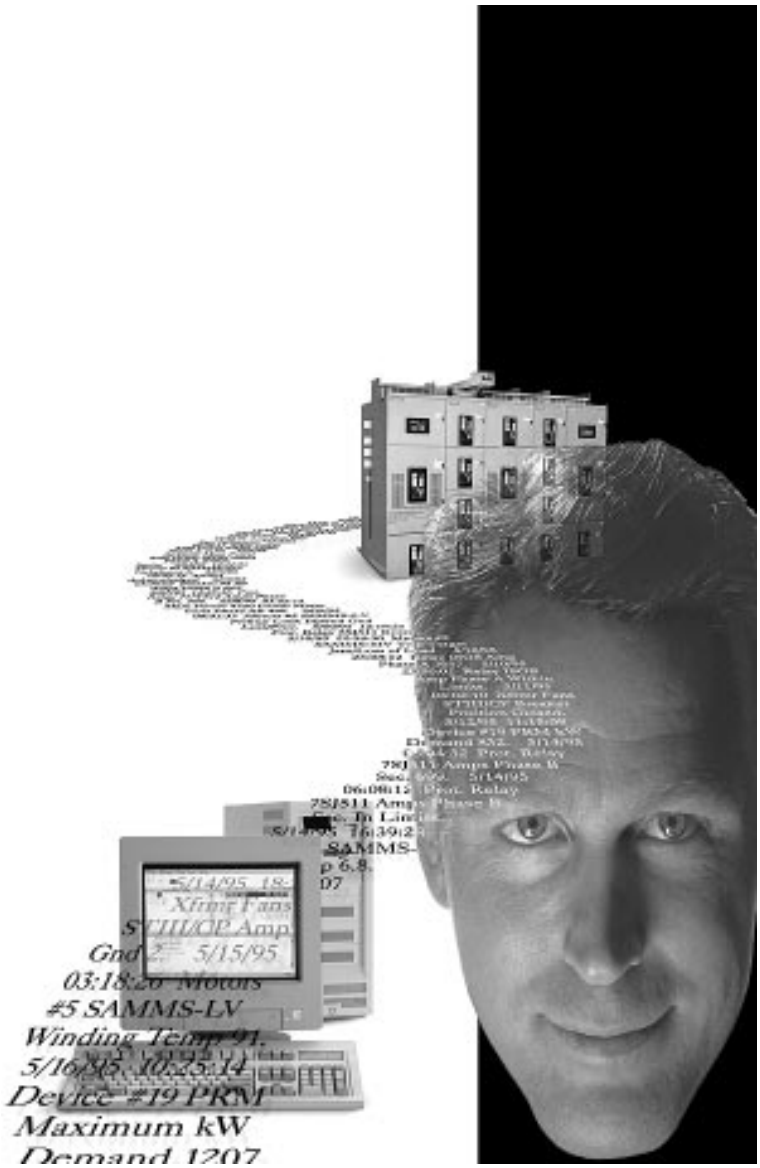
SIEMENS

4700 Power Meter

SEAbus™ Protocol

Reference Manual



Manual No. SG-6363-00

Siemens maintains control of all specifications for the SEAbus and SEAbus Plus protocols. A modification to a protocol for any type of device must be approved by Siemens Energy & Automation, Inc. to guarantee compatibility. Any changes made must be backward compatible so that existing products can coexist on the communications bus without having to support the newer features of the protocol.

Siemens continuously strives to ensure backward compatibility, reliability, and easy implementation of both protocols to meet current market communications requirements. Siemens therefore reserves the right to make improvements including changes to specifications at any time without notice or obligation.

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1 Introduction

The *4700 Power Meter SEAbus Protocol Reference Manual* (Manual No. SG-6363-00) describes the two-way exchange of information between the 4700 power meter and a remote supervisory device. The SEAbus™ protocol is the software communications protocol required for two-wire, RS-485 networks under which the 4700 power meter operates. The SEAbus protocol is an *open* protocol that does not require user permission or the payment of fees for reprogramming it to suit non-Siemens devices.

1.1 About this Manual

The *4700 Power Meter SEAbus Protocol Reference Manual* (Manual No. SG-6363-00) defines the SEAbus protocol and its 4700 power meter data packets. The introduction of this manual offers brief summaries of 4700 power meter features, the ACCESS™ electrical distribution communication system (ACCESS system), the SEAbus protocol, basic packet structure, and common packets supported by all communicating devices. For more information on these subjects, refer to the respective manuals listed below.

- *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual No. SG-6213-01)
- *4700 Power Meter Operator's Manual* (Manual No. SG-6018-03)
- *ACCESS Systems Installation Guide* (Manual No. SG-6028-01)

Starting with Chapter 2, the manual provides detailed descriptions of individual communications packets required for the 4700 power meter. These include the following six categories: setup packets, data retrieval packets, log packets, minimum and maximum data packets, command packets, and waveform capture packets.

1.2 About the 4700 Power Meter

The 4700 power meter is a three-phase, rms sensing power meter that offers

- neutral current monitoring
- minimum and maximum data history of all measured parameters
- analog output of either 0 to 20 mA or 4 to 20 mA
- analog input, AC or DC
- four discrete inputs
- three programmable form C relay output contacts
- measured values including

  line-to-neutral voltage on three phases with averaging; line-to-line voltage on three phases with averaging; current on three phases with averaging; neutral current; kW and kWh total for all phases; kW demand and kW maximum demand; kVA; kVAR; kVARh total for all phases; power factor; and frequency
- optional extended temperature range (-22°F to +158°F)
- optional open protocol communication (RS-232 or RS485)

Communications consists of an optional plug-in communications board for either an RS-232 or an RS-485 port. The RS-232 port is designed for short range communication (under 50ft.) The RS-485 port provides remote communication over a shielded twisted pair wire at distances of up to 4000 ft. RS-485 communication allows the power meter to interface with remote monitoring and control systems running WinPM™ or other supervisory software.

For more information about the 4700 power meter, refer to the *4700 Power Meter Operator's Manual* (Manual No. SG-6018-03).

1.3 About the ACCESS System

The ACCESS system comprises a variety of smart devices that control, monitor, and display data from your electrical distribution system. The first level of control is in the field where microprocessor-based trip units, power meters, protective relays, and motor control devices also send and receive information about your system. At a second higher level are supervisory devices that collect information from these field devices. Supervisory devices display the information and add the capabilities of programming, monitoring alarms, and logging system events. Field and supervisory devices are linked together by an industry-standard, RS-485 communications bus. The Siemens SEAbus communications protocol defines the exchange of information over a shielded, twisted-pair cable that links all devices. Presiding over the system is an ACCESS host personal computer (PC) monitoring an entire electrical system that may consist of more than 1,000 devices.

For more information about the ACCESS system, refer to the *ACCESS Systems Installation Guide* (Manual No. SG-6028-01).

1.4 About the SEAbus Protocol

The SEAbus protocol is an open software communications protocol for two-wire, RS-485 networks. An RS-485 network consists of a single bus supervisory device and up to 32 field devices. Short communication packets (packets) consisting of 5 to 260 characters can be sent and received at various speeds. Adding SEAbus communications to a device provides remote access to the information collected by the device. All configuration and setup procedures that are possible at the device can also be executed from a remote location over the communications link.

In a SEAbus system, only one supervisory device is attached to the bus, but you may have up to 32 field devices. The electrical distribution and communications software installed in a supervisory device, for example, WinPM™, initiates all communication by sending packets addressed to field devices. The field devices do not initiate communication or send unsolicited packets under any circumstances. The packet from the supervisory device may request data, configuration information, a configuration update, or one of several other types of information, depending upon the nature of the field device. If the packet sent to the field device is a request for information (request packet), the field device responds by sending a packet with the requested information back to the supervisory device (response packet). Only one packet is sent at a time.

Information is sent as eight bits with one stop bit and no parity bit. You can set the baud rate to any one of several values, but you must meet certain timing constraints of the protocol.

For more information about timing specifications and the SEAbus protocol, refer to the *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual No. SG-6213-00).

1.5 About SEAbus Packet Structure

This section briefly describes the SEAbus packet structure and identifies the general differences between request and response packets. Throughout this manual, all numbers used are in decimal unless followed by an *h*, which indicates hexadecimal. For detailed information about packets, refer to the *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual No. SG-6213-00).

A packet is a predefined sequence of fields containing one or more predefined bytes. In general, the bytes of a SEAbus packet are sent in the following order: *Synchronization (Sync)* byte, *Device Type (Devt)* byte, *Message Type (Msgt)* byte, *Length (Len)* byte, *Data (Data)* bytes, and *Longitudinal Redundancy Check (LRC)* byte as illustrated below (the letter *N* in the Data field refers to a variable representing the actual number of bytes contained in the Data field when a packet is sent):

Fields:	**Sync**	**Devt**	**Msgt**	**Len**	**Data**	**LRC**
No. of Bytes:	1	1	1	1	N	1

The bytes in a SEAbus packet are defined as follows:

Sync The Sync byte indicates the direction of the data transmission. Use a value of 14h for a supervisory-to-field device transmission (requests) and a value of 27h for field-to-supervisory device transmission (response).

Devt The Devt byte contains the address code of either a specific device (direct address) or a particular type of device (indirect address). For example, for a specific device, a customer might have assigned the address *0Ah* to a Static Trip IIIC trip unit on the communications loop. No other device on this loop can have the same address. A device type address code, for example, *FAh*, addresses a particular type of device on the same communications loop, in this case, all SCORs. Device type address codes can only be assigned by Siemens to avoid any duplication. The following address codes are assigned to Siemens devices:

00h	Universal Request (for unknown address)	F8h	Static Trip IIICP
01h...E0h	Static Trip IIIC trip units and SAMMS™ motor protection and control devices	F9h	Multiplexer Translator
E1h...F1h	Indirect address codes reserved for future device type addresses	FAh	SCOR
F2h	SB Energy/Comm trip unit	FBh	Local display unit
F3h	S7-I/O™ unit	FCh	ACCESS Host
F4h	Pulse reading meter	FDh	3600-S1 power meter
F5h	4720 power meter	FEh	4700 power meter
F6h	4300 power meter	FFh	Broadcast
F7h	ISGS		

Msgt The Msgt byte indicates what type of data the packet contains. For example, in a 4700 power meter packet, *0Eh* indicates the reading and *0Fh* the writing of setpoint parameters.

Len The Len byte indicates the number of bytes in the Data field of the packet. Values for Len range from 0 to 255.

Data The Data bytes contain the information of interest that is being transmitted by the communications protocol. The Data field can contain as many as 255 bytes. When the SEAbus protocol uses indirect addressing, such as when addressing a 4700 power meter, the first byte in this field is the device address.

LRC The LRC byte is the checksum byte. It contains the inverted sum of all bytes except the Sync byte.

1 Introduction

The following illustration represents a typical SEAbus request packet (14h) from a supervisory device to get (read) long real-time data (03h) from a 4700 power meter (FEh). The Len byte (01h) indicates the Data field length (1 byte, the device address 78h). The Data field is followed by the LRC byte (85h).

Example **Get Long Real-Time Data Request**

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	03h	01h	78h	85h

The 4700 power meter responds to the long real-time data request with the following packet:

Example **Response to Get Long Real-Time Data Request**

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	03h	6Eh	78h C4h 01h 00h C4h 01h 00h C4h 01h 00h C4h 01h 00h 0Fh 03h 00h 0Fh 03h 00h 0Fh 03h 00h 0Fh 03h 00h 67h 0Ah 8Bh 0Ah 68h 0Ah 73h 0Ah 64h 00h A6h 04h 00h B7h 04h 00h A8h 04h 00h 08h 0Eh 00h B3h 04h 00h C4h 04h 00h B4h 04h 00h 2Ch 0Eh 00h AAh 00h 00h ADh 00h 00h ABh 00h 00h 03h 02h 00h 00h 00h 00h 63h 58h 02h 78h 00h 00h 00h 00h 85h 7Ah 53h 00h 0Eh 21h 00h 00h EDh 52h 20h 00h 07h 00h 00h 04h D8h 00h 00h 00h 00h C1h 64h 00h 00h	AAh

Note: All values that require two words are sent with the least significant word first and the most significant word second. All words are composed of two bytes. These are also sent with the least significant byte first and the most significant byte second. For example, the four-byte value 12345678h is divided into two words: the least significant word is 5678h and the most significant word is 1234h. Each word is divided into two bytes. For the least significant word, the least significant byte is 78h and the most significant byte is 56h. Therefore, the least significant word is sent as 78h 56h and the entire four-byte value is sent as 78h 56h 34h 12h.

Bits	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Words	Most Significant Word																Least Significant Word															
	1234h																5678h															
Bytes	Most Significant Byte								Byte								Byte								Least Significant Byte							
	12h								34h								56h								78h							
Order Send	**78h 56h 34h 12h** (from least to most significant byte)																															

1.6 About Packet Illustrations

This manual uses two methods of illustrating a communications packet. The first method illustrates the basic packet by displaying the numerical value of each byte in hexadecimal. This method is used when a detailed description of the Data field content is irrelevant, such as for packet structure examples. The second method extends the basic packet by showing a detailed description of its Data field content. This method is used when defining a packet.

In both methods, *xx* always refers to a value that varies depending on the packet's type, size, and actual data content. The value of the LRC byte is only relevant to internal error checking calculation and is represented by lrc. The example below shows a basic packet illustration:

Example **Basic Packet Illustration**

Sync	Devt	Msgt	Len	Data	LRC
14h or 27h	xxh	xxh	xxh	xxh, xxh, ..., xxh,	lrc

The next example shows an extended packet with a detailed description of its Data field content. The Data field content is displayed as a pull-down table from the Data field cell. This table lists the data byte number, its description, the possible range of values, and their unit of measure.

Example **Extended Packet Illustration**

Sync	Devt	Msgt	Len	Data	LRC
14h or 27h	xxh	xxh	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...xxh	First device data	xx...xx	xx
:	Device data (continued)	y, z y = y z = z	---
xxh...xxh	Last device data	xx...xx	0.1 volt

The *Data Byte No.* column contains the data bytes in the sequence in which they are assigned. They are numbered in hexadecimal. By displaying a start and end byte, the data byte number also indicates the length of a function variable (part of a complete function packet).

The *Description* column describes or names the function variable.

The *Range of Values* column provides the minimum and maximum values (possible range of values) of the function variable as well as the value definitions if applicable. Ranges are generally expressed with an ellipsis (...) to prevent confusion with a possible minus (-) sign.

The *Unit* column indicates the unit of measure that applies to the value(s) in the Range of Values column. Any part of a unit of measure is expressed in decimal.

1.7 About Common Packets

Common packets apply to all SEAbus and SEAbus Plus field devices within an ACCESS system. They include a Universal Request packet, Global and Device Type Broadcast packets consisting of the Set Baud Rate and Set Date and Time packets, and general packets including a Set Address and a Get Communications Version packet. Common packets serve several purposes such as allowing to bring new devices on line, configuring new and existing devices, and performing routine maintenance. These common packets are defined as follows:

The **Universal Request** packet is used to determine the address of an individual unknown field device. The Universal Request address code, *00h*, is recognized by all field devices and prompts a response packet containing the device's address. Since all devices on the communications loop will respond to this request and their data would collide, only one field device can be connected to the loop at the same time.

Broadcast packets simultaneously address two or more devices on the communications loop by using the broadcast code *FFh*. All devices on the communications loop will respond to this code by executing the information contained in the Data field. Broadcast packets are used to set devices to the same parameter(s) such as baud rate or time and date. A broadcast packet never requires a response packet. Broadcast packets can be used to address all devices or devices of a particular type.

Global broadcast packets address all devices regardless of type. The broadcast code FFh is placed in the Devt byte of the packet.

Device Type broadcast packets address all devices of a particular type. The Devt byte indicates the device type and the broadcast code FFh is the first byte in the Data field.

Common broadcast packets include

- Set Baud Rate
- Set Date and Time

Other common packets are

- Set Address
- Get Communications Version

For more information on common packets, refer to the *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual No. SG-6213-00).

2 Setup Packets

Setup packets are used to initially configure each individual 4700 power meter or to change present parameter settings. When the 4700 power meter receives setup packets, it stores the information in nonvolatile memory, EEPROM, where it is retained even when the power is turned off. Before making any changes to the parameters, you can view the present settings by using the respective *Get* packet.

Setup packets addressed to 4700 power meters can contain setup data that is only applicable to 4700 power meters with software versions prior to version 2.3.0.4. This data is ignored by power meters with the later versions. In packet illustrations, this data is identified by an appropriate footnote. Setup packets can also contain data that is only applicable to 4700 power meters with software versions 2.3.0.4. or later. This data does not appear in packets addressed to 4700 power meters with an earlier software version. In packet illustrations, this data is identified by a bold-faced **V+** symbol preceding the relevant Data byte in the *Data Byte No.* column.

2.1 Get Date and Time

The Get Date and Time packet is a request to the 4700 power meter to read its present date and time settings.

Get Date and Time Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	0Dh	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter responds by returning all present date and time settings, including the device's communications version.

Response to Get Date and Time Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	0Dh	0Dh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Device type code: integer for 4700, or 125Ch	4700	---
04h...05h	Software revision code: 16-bit value, four bits represent one version number digit (e.g., 2001h is version 2.0.0.1)	0h...9999h	---
06h	Feature code: 8-bit value representing any special feature	0...255	---
07h	Reserved	0	---
08h	Year (modulo)	0...99	year
09h	Month	1...12	month
0Ah	Day	1...31	day
0Bh	Hour	0...23	hour
0Ch	Minute	0...59	minute
0Dh	Second	0...59	second

2.2 Set Date and Time

The Set Date and Time packet is a request to change the present date and time of the 4700 power meter.

The Msgt byte *07h* allows this packet to be used similar to a device type Broadcast packet. All 4700 power meters (software versions 2.0.0.1 or later) recognize this message to set their date and time to the setting indicated in the packet.

The Set Date and Time function is also available as a regular Broadcast packet. For more information about Broadcast packets refer to the *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual No. SG-6213-00).

Set Date and Time Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	07h	0Bh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h	Year (modulo)	0...99	year
03h	Month	1...12	month
04h	Day	1...31	day
05h	Hour	0...23	hour
06h	Minute	0...59	minute
07h	Second	0...59	second
08h...0Bh	Seconds since 12:01 AM, January 1, 1970	0...4294967295	second

This packet does not require a response packet.

2.3 Get Setup Data

The Get Setup Data packet is a request from a supervisory device to the 4700 power meter to read its present setup data.

Get Setup Data Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	0Ah	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter responds to this request by returning the following packet containing the setup data.

Response to Get Setup Data Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	0Ah	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Device type code: integer for 4700, or 125Ch	4700	---
04h...05h	Software revision code: 16-bit value, four bits represent one version number digit (e.g., 2001h is version 2.0.0.1)	0000h...9999h	binary coded decimal
06h	Feature code: 8-bit value representing any special feature	0...255	---
07h...09h	Reserved	0	---
0Ah...0Dh	Voltage scale	0...999999	volt
0Eh...0Fh	Reserved	0	---
10h...11h	Current scale	0...9999	ampere
12h...13h	Baud rate	1...6 1 = 300 4 = 4800 2 = 1200 5 = 9600 3 = 2400 6 = 19200	---
14h...15h	Voltage mode	0...3 0 = wye 2 = single-phase 1 = delta 3 = demo	---
16h...17h	Password	0...9999	---
18h...19h	Phase sequence	0, 1 0 = ABC 1 = ACB	---
1Ah...1Dh	Snapshot interval	0...4294967295	second[1]
1Eh...1Fh	Demand period length	0...99 0 = demand sync mode	minute
20h...21h	Number of demand periods	1...15	demand period
22h	Analog current output (I_{out}) range	0, 1 0 = 0...20 mA 1 = 4...20 mA	---
23h	Analog current output (I_{out}) key (see table on page xx)	1...25	key number
23h...25h	Frequency standard	0...30000	0.1 hertz
26h...29h	Analog current output (I_{out}) scale	0...999999	ampere
2Ah...2Bh	Serial port	0, 1 0 = RS-232 1 = RS-485	---
2Ch...2Dh[2]	Relay 3 kilowatt hours between pulses	0...32767 0 = not pulsed	kilowatt-hour

[1] Seconds since 12:01 AM, January 1, 1970.
[2] These bytes are ignored by software versions 2.3.0.4 or later.

(continued) **Response to Get Setup Data Request**

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	0Ah	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
2Eh...2Fh	Log status (SETPOINT mode), presently, for Input 1 only bits 15...12 Input 4 bits 11...8 Input 3 bits 7...4 Input 2 bits 3...0 Input 1	0, 1 0 = not logging 1 = logging	status
30h...31h[2]	Relay 2 kilovolt-ampere reactive hours between pulses	0...32767 0 = not pulsed	kilovolt-ampere-reactive-hour
32h...35h	Auxiliary voltage (V_{aux}) input scale	0...999999	volt
36h...37h	Fourth current input (I_4) scale	0...9999	ampere
V+ 38h...39h	Relay 1 mode	0...2 0 = SETPOINT 1 = KWh PULSE 2 = KVARh PULSE	mode
V+ 3Ah...3Bh	Relay 1 mode values SETPOINT: latch mode or pulse length KWh PULSE: kilowatt hours between pulses KVARh PULSE: kilovolt-ampere reactive hours between pulses	0...65535 0 = latched 0 = not pulsed 0 = not pulsed	 second kilowatt hour kilovolt-ampere reactive hour
V+ 3Ch...3Dh	Relay 2 mode	0...2 0 = SETPOINT 1 = KWh PULSE 2 = KVARh PULSE	mode
V+ 3Eh...3Fh	Relay 2 mode values SETPOINT: latch mode or pulse length KWh PULSE: kilowatt hours between pulses KVARh PULSE: kilovolt-ampere reactive hours between pulses	0...65535 0 = latched 0 = not pulsed 0 = not pulsed	 second kilowatt hour kilovolt-ampere reactive hour
V+ 40h...41h	Relay 3 mode	0...2 0 = SETPOINT 1 = KWh PULSE 2 = KVARh PULSE	mode
V+ 42h...43h	Relay 3 mode values SETPOINT: latch mode or pulse length KWh PULSE: kilowatt hours between pulses KVARh PULSE: kilovolt-ampere reactive hours between pulses	0...65535 0 = latched 0 = not pulsed 0 = not pulsed	 second kilowatt hour kilovolt-ampere reactive hour

[1] Seconds since 12:01 AM, January 1, 1970.
[2] These bytes are ignored by software versions 2.3.0.4 or later.

2.4 Set Setup Data

The Set Setup Data packet is a request to change the 4700 power meter's setup parameters.

Set Setup Data Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	0Bh	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h	New device address	1...254	---
03h...06h	Voltage scale	0...999999	volt
07h...08h	Reserved	0	---
09h...0Ah	Current scale	0...9999	ampere
0Bh...0Ch	Baud rate	1...6 1 = 300 4 = 4800 2 = 1200 5 = 9600 3 = 2400 6 = 19200	---
0Dh...0Eh	Voltage mode	0...3 0 = wye 2 = single-phase 1 = delta 3 = demo	---
0Fh...10h	Phase sequence	0, 1 0 = ABC 1 = ACB	---
11h...14h	Snapshot interval	0...4294967295	second[1]
15h...16h	Demand period length	0...99 0 = demand sync mode	minute
17h...18h	Number of demand periods	1...15	demand period
19h	Analog current output (I_{out}) range	0, 1 0 = 0...20 mA 1 = 4...20 mA	---
1Ah	Analog current output (I_{out}) key (see table on page 13)	1...25	key number
1Bh...1Ch	Frequency standard	0...30000	0.1 hertz
1Dh...20h	Analog current output (I_{out}) scale	0...999999	ampere
21h...22h	Reserved	0	---
23h...24h[2]	Relay 3 kilowatt hours between pulses	0...32767 0 = not pulsed	kilowatt-hour
25h...26h	Log status (SETPOINT mode), presently, for Input 1 only bits 15...12 Input 4 bits 11...8 Input 3 bits 7...4 Input 2 bits 3...0 Input 1	0, 1 0 = not logging 1 = logging	status

[1] Seconds since 12:01 AM, January 1, 1970
[2] These bytes are ignored by software versions 2.3.0.4 or later.

(continued) **Set Setup Data Request**

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	0Bh	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
27h...28h[2]	Relay 2 kilovolt-ampere reactive hours between pulses	0...32767 0 = not pulsed	kilovolt-ampere-reactive-hour
29h...2Ch	Auxiliary voltage (V_{aux}) input scale	0...999999	volt
2Dh...2Eh	Fourth current input (I_4) scale	0...9999	ampere
V+ 2Fh...30h	Relay 1 mode	0...2 0 = SETPOINT 1 = KWh PULSE 2 = KVARh PULSE	mode
V+ 31h...32h	Relay 1 mode values	0...65535	
	SETPOINT: latch mode or pulse length	0 = latched	second
	KWh PULSE: kilowatt hours between pulses	0 = not pulsed	kilowatt hour
	KVARh PULSE: kilovolt-ampere reactive hours between pulses	0 = not pulsed	kilovolt-ampere reactive hour
V+ 33h...34h	Relay 2 mode	0...2 0 = SETPOINT 1 = KWh PULSE 2 = KVARh PULSE	mode
V+ 35h...36h	Relay 2 mode values	0...65535	
	SETPOINT: latch mode or pulse length	0 = latched	second
	KWh PULSE: kilowatt hours between pulses	0 = not pulsed	kilowatt hour
	KVARh PULSE: kilovolt-ampere reactive hours between pulses	0 = not pulsed	kilovolt-ampere reactive hour
V+ 37h...38h	Relay 3 mode	0...2 0 = SETPOINT 1 = KWh PULSE 2 = KVARh PULSE	mode
V+ 39h...3Ah	Relay 3 mode values	0...65535	
	SETPOINT: latch mode or pulse length	0 = latched	second
	KWh PULSE: kilowatt hours between pulses	0 = not pulsed	kilowatt hour
	KVARh PULSE: kilovolt-ampere reactive hours between pulses	0 = not pulsed	kilovolt-ampere reactive hour

[1] Seconds since 12:01 AM, January 1, 1970
[2] These bytes are ignored by software versions 2.3.0.4 or later.

The 4700 power meter responds by acknowledging the request with the following packet.

Response to Get Setup Data Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	0Bh	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The following table lists the analog current output (I_{out}) keys available for the 4700 power meter which are set in the *Analog Current Output* parameter of the Setup Data packet. Each key indicates to which measured parameter the 4700 power meter's analog current output will be proportional.

Analog Current Output (I_{out}) Keys

Key	Measured Parameter	Key	Measured Parameter
0	Voltage, phase A (phase A-B for Delta connection)	13	Kilovolt-amperes reactive, phase B
1	Voltage, phase B (phase B-C for Delta connection)	14	Kilovolt-amperes reactive, phase C
2	Voltage, phase C (phase C-A) for Delta connection)	15	Average voltage
3	Current, phase A	16	Average current
4	Current, phase B	17	Total kilowatts
5	Current, phase C	18	Total kilovolt-amperes
6	Kilowatts, phase A	19	Total kilovolt-amperes reactive
7	Kilowatts, phase B	20	Power factor
8	Kilowatts, phase C	21	Kilowatt demand
9	Kilovolt-amperes, phase A	22	Current demand
10	Kilovolt-amperes, phase B	23	Frequency
11	Kilovolt-amperes, phase C	24	Auxiliary voltage
12	Kilovolt-amperes reactive, phase A	25	Current input (I_4)

2.5 Get Setpoint Parameters

The Get Setpoint Parameters packet is a request to the 4700 power meter to read its present setpoint parameters. The 4700 power meter offers up to seventeen setpoints, each requiring sixteen bytes to display its information. As a result, the Get Setpoint Parameters packet can only retrieve the data of up to fifteen setpoints at a time. To request all setpoint parameters, two request packets are required. You can control how many setpoints to retrieve and with which setpoint to start by setting the number of setpoints in the packet and the number of the first setpoint.

For example, if you request the first fifteen setpoints in one packet followed by the last two setpoints in the next packet, set the number of setpoints in the first packet to 15 and in the next packet to 2. Respectively, set the number of the first setpoint to 1 in the first packet and to 16 in the next packet.

The following table illustrates a Get Setpoint Parameters packet.

Get Setpoint Parameters Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	0Eh	05h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Reserved	0	---
04h	Number of setpoints in packet	1...15	---
05h	Number of first setpoint	1...17	---

The 4700 power meter responds to the request by returning the information of all requested setpoints. The parameter key returned with each setpoint information identifies the particular setpoint parameter. The parameter keys are listed in the Setpoint Parameter table on page 16.

Response to Get Setpoint Parameters Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	0Eh	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1-254	---
02h...03h	Reserved	0	---
04h...05h	Software revision code: 16-bit value, four bits represent one version number digit (e.g., 2001h is version 2.0.0.1)	0000h...9999h	---
06h	Feature code: 8-bit value representing any special feature	0...255	---
07h	Reserved	0	---
08h	Number of setpoints in packet	1...15	setpoint
09h	Number of first setpoint	1...17	setpoint
0Ah...0Dh	First setpoint high limit		
0Eh...11h	low limit		
12h...13h	release time delay		
14h...15h	operate time delay		
16h...17h	relay number	1...3	relay
18h...19h	parameter key (see table p. 16)	1...20	key
1Ah...xxh	Second to fifteenth setpoint information	---	---

2.6 Set Setpoint Parameters

The Set Setpoint Parameters packet is a request to write the setpoint parameters of the 4700 power meter. The same limitations applying to the retrieval of setpoint parameters described in the previous section apply to the setting of setpoint parameters.

Set Setpoint Parameters Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	0Fh	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Reserved	0	---
04h	Number of setpoints in packet	1...15	setpoint
05h	Number of first setpoint	1...17	setpoint
0Ah...0Dh	First setpoint high limit		
0Eh...11h	low limit		
12h...13h	release time delay		
14h...15h	operate time delay		
16h...17h	relay number	1...3	relay
18h...19h	parameter key (see table p. 16)	1...20	key
1Ah...xxh	Second to fifteenth setpoint information	---	---

The 4700 power meter acknowledges the request with the following packet:

Response to Set Setpoint Parameters Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	0Fh	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

2.7 Setpoint Parameter Table

The following table provides the keys for the setpoint parameter settings available to the 4700 power meter.

Setpoint Parameter Table

Key	Setpoint Parameter	Key	Setpoint Parameter
1	Overvoltage	11	Overcurrent demand
2	Undervoltage	12	Overfrequency
3	Voltage unbalance	13	Underfrequency
4	Overcurrent	14	Over V_{aux}
5	Current unbalance	15	Under V_{aux}
6	Overkilovolt-amperes	16	Phase reversal
7	Overkilowatt forward	17	Under power factor lagging
8	Overkilowatt reverse	18	Over power factor leading
9	Overkilovolt-amperes-reactive forward	19	Overcurrent I_4
10	Overkilowatt demand	20	Overkilovolt-amperes-reactive reverse

3 Data Retrieval Packets

Data retrieval packets are used to view real-time values as well as status information of the 4700 power meter. At the end of each real-time data or status packet, alarm status bytes alert the supervisory device to alarm conditions and new events. The alarm status bytes are defined at the end of this chapter on page 20. Any values that are not available (for example, line-to-neutral voltage in a Delta configuration) are returned as undefined.

3.1 Get Real-Time Data Summary

The Get Real-Time Data Summary packet is a request to the 4700 power meter to view a real-time data summary:

Get Real-Time Data Summary Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	04h	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter responds to this request by returning a packet containing its real-time data summary.

Response to Get Real-Time Data Summary Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	0Eh	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...04h	Line-to-neutral voltage, average[1]	0...999999	volt
05h...07h	Line-to-line voltage, average	0...999999	volt
08h...09h	Current, average	0...9999	ampere
0Ah...0Ch	Kilovolt-amperes, total[2]	-999999...+999999	kilovolt-ampere
0Dh...0Fh	Kilowatts, total[2]	-999999...+999999	kilowatt
10h...12h	Kilovolt-amperes reactive, total [2]	-999999...+999999	kilovolt-ampere reactive
13h...15h	Kilowatt demand	-999999...+999999	kilowatt
16h	Power factor	-99...-60 leading +60...+100 lagging	percent
17h...18h	Current demand	-9999...+9999	ampere
19h...21h	Alarm Status	(refer to page 20)	---

[1] Undefined in DELTA mode [2] Vector sum over each phase

3.2 Get Long Real-Time Data

The Get Long Real-Time Data packet is a request to the 4700 power meter for all of its real-time data.

Get Long Real-Time Data Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	03h	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter responds to the long real-time data request by returning all of its real-time data.

Response to Get Long Real-Time Data Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	03h	67h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...04h	Line-to-neutral voltage, phase A[1]	0...999999	volt
05h...07h	Line-to-neutral voltage, phase B[1]	0...999999	volt
08h...0Ah	Line-to-neutral voltage, phase C[1]	0...999999	volt
0Bh...0Dh	Line-to-neutral voltage, average[1]	0...999999	volt
0Eh...10h	Line-to-line voltage, phase A-B	0...999999	volt
11h...13h	Line-to-line voltage, phase B-C	0...999999	volt
14h...16h	Line-to-line voltage, phase C-A	0...999999	volt
17h...019h	Line-to-line voltage, average	0...999999	volt
1Ah...2B1h	Current, phase A	0...9999	ampere
1Ch...1Dh	Current, phase B	0...9999	ampere
1Eh...1Fh	Current, phase C[2]	0...9999	ampere
20h...21h	Current, average	0...9999	ampere
22h...23h	Current input (I_4)	0...9999	ampere
24h...26h	Kilowatts, phase A-B[1]	-999999...+999999	kilowatt
27h...29h	Kilowatts, phase B-C[1]	-999999...+999999	kilowatt
2Ah...2Ch	Kilowatts, phase C-A[1]	-999999...+999999	kilowatt
2Dh...2Fh	Kilowatts, total[3]	-999999...+999999	kilowatt
30h...32h	Kilovolt-amperes, phase A-B[1]	0...999999	kilovolt-ampere
33h...35h	Kilovolt-amperes, phase B-C[1]	0...999999	kilovolt-ampere

[1] Undefined in DELTA mode [2] Undefined in single-phase, 3-wire mode [3] Vector sum over each phase

(continued) **Response to Get Long Real-Time Data Request**

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	03h	67h		lrc

Data Byte No.	Description	Range of Values	Unit
36h...38h	Kilovolt-amperes, phase C-A[1]	0...999999	kilovolt-ampere
39h...3Bh	Kilovolt-amperes, total[3]	0...999999	kilovolt-ampere
3Ch...3Eh	Kilovolt-amperes reactive, phase A-B[1]	-999999...+999999	kilovolt-ampere reactive
3Fh...41h	Kilovolt-amperes reactive, phase B-C[1]	-999999...+999999	kilovolt-ampere reactive
42h...44h	Kilovolt-amperes reactive, phase C-A[1]	-999999...+999999	kilovolt-ampere reactive
45h...47h	kilovolt-amperes reactive, total [3]	-999999...+999999	kilovolt-ampere reactive
48h...4Ah	Kilowatt demand	-999999...+999999	kilowatt
4Bh	Power factor	-99...-60 leading +60...+100 lagging	---
4Ch...4Dh	Frequency	400...700	hertz
4Eh...50h	Auxiliary voltage	0...999999	volt
51h...52h	Current demand	0...999999	ampere
53h...56h	Kilowatt hours, forward (since last cleared)[4]	0...1 000 000 000	kilowatt hour
57h...5Ah	Kilowatt hours, reverse (since last cleared)	0...1 000 000 000	kilowatt hour
5Bh...5Eh	Kilovolt-ampere reactive hours, forward[5] (since last cleared)	0...1 000 000 000	kilovolt-ampere reactive hour
5Fh...67h	Alarm status bytes (see section 3.4, page 20)	---	---
68h...6Bh	Kilovolt-ampere reactive hours, forward[5] (since last cleared)	0...1 000 000 000	kilovolt-ampere reactive hour

[1] Undefined in DELTA mode [2]Undefined in single-phase, 3-wire mode [3]Vector sum over each phase
[4] Prior to software version 2.3.0.4, these bytes returned kilowatt hours, total
[5] Prior to software version 2.3.0.4, these bytes returned kilovolt-ampere reactive hours, total

3.3 Get Status Information

The Get Status Information packet is a request to the 4700 power meter for its status information.

Get Real-Time Summary Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	0Ch	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter returns its present status.

Response to Status Information Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	0Ch	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...0Ah	Alarm status bytes (see section 3.4, page 20)	---	---

3.4 Alarm Status Bytes Description

The nine alarm status bytes described in this section are attached to each real-time data or status packet to alert the supervisory device to alarm conditions and new events.

Data Byte No.	Description	Range of Values	Unit
01h	Alarm Status:	0, 1	---
	Bits 0 to 7 Setpoints 1 to 8	0 = normal 1 = active	
02h	Alarm Status (continued):	0, 1	---
	Bits 0 to 7 Setpoints 9 to 16	0 = normal 1 = active	
03h	Alarm Status (continued):	0, 1	---
	Bit 0 Setpoint 17	0 = normal 1 = active	
	Bit 1 Reserved	0	
	Bits 2 to 4 Relays 1 to 3	0 = released 1 = operated	
	Bits 5 to 7 Discrete Inputs S1 to S3	0 = ground 1 = 120 VAC	
04h	Alarm Status (continued):	0, 1	---
	Bit 0 Discrete input S4	0 = ground 1 = 120 VAC	
	Bit 1 Flag alarm status change	0 = normal 1 = asserted	
	Bit 2 Flag new event	0 = normal 1 = asserted	---
	Bit 3 Flag new min/max data	0 = normal 1 = asserted	---
	Bit 4 Flag diagnostic failure	0 = normal 1 = asserted	
	Bit 5 Flag new snapshot	0 = normal 1 = asserted	
	Bits 6 to 7 Reserved	0	
05h	Alarm Status (continued): Event counter	0...255	---
06h...09h	Alarm Status (continued): Discrete input counter	0...4294967295	---

4 Log Packets

The 4700 power meter can record up to three data logs: the event log, the snapshot log, and the min/max log. All log data is time-stamped to the nearest second using the *Compressed Time Format*. See Appendix B for a description of the compressed time format. This chapter presents the packets used to retrieve data from these logs.

The event log contains the 50 most recent events. Each event encompasses 12 bytes of data. A packet responding to a Get Event Log request can retrieve as many as 19 event records.

The snapshot log contains the 100 most recent snapshots. Each snapshot is made up of 52 bytes of data. A response to a snapshot log request can return up to four snapshot records per packet.

The min/max log contains the extreme values for measured parameters. A response to a minimum or maximum data request returns all minimum or maximum data in one packet.

4.1 Get Event Log

The Get Event Log packet retrieves up to nineteen available events beginning with the event number identified in the request.

Get Event Log Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	12h	04h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h	Not used	0	---
03h...04h	Number of first event requested	0...49 (newest to oldest)	event

The 4700 power meter returns up to nineteen available events. The response packet is defined in the next section.

4.2 Get Next Event

The Get Next Event packet allows the retrieval of one event at a time. This packet requests the oldest event that has been logged but has not been previously requested using this packet type (Msgt 13h).

Get Next Event Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	13h	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter responds to both of the preceding packets with the following packet, varying the Msgt byte (either 12h or 13h) to match the specific request. When returned in response to Msgt 13h, this packet returns information about only one event.

Response to Get Event Log and Get Next Event Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	12h or 13h	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Device type code: integer for 4700, or 125Ch	4700	---
04h...05h	Software revision code: 16-bit value, four bits represent one version number digit (e.g., 2001h is version 2.0.0.1)	0h...9999h	---
06h	Feature code: 8-bit value representing any special feature	0...255	---
07h	Reserved	0	---
08h...09h	Number of last recorded event	0...49 (newest to oldest)	event
0Ah...0Bh	Number of last event in packet	0...49 (newest to oldest)	event
0Ch...0Dh	Number of events in packet	1...19	event
0Eh...11h	First event: time stamp (compressed time format)	---	---
12h	First event: year (modulo 100)	0...99	year
13h	First event: event flag	0...3	---
	bits 0...1 general information	0 = no data 1 = front panel even 2 = comm packet event 3 = forced relay operation	
	bit 2 setpoint status	0 = inactive 1 = active	
	bits 3 to 4 relay number	0 = none 1 = Relay 1 2 = Relay 2 3 = Relay 3	
	bit 5 status of relay 1	0 = operated 1 = released	
	bit 6 status of relay 2	0 = operated 1 = released	
	bit 7 status of relay 3	0 = operated 1 = released	
14h...15h	First event: event code (see Event Code table, p.23)	1...288	
16h...19h	First event: event log data		
1Ah...xxh	Second to nineteenth event: Repeat bytes 0Eh to 17h for each event	---	---

4.3 Event Codes Table

The following table defines the event codes applying to the events stored by the 4700 power meter.

Event Codes

Value	Event Code	Value	Event Code
01	Setpoint Overvoltage	48	Setpoint Current Unbalance, Phase A
02	Setpoint Undervoltage	49	Setpoint Current Unbalance, Phase B
03	Setpoint Voltage Unbalance	50	Setpoint Current Unbalance, Phase C
04	Setpoint Overcurrent	257	Time Set
05	Setpoint Current Unbalance	258	Setup Changed
06	Setpoint Over KVA	259	Alarms Changed
07	Setpoint Over KW	260	Power Up/Reset
08	Setpoint Over KW Reverse	261	Relay Control
09	Setpoint Over KVAR	262	Cleared Max/Min
10	Setpoint Over KW Demand	263	Cleared Hours
11	Setpoint Overcurrent Demand	268	Factory Clear
12	Setpoint Overfrequency (×10)	269	Firmware Revision
13	Setpoint Underfrequency (×10)	270	NV Failure
14	Setpoint Over V_{aux}	271	Frequency Failure
15	Setpoint Under V_{aux}	272	Hydro Failure
16	Setpoint Phase Reversal	273	Setpoint Failure
17	Setpoint Under PF Lagging	274	Front Panel Failure
18	Setpoint Under PF Leading	275	Propack Failure
19	Setpoint Over I_4	276	ISR Failure
32	Setpoint Overvoltage, Phase A	277	Init Failure
33	Setpoint Overvoltage, Phase B	278	Calc Failure
34	Setpoint Overvoltage, Phase C	279	Timer Failure
36	Setpoint Undervoltage, Phase A	280	Status Input Failure
37	Setpoint Undervoltage, Phase B	281	Status Input 1 - Normal
38	Setpoint Undervoltage, Phase C	282	Status Input 2 - Normal
40	Setpoint Voltage Unbalance, Phase A	283	Status Input 3 - Normal
41	Setpoint Voltage Unbalance, Phase B	284	Status Input 4 - Normal
42	Setpoint Voltage Unbalance, Phase C	285	Status Input 1 - Active
44	Setpoint Overcurrent, Phase A	286	Status Input 2 - Active
45	Setpoint Overcurrent, Phase B	287	Status Input 3 - Active
46	Setpoint Overcurrent, Phase C	288	Status Input 4 - Active

4.4 Get Snapshot Log

The Get Snapshot Log packet retrieves up to four available snapshots beginning with the snapshot number identified in the request.

Get Snapshot Log Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	10h	05h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Reserved	0	---
04h...05h	Number of first snapshot requested	0...99 (newest to oldest)	snapshot

The 4700 power meter returns up to four available snapshots. The response packet is defined in the next section.

4.5 Get Next Snapshot

The Get Next Snapshot packet allows the retrieval of one snapshot at a time. This packet requests the oldest snapshot that has been logged but has not been previously requested using this packet type (Msgt 11h).

Get Next Event Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	11h	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter responds to both of the preceding packets with the following packet, varying the Msgt byte (either 10h or 11h) to match the specific request. When returned in response to Msgt 11h, this packet returns information about only one snapshot.

Response to Get Snapshot Log and Get Next Snapshot Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	10h/11h	xxh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Device type code: integer for 4700, or 125Ch	4700	---
04h...05h	Software revision code: 16-bit value, four bits represent one version number digit (e.g., 2001h is version 2.0.0.1)	0h...9999h	---
06h	Feature code: 8-bit value representing any special feature	0...255	---
07h	Reserved	0	---
08h...09h	Number of last recorded snapshot	0...99 (newest to oldest)	snapshot
0Ah...0Bh	Number of last snapshot in packet	0...99 (newest to oldest)	snapshot
0Ch...0Dh	Number of snapshots in packet	1...4	snapshot
0Eh...11h	First snapshot: Time (compressed time format)	---	---
12h...15h	First snapshot: Line-to-neutral or line-to-line voltage, average[1]	0...999999	volt
16h...19h	First snapshot: Current, average	0...9999	ampere
1Ah...1Ch	First snapshot: Kilowatts, total[2]	-999999...+999999	kilowatt
1Dh...20h	First snapshot: Kilovolt-amperes reactive, total[2]	-999999...+999999	kilovolt-ampere reactive
21h...24h	First snapshot: Kilowatt demand	-999999...+999999	kilowatt
25h...28h	First snapshot: Current demand	-9999...+9999	ampere
29h...2Ah	First snapshot: Power factor	-99...-60 leading +60...+100 lagging	---
2Bh...2Ch	First snapshot: Frequency	400...700	hertz
2Dh...30h	First snapshot: Auxiliary voltage	0...999999	volt
53h...56h	First snapshot: Kilowatt hours forward	0...1,000,000,000	kilowatt hour
57h...5Ah	First snapshot: Kilovolt-ampere reactive hours, forward[5] (since last cleared)	0...1,000,000,000	kilovolt-ampere hours reactive
5Bh...5Eh	First snapshot: Kilowatt hours reverse since last cleared	0...1,000,000,000	kilowatt hour
5Fh...62h	Reserved	0	---
63h...xxh	Second to fourth snapshot: Repeat bytes 0Eh to 62h for each snapshot	---	---

4.6 Get Minimum Data

The Get Minimum Data packet is a request to the 4700 power meter to read its minimum data values and their time stamps. This packet (Msgt 1Bh) does not reset any of the values it returns.

Get Minimum Data Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	1Bh	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The response packet is described in the next section.

4.7 Get Minimum Data with Subsequent Reset

The Get Minimum Data with Subsequent Reset packet is a request to the 4700 power meter to read its minimum data values and their time stamps. After reading this packet (Msgt 1Ch), the power meter resets the values and time to the present data for each parameter.

Get Minimum Data with Subsequent Reset Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	1Ch	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter responds to both preceding request packets with the following packet, varying the Msgt byte (either 1Bh or 1Ch) to match the specific request. When returned in response to Msgt 1Ch, the power meter resets all minimum data values and their times to the meter's present values and times for each parameter.

Response to Get Minimum Data and Get Minimum Data with Subsequent Reset Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	1Bh or 1Ch	8Bh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...04h	Minimum line-to-neutral voltage, phase A[1]	0...999999	volt
05h...07h	Minimum line-to-neutral voltage, phase B[1]	0...999999	volt
08h...0Ah	Minimum line-to-neutral voltage, phase C[1]	0...999999	volt
0Bh...0Dh	Minimum line-to-neutral voltage, average[1]	0...999999	volt
0Eh...10h	Minimum line-to-line voltage, phase A-B	0...999999	volt
11h...13h	Minimum line-to-line voltage, phase B-C	0...999999	volt
14h...16h	Minimum line-to-line voltage, phase C-A	0...999999	volt
17h...019h	Minimum line-to-line voltage, average	0...999999	volt
1Ah...2B1h	Minimum current, phase A	0...9999	ampere
1Ch...1Dh	Minimum current, phase B	0...9999	ampere
1Eh...1Fh	Minimum current, phase C[2]	0...9999	ampere
20h...21h	Minimum current, average	0...9999	ampere
22h...24h	Minimum kilowatts, total[3]	-999999...+999999	kilowatt
25h...27h	Minimum kilovolt-amperes, total[3]	0...999999	kilovolt-ampere
28h...2Ah	Minimum kilovolt-amperes reactive, total [3]	-999999...+999999	kilovolt-ampere reactive
2Bh...2Dh	Minimum kilowatt demand	-999999...+999999	kilowatt
2Eh	Minimum power factor	-99...-60 leading +60...+100 lagging	---
2Fh...30h	Minimum frequency	400...700	Hertz
31h...33h	Minimum auxiliary voltage	0...999999	volt
34h...35h	Minimum current demand	0...9999	ampere
36h...37h	Minimum current input (I_4)	0...9999	ampere
38h...3Bh	Time of minimum line-to-neutral voltage, phase A[1]	**Refer to Appendix B for** ***Compressed Time Format***	
3Ch...3Fh	Time of minimum line-to-neutral voltage, phase B[1]		
40h...43h	Time of minimum line-to-neutral voltage, phase C[1]		
44h...47h	Time of minimum line-to-neutral voltage, average[1]		
48h...4Bh	Time of minimum line-to-line voltage, phase A-B		
4Ch...4Fh	Time of minimum line-to-line voltage, phase B-C		
50h...53h	Time of minimum line-to-line voltage, phase C-A		

[1] Undefined in DELTA mode [2] Undefined in single-phase, 3-wire mode [3] Vector sum over each phase

(cont.) Response to Get Minimum Data and Get Minimum Data with Subsequent Reset Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	1Bh or 1Ch	8Bh		lrc

Data Byte No.	Description	Range of Values	Unit
54h...57h	Time of minimum line-to-line voltage, average	**Refer to Appendix B for** ***Compressed Time Format***	
58h...5Bh	Time of minimum current, phase A		
5Ch...5Fh	Time of minimum current, phase B		
60h...63h	Time of minimum current, phase C[2]		
64h...67h	Time of minimum current, average		
68h...6Bh	Time of minimum kilowatts, total[3]		
6Ch...6Fh	Time of minimum kilovolt-amperes, total[3]		
70h...73h	Time of minimum kilovolt-amperes reactive, total[3]		
74h...77h	Time of minimum kilowatt demand		
78h...7Bh	Time of minimum power factor		
7Ch...7Fh	Time of minimum frequency		
80h...83h	Time of minimum auxiliary voltage		
84h...87h	Time of minimum current demand		
88h...8Bh	Time of minimum current input (I_4)		

[1] Undefined in DELTA mode [2] Undefined in single-phase, 3-wire mode [3] Vector sum over each phase

Note: All 4-byte values are stored least significant word first with the least significant byte of each word first. All 2-byte and 3-byte values are stored least significant byte first, most significant byte last. Any values that are not available (for example, line-to-neutral voltage in a Delta configuration) are returned as undefined.

4.8 Get Maximum Data

The Get Maximum Data packet is a request to the 4700 power meter to read its maximum data values and their time stamps. This packet (Msgt 1Dh) does not reset any of the values it returns.

Get Maximum Data Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	1Dh	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The response packet is described in the next section.

4.9 Get Maximum Data with Subsequent Reset

The Get Maximum Data with Subsequent Reset packet is a request to the 4700 power meter to read its maximum data values and their time stamps. After reading this packet (Msgt 1Eh), the power meter resets the values and time to the present data for each parameter.

Get Maximum Data with Subsequent Reset Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	1Eh	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter responds to both preceding request packets with the following packet, varying the Msgt byte (either 1Dh or 1Eh) to match the specific request. When returned in response to Msgt 1Eh, the power meter resets all maximum data values and their times to the meter's present values and times for each parameter.

Response to Get Maximum Data and Get Maximum Data with Subsequent Reset Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	1Dh or 1Eh	8Bh		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...04h	Maximum line-to-neutral voltage, phase A[1]	0...999999	volt
05h...07h	Maximum line-to-neutral voltage, phase B[1]	0...999999	volt
08h...0Ah	Maximum line-to-neutral voltage, phase C[1]	0...999999	volt
0Bh...0Dh	Maximum line-to-neutral voltage, average[1]	0...999999	volt
0Eh...10h	Maximum line-to-line voltage, phase A-B	0...999999	volt
11h...13h	Maximum line-to-line voltage, phase B-C	0...999999	volt
14h...16h	Maximum line-to-line voltage, phase C-A	0...999999	volt
17h...019h	Maximum line-to-line voltage, average	0...999999	volt
1Ah...2B1h	Maximum current, phase A	0...9999	ampere
1Ch...1Dh	Maximum current, phase B	0...9999	ampere
1Eh...1Fh	Maximum current, phase C[2]	0...9999	ampere
20h...21h	Maximum current, average	0...9999	ampere
22h...24h	Maximum kilowatts, total [3]	-999999...+999999	kilowatt
25h...27h	Maximum kilovolt-amperes, total [3]	0...999999	kilovolt-ampere
28h...2Ah	Maximum kilovolt-amperes reactive, total [3]	-999999...+999999	kilovolt-ampere reactive

[1] Undefined in DELTA mode [2] Undefined in single-phase, 3-wire mode [3] Vector sum over each phase

(cont.) Response to Get Maximum Data and Get Maximum Data with Subsequent Reset Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	1Dh or 1Eh	8Bh		lrc

Data Byte No.	Description	Range of Values	Unit
2Bh...2Dh	Maximum kilowatt demand	-999999...+999999	kilowatt
2Eh	Maximum power factor	-99...-60 leading +60...+100 lagging	---
2Fh...30h	Maximum frequency	400...700	Hertz
31h...33h	Maximum auxiliary voltage	0...999999	volt
34h...35h	Maximum current demand	0...9999	ampere
36h...37h	Maximum current input (I_4)	0...9999	ampere
38h...3Bh	Time of maximum line-to-neutral voltage, phase A[1]	**Refer to Appendix B for** ***Compressed Time Format***	
3Ch...3Fh	Time of maximum line-to-neutral voltage, phase B[1]		
40h...43h	Time of maximum line-to-neutral voltage, phase C[1]		
44h...47h	Time of maximum line-to-neutral voltage, average[1]		
48h...4Bh	Time of maximum line-to-line voltage, phase A-B		
4Ch...4Fh	Time of maximum line-to-line voltage, phase B-C		
50h...53h	Time of maximum line-to-line voltage, phase C-A		
54h...57h	Time of maximum line-to-line voltage, average		
58h...5Bh	Time of maximum current, phase A		
5Ch...5Fh	Time of maximum current, phase B		
60h...63h	Time of maximum current, phase C[2]		
64h...67h	Time of maximum current, average		
68h...6Bh	Time of maximum kilowatts, total[3]		
6Ch...6Fh	Time of maximum kilovolt-amperes, total[3]		
70h...73h	Time of maximum kilovolt-amperes reactive, total[3]		
74h...77h	Time of maximum kilowatt demand		
78h...7Bh	Time of maximum power factor		
7Ch...7Fh	Time of maximum frequency		
80h...83h	Time of maximum auxiliary voltage		
84h...87h	Time of maximum current demand		
88h...8Bh	Time of maximum current input (I_4)		

[1] Undefined in DELTA mode [2] Undefined in single-phase, 3-wire mode [3] Vector sum over each phase

Note: All 4-byte values are stored least significant word first with the least significant byte of each word first. All 2-byte and 3-byte values are stored least significant byte first, most significant byte last. Any values that are not available (for example, line-to-neutral voltage in a Delta configuration) are returned as undefined.

5 Control Packets

Control packets are used to control specific functions of the 4700 power meter, including clearing total kilowatt hours, total kilovolt-ampere reactive hours, and the discrete input counter, as well as controlling the relays.

5.1 Clear Total Kilowatt Hours

The Clear Total Kilowatt Hours packet instructs the 4700 power meter to clear its kilowatt-hour counter, resetting it to zero.

Clear Total Kilowatt Hours Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	16h	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter acknowledges the request with the following packet and resets its kilowatt-hour counter to zero.

Response to Clear Total Kilowatt Hours Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	16h	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

5.2 Clear Total Kilovolt-Ampere Reactive Hours

The Clear Total Kilovolt-Ampere Reactive Hours packet instructs the 4700 power meter to clear its kilovolt-ampere reactive hour counter, resetting it to zero.

Clear Total Kilovolt-Ampere Reactive Hours Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	17h	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter acknowledges the request with the following packet and resets its kilovolt-ampere reactive hour counter to zero.

Response to Clear Total Kilovolt-Ampere Reactive Hours Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	17h	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

5.3 Clear Discrete Input Counter

The Clear Discrete Input Counter packet instructs the 4700 power meter to clear the discrete input counter, resetting it to zero.

Clear Discrete Input Counter Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	1Fh	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

The 4700 power meter acknowledges the request with the following packet and resets its discrete input counter to zero.

Response to Clear Discrete Input Counter Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	1Fh	01h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---

5.4 Set Relay Control Function

The Set Relay Control Function packet can set the relays to perform one of three functions: reset relay to setpoint control, open the relay, and close the relay.

Set Relay Control Function Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	1Ah	05h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Relay number	1...3	---
04h...05h	Relay command	0 = reset 1 = closed 2 = open	---

The 4700 power meter returns a packet with a single value indicating whether the relay is closed or open. Upon a reset command, the relay returns *open*.

Response to Set Relay Control Function Request

Sync	Devt	Msgt	Len	Data	LRC
27h	FEh	1Ah	03h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h...03h	Relay status	1, 2 1 = closed 2 = open	---

5 Control Packets

6 Waveform Capture Packets

Waveform capture allows high-speed sampling of voltage and current inputs in WYE or DELTA mode at a rate of 128 samples per cycle at a a single input. The 4700 power meter stores the sampled waveform data and you can retrieve it by requesting individually selected inputs.

6.1 Get Waveform Capture Data

The Get Waveform Capture Data packet is a request to retrieve waveform data for one of eight selected inputs.

Get Waveform Capture Data Requestl

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	22h	02h		lrc

Data Byte No.	Description			Range of Values	Unit
01h	Device address			1...254	---
02h	Channel number	Wye	Delta	1...7	---
	0	V_1	V_{ab}		
	1	I_1	I_1		
	2	V_2	---		
	3	I_2	I_2		
	4	V_3	V_3		
	5	I_3	V_{cb}		
	6	I_4	I_4		
	7	V_{aux}	V_{aux}		

The 4700 power meter responds to this request by returning the following packet:

Response to Get Waveform Capture Data Request

Sync	Devt	Msgt	Len	Data	LRC
14h	FEh	22h	C6h		lrc

Data Byte No.	Description	Range of Values	Unit
01h	Device address	1...254	---
02h	Channel number	1...7	---
03h...04h	Number of waveform samples in packet	128	---
05h...06h	Delay between waveform samples	130	microsecond
07h...C6h	Waveform data (each sample is 12 bits)	0...4095	volt or ampere

6 Waveform Capture Packets

A Address Codes

The following table lists all address codes that have been assigned by Siemens. These codes are used in the Devt byte of a communications packet. For more information on packets and addressing, refer to the *SEAbus and SEAbus Plus Protocol Reference Manual* (Manual No. SG-6213-00). For easy reference, the left side of the table lists the codes for each device in numerical order; the right side of the table lists the devices with their codes in alphanumeric order. Codes are given in (h)exadecimal and (d)ecimal.

Codes in Numerical Order			**Device Types in Alphanumeric Order**		
Address Codes (h/d)		**Device Type**	**Address Codes (h/d)**		**Device Type**
00h	0	Universal Request	FDh	253	3600-S1 power meter
01h...E0h	1...224	Direct address codes	F6h	246	4300 power meter
E1h...F1h	225...241	Indirect address codes (reserved)	FEh	254	4700 power meter
F2h	242	SB Energy/Comm trip unit	F5h	245	4720 power meter
F3h	243	S7-I/O unit	FCh	252	ACCESS Host PC
F4h	244	Pulse reading meter (PRM)	01h...E0h	1...224	Direct address codes
F5h	245	4720 power meter	FFh	255	Broadcast
F6h	246	4300 power meter	E1h...F1h	225...241	Indirect address codes (reserved)
F7h	247	ISGS	F7h	247	ISGS
F8h	248	Static Trip IIICP trip unit	FBh	251	Local display unit
F9h	249	Multiplexer Translator	F9h	249	Multiplexer Translator
FAh	250	SCOR	F4h	244	Pulse reading meter (PRM)
FBh	251	Local display unit	F3h	243	S7-I/O unit
FCh	252	ACCESS Host PC	F2h	242	SB Energy/Comm trip unit
FDh	253	3600-S1 power meter	FAh	250	SCOR
FEh	254	4700 power meter	F8h	248	Static Trip IIICP trip unit
FFh	255	Broadcast	00h	0	Universal Request

B Compressed Time Format

4700 power meter communications packets with time stamp use a compressed time format consisting of four bytes with date and time information assigned as follows:

Data Byte No.	Description		Range of Values	Unit
01h...04h	Compressed Time Format		---	---
	bits 0...3	reserved	0	---
	bits 4...9	seconds	0...59	second
	bits 10...15	minutes	0...59	minute
	bits 16...20	hours	0...23	hour
	bits 21...25	days	1...31	day
	bits 26...29	months	1...12	month
	bits 30...31	reserved	0	---

C Decimal/Hexadecimal Conversion Table

Conversion Table (d)ecimal and (h)exadecimal

d	h	d	h	d	h	d	h	d	h	d	h	d	h	d	h
0	00	32	20	64	40	96	60	128	80	160	A0	192	C0	224	E0
1	01	33	21	65	41	97	61	129	81	161	A1	193	C1	225	E1
2	02	34	22	66	42	98	62	130	82	162	A2	194	C2	226	E2
3	03	35	23	67	43	99	63	131	83	163	A3	195	C3	227	E3
4	04	36	24	68	44	100	64	132	84	164	A4	196	C4	228	E4
5	05	37	25	69	45	101	65	133	85	165	A5	197	C5	229	E5
6	06	38	26	70	46	102	66	134	86	166	A6	198	C6	230	E6
7	07	39	27	71	47	103	67	135	87	167	A7	199	C7	231	E7
8	08	40	28	72	48	104	68	136	88	168	A8	200	C8	232	E8
9	09	41	29	73	49	105	69	137	89	169	A9	201	C9	233	E9
10	0A	42	2A	74	4A	106	6A	138	8A	170	AA	202	CA	234	EA
11	0B	43	2B	75	4B	107	6B	139	8B	171	AB	203	CB	235	EB
12	0C	44	2C	76	4C	108	6C	140	8C	172	AC	204	CC	236	EC
13	0D	45	2D	77	4D	109	6D	141	8D	172	AD	205	CD	237	ED
14	0E	46	2E	78	4E	110	6E	142	8E	174	AE	206	CE	238	EE
15	0F	47	2F	79	4F	111	6F	143	8F	175	AF	207	CF	239	EF
16	10	48	30	80	50	112	70	144	90	176	B0	208	D0	240	F0
17	11	49	31	81	51	113	71	145	91	177	B1	209	D1	241	F1
18	12	50	32	82	52	114	72	146	92	178	B2	210	D2	242	F2
19	13	51	33	83	53	115	73	147	93	179	B3	211	D3	243	F3
20	14	52	34	84	54	116	74	148	94	180	B4	212	D4	244	F4
21	15	53	35	85	55	117	75	149	95	181	B5	213	D5	245	F5
22	16	54	36	86	56	118	76	150	96	182	B6	214	D6	246	F6
23	17	55	37	87	57	119	77	151	97	183	B7	215	D7	247	F7
24	18	56	38	88	58	120	78	152	98	184	B8	216	D8	248	F8
25	19	57	39	89	59	121	79	153	99	185	B9	217	D9	249	F9
26	1A	58	3A	90	5A	122	7A	154	9A	186	BA	218	DA	250	FA
27	1B	59	3B	91	5B	123	7B	155	9B	187	BB	219	DB	251	FB
28	1C	60	3C	92	5C	124	7C	156	9C	188	BC	220	DC	252	FC
29	1D	61	3D	93	5D	125	7D	157	9D	189	BD	221	DD	253	FD
30	1E	62	3E	94	5E	126	7E	158	9E	190	BE	222	DE	254	FE
31	1F	63	3F	95	5F	127	7F	159	9F	191	BF	223	DF	255	FF

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SIEMENS

Siemens Energy &
Automation, Inc.
Switchgear and Motor Control
Business
P.O. Box 29503
Raleigh, NC 27626-0503

Manual SG-6363-00 (Replaces AED-01-002-003-0493) 02/96
Printed in U.S.A.