event without Time	1	07,08	129	17
22	2	16-bit Counter Change Event without Time	1	07,08	129	17
22	5	32-bit Counter Change Event with Time	1	07,08	129	17
22	6	16-bit Counter Change Event with Time	1	07,08	129	17
30	0	Analog Input (respond like 30:3)	1	B	129	01
30	1	32-bit Analog Input	1	A	129	C
30	2	16-bit Analog Input	1	A	129	C
30	3	32-bit Analog Input without flag	1	A	129	C
30	4	16-bit Analog Input without flag	1	A	129	C
32	0	Analog Change Event	1	06	129	17
32	1	32-bit Analog Change Event without Time	1	07,08	129	17
32	2	16-bit Analog Change Event without Time	1	07,08	129	17
32	3	32-bit Analog Change Event with Time	1	07,08	129	17
32	4	16-bit Analog Change Event with Time	1	07,08	129	17
40	0	Analog Output Status (respond like 40:1)	1	B	129	01
40	1	32-bit Analog Output Status	1	A	129	C
40	2	16-bit Analog Output Status	1	A	129	C
41	1	32-bit Analog Output Block	3,4,5	A	129	C
41	2	16-bit Analog Output Block	3,4,5	A	129	C
41	1	32-bit Analog Output Block	6	A	None	N/A
41	2	16-bit Analog Output Block	6	A	None	N/A
50	1	Time and Date [1]	1,2	A	129	C
60	1	Class 0	1	B	129	01
60	2	Class 1	1	06,07,08	129	17
60	3	Class 2	1	06,07,08	129	17
60	4	Class 3	1	06,07,08	129	17

Object			Request		Response	
Object	**Variation**	**Description**	**Function Code**	**Qualifier Code**	**Function Code**	**Qualifier Code**
80	1	Internal indication [2]	2	D	129	
N/A	N/A	Cold Restart [3] (respond Obj. 52:2)	13	N/A	129	07
N/A	N/A	Delay Measurement (respond Obj. 52:2)	23	N/A	129	07

[1] For this object, the quantity specified in the request must be exactly 1or an index of 0, as there is only one instance of this object defined in the device.

[2] For this object, the qualifier code must specify an index 7 only.

[3] Respond with time object 50 variation 2 indicating time until device availability.

Qualifier Hex Codes for each category:
A - 00,01,03,04,07,17,27,08,18,28
B - 06 only
C - Qualifier echo
D - 00,01,03,04,17,27,18,28

N/A - Not Available

N/R - Null Response

Appendix B DNP Device Profile

DNP3

DEVICE PROFILE DOCUMENT

This document must be accompanied by a table having the following headings:

Object Group | Request Function Codes | Response Function Codes

Object Variation | Request Qualifiers | Response Qualifiers

Object Name (optional)

Vendor Name: SATEC Ltd.

Device Name: Powermeter Series EM920

Highest DNP Level Supported:	Device Function:
For Requests L2	☐ Master ■ Slave
For Responses L2	

Device supports READ of each object using either all points (Qualifier = 6) or specific points using qualifier defined in Basic 4 Documentation Set: 00, 01, 03, 04, 07, 17, 27, 08, 18, 28. Control Relay Block requires specific parameters described in this manual. Treats range field of qualifier 07 and 08 to mean point range [0…N-1].

Maximum Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted 292	Transmitted 2048
Received 292	Received 249

Maximum Data Link Retries:	Maximum Application Layer Retries:
■ None	■ None
☐ Fixed at_____	☐ Configurable, range ____ to _____
☐ Configurable, range ___ to_____	(Fixed is not permitted)

Requires Data Link Layer Confirmation:

■ Never

☐ Always

☐ Sometimes If 'Sometimes', when? _____

☐ Configurable If 'Configurable', how? _____

Requires Application Layer Confirmation:

☐ Never

☐ Always (not recommended)

■ When reporting Event Data (Slave devices only)

☐ When sending multi-fragment responses (Slave devices only)

☐ Sometimes If 'Sometimes', when? _____

☐ Configurable If 'Configurable', how? _____

Device Profile Document (continued)

Timeouts while waiting for:

Data Link Confirm ■ None ☐ Fixed at _____ ☐ Variable ☐ Configurable

Complete Appl. Fragment ■ None ☐ Fixed at _____ ☐ Variable ☐ Configurable

Application Confirm ☐ None ■ Fixed at _5 sec__ ☐ Variable ☐ Configurable

Complete Appl. Response ■ None ☐ Fixed at _____ ☐ Variable ☐ Configurable

Others

Timeouts between fragments of the multi-fragment responses. Configurable:

50-500 ms (50 ms by default).

_____

Attach explanation if 'Variable' or 'Configurable' was checked for any timeout

Sends/Executes Control Operations:

WRITE Binary Outputs	■ Never	☐ Always	☐ Sometimes	☐ Configurable
SELECT/OPERATE	☐ Never	■ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE	☐ Never	■ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE -				
NO ACK	☐ Never	■ Always	☐ Sometimes	☐ Configurable
Count > 1	■ Never	☐ Always	☐ Sometimes	☐ Configurable
Pulse On	☐ Never	☐ Always	■ Sometimes[1,4]	☐ Configurable
Pulse Off	■ Never	☐ Always	☐ Sometimes[4]	☐ Configurable
Latch On	☐ Never	☐ Always	■ Sometimes[2]	☐ Configurable
Latch Off	☐ Never	☐ Always	■ Sometimes[3]	☐ Configurable
Queue	■ Never	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	☐ Never	☐ Always	■ Sometimes[4]	☐ Configurable

♦ **Select timeout period is configurable: 2s to 30s**

[1] used to activate the *Reset* function associated with points 0 to 21

[2, 3, 4] used to control Relays associated with points 80 to 81

[3] used to reset the self-check alarm registers associated with points 64 to 75

Reports Binary Input Change Events when no specific variation requested:

☐ Never

☐ Only time-tagged

☐ Only non-time-tagged

■ Configurable to send both, one or the other (attach explanation)

Configurable to send one or the other.

Reports time-tagged Binary Input Change Events when no specific variation requested:

☐ Never

■ Binary Input Change With Time

☐ Binary Input Change With Relative Time

☐ Configurable (attach explanation)

Device Profile Document (continued)

<table>
<tr>
<td>Sends Unsolicited Responses:
■ Never
☐ Configurable (attach explanation)
☐ Only certain objects
☐ Sometimes (attach explanation)
☐ ENABLE/DISABLE UNSOLICITED Function codes supported</td>
<td>Sends Static Data in Unsolicited Responses:
■ Never
☐ When Device Restarts
☐ When Status Flags Change

No other options are permitted.</td>
</tr>
<tr>
<td>Default Counter Object/Variation:
☐ No Counters Reported
☐ Configurable (attach explanation)
■ Default Object 20
Default Variation 5
☐ Point-by-point list attached</td>
<td>Counters Roll Over at:
☐ No Counters Reported
☐ Configurable (attach explanation)
☐ 16 Bits
☐ 32 Bits
■ Other Value Counters
-999999999 to 99999999 (point 2)
0 to 9999999 (points 0,1,3)
☐ Point-by-point list attached</td>
</tr>
<tr>
<td colspan="2">Sends Multi-Fragment Responses: ☐ Yes ■ No</td>
</tr>
</table>