



# **Power Quality and Revenue Meter EM720/EM720T**

## IEC 62056-21 Communications Protocol

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### Reference Guide

Every effort has been made to ensure that the material herein is complete and accurate. However, the manufacturer is not responsible for any mistakes in printing or faulty instructions contained in this book. Notification of any errors or misprints will be received with appreciation.

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

#### REVISION HISTORY

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A2	June 2010	Added imported/exported kVAh and 4-quadrant kvarh

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# 1 General

This document specifies a subset of the IEC 62056-21 communications protocol used to transfer data between a master computer station and the EM720. The document provides the complete information necessary to develop third-party communications software capable of communication with the EM720. Refer to the EM720 Installation Manual and EM720 Operation Manual for more information on communication connections and configuring communication parameters in your device.

## 2 IEC 62056-21 Implementation

For detailed information on the IEC 62056-21 data transmission protocol see IEC publications:

IEC 62056-21 Electricity metering. Data exchange for meter reading, tariff and load control. Part 21: Direct local data exchange.

IEC 62056-61 Electricity metering. Data exchange for meter reading, tariff and load control. Part 61: Object identification system (OBIS).

The following paragraphs outline details of the implementation of the IEC 62056-21 protocol in the EM720.

### 2.1 Connection Ports

The IEC 62056-21 protocol is supported via the optical IR port COM1 (it is the default mode for COM1) and serial port COM3. See the EM720 Operation Manual for information on changing the transmission protocol for serial ports.

### 2.2 Device Identification

The EM720 manufacturer identification characters are SAT.

The device identification message includes the EM720 model name and an 8-character device serial number with two leading zeros without an optional enhanced protocol identification character, as shown in the following example:

```
SAT6EM72000656621
```

### 2.3 Protocol Mode

The EM720 implements the IEC 62056-21 protocol mode C with ASCII-coded data. Binary mode (HDLC) is not available.

### 2.4 Baud Rates

The initial baud rate for data exchange is programmable for IEC 62056-21 ports. For the optical port, it can be selected from 300 Bd to 19200 Bd. For port COM3, it can be set to one of the standard baud rates from 300 Bd to 19200 Bd, and to not-standard baud rates 38400 Bd (Z=7), 57600 Bd (Z=8) or 115200 Bd (Z=9).

The default factory set baud rate is 19200 Bd (Z=6) for all serial ports.

### 2.5 Data Readout Mode

The meter provides a standard data readout of ASCII-coded data with optional baud rate switching. Partial block communication is not supported.

A data readout includes energy, maximum demand and cumulative maximum demand readings for all configured total and tariff registers for the present and three previous billing periods. See the EM720 Operation Manual for more information on configuring billing registers and tariffs in the meter.

Data readings are provided with the OBIS data identification code (see below) and unit information.

See Appendix for a data readout example.

## 2.6 Programming Mode

In programming mode, the EM720 supports reading (with command R1) and setting (with command W1) the device time and date. When entering programming mode, the EM720 always asks for a password.

See Appendix for the data exchange examples.

## 2.7 OBIS Data Coding

The OBIS (IEC 62056-61 Object Identification System) codes are used to identify data items in the IEC 62056-21 data exchange.

The OBIS code structure used in the EM720 is as follows:

**B : C.D.E \* F**

where

B – energy metering channel 1-6. Not indicated for a single self-metering channel when no external channels are defined.

C – identifies a physical instrumentation quantity, like the type of a source power and its direction. 0 identifies general purpose objects.

D – identifies a quantity processing algorithm, like time accumulation, maximum and cumulative maximum.

E – tariff rate 1...8, or 0 for total readings.

F – billing period 0-3, 0 (not indicated) for present billing period, 1 for the first previous (last) period, 2 for the second previous billing period, 3 for the third previous billing period.

The following table lists the OBIS codes used in the EM720 data readouts.

OBIS Code	Unit	Description
0.1.0		Billing period counter
0.1.2 * F		Timestamp of the billing period
0.8.6 * F	Day	Billing period duration
0.9.1	hh:mm:ss	Time (with an optional delimiter)
0.9.2	YY-MM-DD	Date (with an optional delimiter)
1.8.0	kWh	kWh import (Q1+Q4), total
1.8.1-1.8.8	kWh	kWh import (Q1+Q4), tariff 1-8
2.8.0	kWh	kWh export (Q2+Q3), total
2.8.1-2.8.8	kWh	kWh export (Q2+Q3), tariff 1-8
3.8.0	kvarh	kvarh import (Q1+Q2), total
3.8.1-3.8.8	kvarh	kvarh import (Q1+Q2), tariff 1-8
4.8.0	kvarh	kvarh export (Q3+Q4), total
4.8.1-4.8.8	kvarh	kvarh export (Q3+Q4), tariff 1-8
5.8.0	kvarh	kvarh Q1, total
5.8.1-5.8.8	kvarh	kvarh Q1, tariff 1-8
6.8.0	kvarh	kvarh Q2, total
6.8.1-6.8.8	kvarh	kvarh Q2, tariff 1-8
7.8.0	kvarh	kvarh Q3, total
7.8.1-7.8.8	kvarh	kvarh Q3, tariff 1-8
8.8.0	kvarh	kvarh Q4, total
8.8.1-8.8.8	kvarh	kvarh Q4, tariff 1-8
9.8.0	kVAh	kVAh (Q1+Q2+Q3+Q4), total
9.8.1-9.8.8	kVAh	kVAh (Q1+Q2+Q3+Q4), tariff 1-8
9.8.0	kVAh	kVAh import (Q1+Q4), total
9.8.1-9.8.8	kVAh	kVAh import (Q1+Q4), tariff 1-8
10.8.0	kVAh	kVAh export (Q2+Q3), total

<b>OBIS Code</b>	<b>Unit</b>	<b>Description</b>
10.8.1-10.8.8	kVAh	kVAh export (Q2+Q3), tariff 1-8
1.6.0	kW/MW	kW import maximum demand, total
1.6.1-1.6.8	kW/MW	kW import maximum demand, tariff 1-8
2.6.0	kW/MW	kW export maximum demand, total
2.6.1-2.6.8	kW/MW	kW export maximum demand, tariff 1-8
3.6.0	kvar/Mvar	kvar import maximum demand, total
3.6.1-3.6.8	kvar/Mvar	kvar import maximum demand, tariff 1-8
4.6.0	kvar/Mvar	kvar export maximum demand, total
4.6.1-4.6.8	kvar/Mvar	kvar export maximum demand, tariff 1-8
5.6.0	kvar/Mvar	kvarh Q1 maximum demand, total
5.6.1-5.6.8	kvar/Mvar	kvarh Q1 maximum demand, tariff 1-8
6.6.0	kvar/Mvar	kvarh Q2 maximum demand, total
6.6.1-6.6.8	kvar/Mvar	kvarh Q2 maximum demand, tariff 1-8
7.6.0	kvar/Mvar	kvarh Q3 maximum demand, total
7.6.1-7.6.8	kvar/Mvar	kvarh Q3 maximum demand, tariff 1-8
8.6.0	kvar/Mvar	kvarh Q4 maximum demand, total
8.6.1-8.6.8	kvar/Mvar	kvarh Q4 maximum demand, tariff 1-8
9.6.0	kVA/MVA	kVA maximum demand, total
9.6.1-9.6.8	kVA/MVA	kVA maximum demand, tariff 1-8
9.6.0	kVA/MVA	kVAh import maximum demand, total
9.6.1-9.6.8	kVA/MVA	kVAh import maximum demand, tariff 1-8
10.6.0	kVA/MVA	kVAh export maximum demand, total
10.6.1-10.6.8	kVA/MVA	kVAh export maximum demand, tariff 1-8
1.2.0	kW/MW	kW import cumulative maximum demand, total
1.2.1-1.2.8	kW/MW	kW import cumulative maximum demand, tariff 1-8
2.2.0	kW/MW	kW export cumulative maximum demand, total
2.2.1-2.2.8	kW/MW	kW export cumulative maximum demand, tariff 1-8
3.2.0	kvar/Mvar	kvar import cumulative maximum demand, total
3.2.1-3.2.8	kvar/Mvar	kvar import cumulative maximum demand, tariff 1-8
4.2.0	kvar/Mvar	kvar export cumulative maximum demand, total
4.2.1-4.2.8	kvar/Mvar	kvar export cumulative maximum demand, tariff 1-8
5.2.0	kvar/Mvar	kvarh Q1 cumulative maximum demand, total
5.2.1-5.2.8	kvar/Mvar	kvarh Q1 cumulative maximum demand, tariff 1-8
6.2.0	kvar/Mvar	kvarh Q2 cumulative maximum demand, total
6.2.1-6.2.8	kvar/Mvar	kvarh Q2 cumulative maximum demand, tariff 1-8
7.2.0	kvar/Mvar	kvarh Q3 cumulative maximum demand, total
7.2.1-7.2.8	kvar/Mvar	kvarh Q3 cumulative maximum demand, tariff 1-8
8.2.0	kvar/Mvar	kvarh Q4 cumulative maximum demand, total
8.2.1-8.2.8	kvar/Mvar	kvarh Q4 cumulative maximum demand, tariff 1-8
9.2.0	kVA/MVA	kVA cumulative maximum demand, total
9.2.1-9.2.8	kVA/MVA	kVA cumulative maximum demand, tariff 1-8
9.2.0	kVA/MVA	kVAh import cumulative maximum demand, total
9.2.1-9.2.8	kVA/MVA	kVAh import cumulative maximum demand, tariff 1-8
10.2.0	kVA/MVA	kVAh export cumulative maximum demand, total
10.2.1-10.2.8	kVA/MVA	kVAh export cumulative maximum demand, tariff 1-8

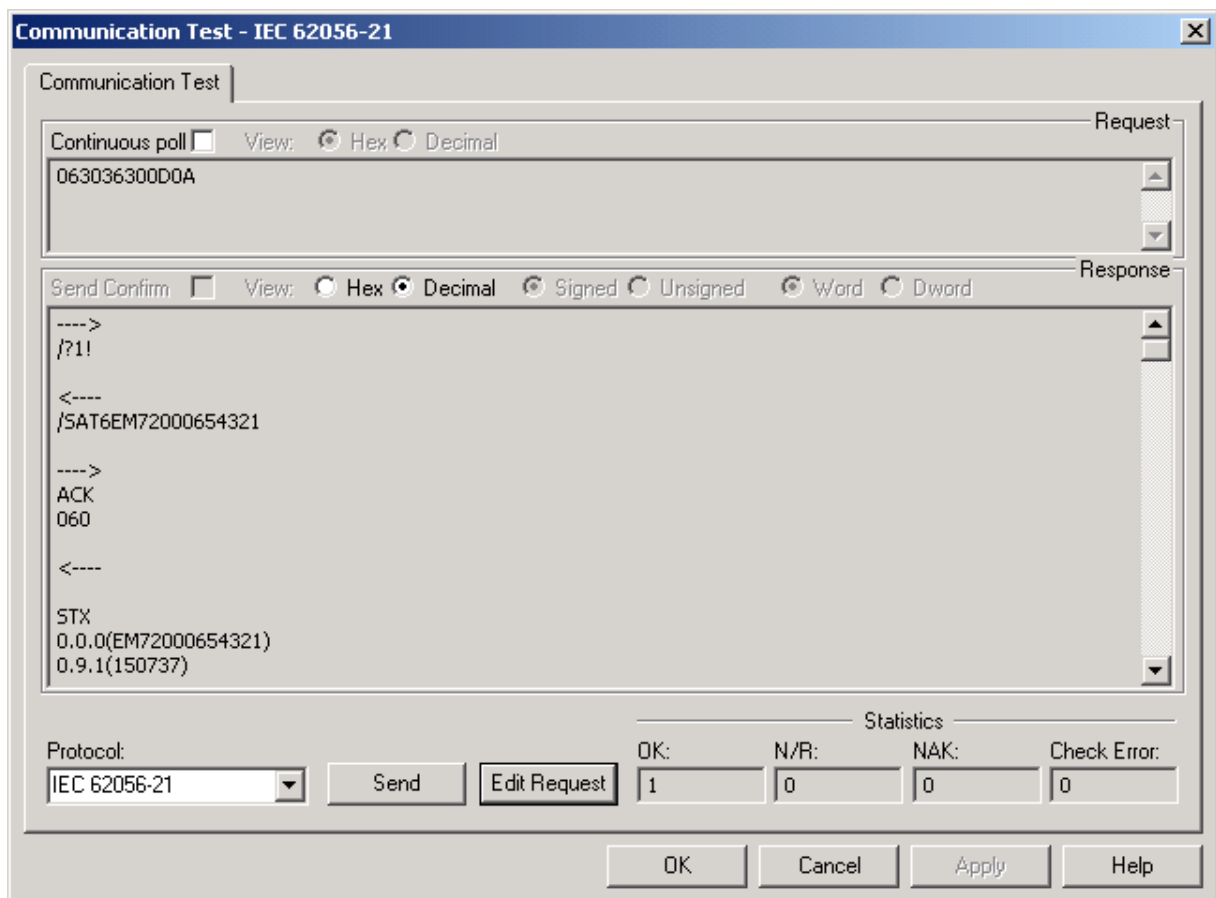
## 3 IEC 62056-21 Communication via PAS

You can use the PAS software provided with your meter to check IEC 62056-21 responses. You can also use PAS for retrieving and storing the IEC 62056-21 readout data to an ASCII file. See the EM720 Operation Manual for more information on installation and operating PAS on your computer.

### 3.1 Running Communication Test

IEC 62056-21 communications is available via the PAS Communication Test. To run the Communication Test in IEC 62056-21 mode:

1. Connect a meter IEC 62056-21 port to your computer. Refer to the EM720 Installation Manual for information on communication connections.
2. Create a device site for your meter in PAS. See Creating a New Site in Chapter 4 of the EM720 Operation Manual for information on configuring devices in PAS.
3. Configure your PC IEC 62056-21 port in PAS for a compatible baud rate. See Setting Up Communications in Chapter 4 of the EM720 Operation Manual on configuring communications in PAS.
4. Select your meter's device site from the list box on the PAS toolbar.
5. Ensure that the On-line button on the PAS toolbar is unchecked.
6. Select Communication Test from the Monitor menu.
7. Select IEC 62056-21 in the Protocol box.

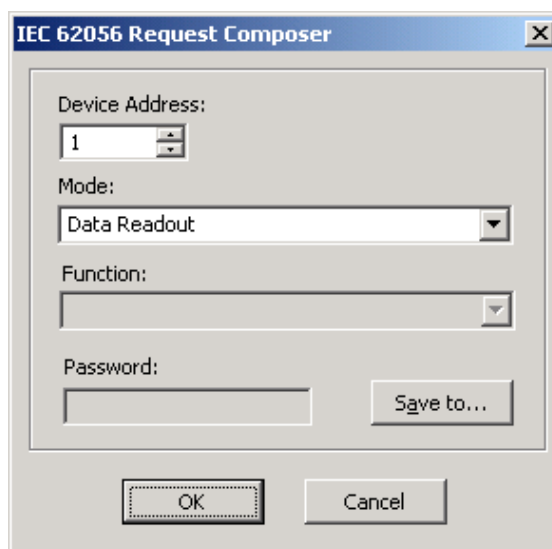




## 3.2 Getting Readout Data

To receive the IEC 62056-21 readout data from your meter:

1. Click on the Edit Request button to open the IEC 62056-21 request composer dialog.



2. Select your meter's device address.
3. Select Data Readout in the Mode box.
4. If you wish to save the readout data to an ASCII file, click Save to..., select a folder where you want to save it, type the file name, and click Save.
5. Click OK to close the request composer window.
6. Click Send to send your request to the meter.

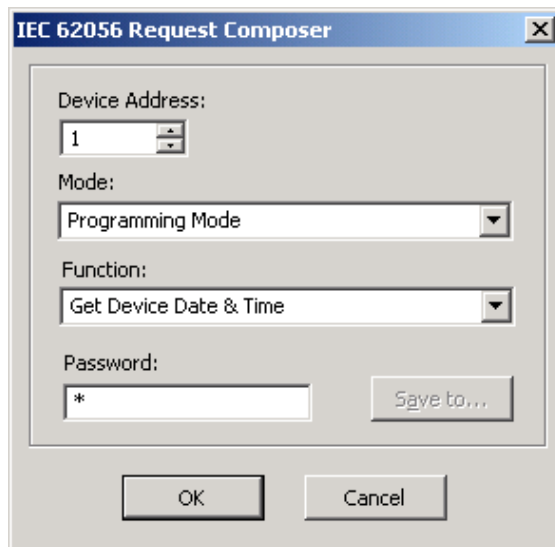
Check the Hex button if you wish to see a hexadecimal message printout.

See Appendix for a readout data exchange example. If you selected to save data to a file, the retrieved ASCII-coded data will be stored to the file.

## 3.3 Getting and Setting Date and Time

To read or update the meter clock:

1. Click on the Edit Request button to open the IEC 62056-21 request composer dialog.
2. Select your meter's device address.
3. Select Programming Mode in the Mode box.
4. In the Function box, select Get Device Date & Time to read, or Set Device Date & Time to update the device date and time.
5. Type your device password.
6. Click OK to close the request composer window.
7. Click Send to send your request to the meter.



See Appendix for the data exchange examples.

If the Set Device Date & Time function is selected, PAS sends the present PC time to the meter.

# Appendix Data Exchange Examples

The following paragraphs give examples of data exchange between a master computer and the EM720 in data readout mode and in programming mode.

Arrows indicate the transmission direction: master ----> meter, master <---- meter. Characters following ETX represent a block check character (BCC). For better readability, message components are shown separated by a space.

## Data Readout

The following printout shows a typical EM720 readout response for a device with 4 configured billing registers (kWh import and export, kvarh import and export) and 3 tariffs. Data rows are terminated with two ASCII characters CR LF (not shown in the example).

```
---->
/?!

<----
/SAT6EM72000656621

---->
ACK
060

<----
STX
0.0.0(EM72000656621)
0.9.1(172751)
0.9.2(100209)
1.8.0(343642.9*kWh)
2.8.0(1958.9*kWh)
3.8.0(120.7*kvarh)
4.8.0(7068.5*kvarh)
1.6.0(18014*kW)(10-02-01 00:15)
2.6.0(0*kW)(10-02-01 00:15)
3.6.0(186*kvar)(10-02-01 00:15)
4.6.0(366*kvar)(10-02-01 00:15)
1.2.0(275663*kW)
2.2.0(2158*kW)
3.2.0(54*kvar)
4.2.0(5683*kvar)
1.8.1(150967.3*kWh)
1.8.2(104673.3*kWh)
1.8.3(88002.3*kWh)
2.8.1(1958.9*kWh)
2.8.2(0.0*kWh)
2.8.3(0.0*kWh)
3.8.1(55.1*kvarh)
3.8.2(2.8*kvarh)
3.8.3(62.8*kvarh)
4.8.1(3125.7*kvarh)
4.8.2(2140.7*kvarh)
4.8.3(1802.1*kvarh)
1.6.1(0*kW)(10-02-01 00:00)
1.6.2(0*kW)(10-02-01 00:00)
1.6.3(18014*kW)(10-02-01 00:15)
2.6.1(0*kW)(10-02-01 00:00)
2.6.2(0*kW)(10-02-01 00:00)
2.6.3(0*kW)(10-02-01 00:15)
3.6.1(0*kvar)(10-02-01 00:00)
3.6.2(0*kvar)(10-02-01 00:00)
3.6.3(186*kvar)(10-02-01 00:15)
4.6.1(0*kvar)(10-02-01 00:00)
```

4.6.2(0\*kvar)(10-02-01 00:00)  
4.6.3(366\*kvar)(10-02-01 00:15)  
1.2.1(275663\*kW)  
1.2.2(0\*kW)  
1.2.3(0\*kW)  
2.2.1(2158\*kW)  
2.2.2(0\*kW)  
2.2.3(0\*kW)  
3.2.1(54\*kvar)  
3.2.2(0\*kvar)  
3.2.3(0\*kvar)  
4.2.1(5683\*kvar)  
4.2.2(0\*kvar)  
4.2.3(0\*kvar)  
0.1.2\*01(10-02-01 00:00)  
1.8.0\*01(320695.7\*kWh)  
2.8.0\*01(1958.9\*kWh)  
3.8.0\*01(49.4\*kvarh)  
4.8.0\*01(6599.6\*kvarh)  
1.6.0\*01(275663\*kW)(10-01-03 19:15)  
2.6.0\*01(2158\*kW)(10-01-03 19:15)  
3.6.0\*01(54\*kvar)(10-01-03 19:15)  
4.6.0\*01(5683\*kvar)(10-01-03 19:15)  
1.2.0\*01(0\*kW)  
2.2.0\*01(0\*kW)  
3.2.0\*01(0\*kvar)  
4.2.0\*01(0\*kvar)  
1.8.1\*01(141503.7\*kWh)  
1.8.2\*01(97883.8\*kWh)  
1.8.3\*01(81308.2\*kWh)  
2.8.1\*01(1958.9\*kWh)  
2.8.2\*01(0.0\*kWh)  
2.8.3\*01(0.0\*kWh)  
3.8.1\*01(46.6\*kvarh)  
3.8.2\*01(2.8\*kvarh)  
3.8.3\*01(0.0\*kvarh)  
4.8.1\*01(2932.0\*kvarh)  
4.8.2\*01(2002.2\*kvarh)  
4.8.3\*01(1665.4\*kvarh)  
1.6.1\*01(275663\*kW)(10-01-03 19:15)  
1.6.2\*01(0\*kW)(10-01-01 00:00)  
1.6.3\*01(0\*kW)(10-01-01 00:00)  
2.6.1\*01(2158\*kW)(10-01-03 19:15)  
2.6.2\*01(0\*kW)(10-01-01 00:00)  
2.6.3\*01(0\*kW)(10-01-01 00:00)  
3.6.1\*01(54\*kvar)(10-01-03 19:15)  
3.6.2\*01(0\*kvar)(10-01-01 00:00)  
3.6.3\*01(0\*kvar)(10-01-01 00:00)  
4.6.1\*01(5683\*kvar)(10-01-03 19:15)  
4.6.2\*01(0\*kvar)(10-01-01 00:00)  
4.6.3\*01(0\*kvar)(10-01-01 00:00)  
1.2.1\*01(0\*kW)  
1.2.2\*01(0\*kW)  
1.2.3\*01(0\*kW)  
2.2.1\*01(0\*kW)  
2.2.2\*01(0\*kW)  
2.2.3\*01(0\*kW)  
3.2.1\*01(0\*kvar)  
3.2.2\*01(0\*kvar)  
3.2.3\*01(0\*kvar)  
4.2.1\*01(0\*kvar)  
4.2.2\*01(0\*kvar)  
4.2.3\*01(0\*kvar)  
0.1.2\*02(10-01-01 00:00)  
1.8.0\*02(230481.9\*kWh)  
2.8.0\*02(1958.9\*kWh)  
3.8.0\*02(46.0\*kvarh)  
4.8.0\*02(4728.0\*kvarh)  
1.6.0\*02(0\*kW)(09-12-01 00:00)

2.6.0\*02(0\*kW)(09-12-01 00:00)  
3.6.0\*02(0\*kvar)(09-12-01 00:00)  
4.6.0\*02(0\*kvar)(09-12-01 00:00)  
1.2.0\*02(0\*kW)  
2.2.0\*02(0\*kW)  
3.2.0\*02(0\*kvar)  
4.2.0\*02(0\*kvar)  
1.8.1\*02(105851.0\*kWh)  
1.8.2\*02(68334.5\*kWh)  
1.8.3\*02(56296.4\*kWh)  
2.8.1\*02(1958.9\*kWh)  
2.8.2\*02(0.0\*kWh)  
2.8.3\*02(0.0\*kWh)  
3.8.1\*02(46.0\*kvarh)  
3.8.2\*02(0.0\*kvarh)  
3.8.3\*02(0.0\*kvarh)  
4.8.1\*02(2179.5\*kvarh)  
4.8.2\*02(1396.7\*kvarh)  
4.8.3\*02(1151.8\*kvarh)  
1.6.1\*02(0\*kW)(09-12-01 00:00)  
1.6.2\*02(0\*kW)(09-12-01 00:00)  
1.6.3\*02(0\*kW)(09-12-01 00:00)  
2.6.1\*02(0\*kW)(09-12-01 00:00)  
2.6.2\*02(0\*kW)(09-12-01 00:00)  
2.6.3\*02(0\*kW)(09-12-01 00:00)  
3.6.1\*02(0\*kvar)(09-12-01 00:00)  
3.6.2\*02(0\*kvar)(09-12-01 00:00)  
3.6.3\*02(0\*kvar)(09-12-01 00:00)  
4.6.1\*02(0\*kvar)(09-12-01 00:00)  
4.6.2\*02(0\*kvar)(09-12-01 00:00)  
4.6.3\*02(0\*kvar)(09-12-01 00:00)  
1.2.1\*02(0\*kW)  
1.2.2\*02(0\*kW)  
1.2.3\*02(0\*kW)  
2.2.1\*02(0\*kW)  
2.2.2\*02(0\*kW)  
2.2.3\*02(0\*kW)  
3.2.1\*02(0\*kvar)  
3.2.2\*02(0\*kvar)  
3.2.3\*02(0\*kvar)  
4.2.1\*02(0\*kvar)  
4.2.2\*02(0\*kvar)  
4.2.3\*02(0\*kvar)  
0.1.2\*03(09-12-01 00:00)  
1.8.0\*03(160737.9\*kWh)  
2.8.0\*03(1958.9\*kWh)  
3.8.0\*03(46.0\*kvarh)  
4.8.0\*03(3299.5\*kvarh)  
1.6.0\*03(0\*kW)(09-11-01 00:00)  
2.6.0\*03(0\*kW)(09-11-01 00:00)  
3.6.0\*03(0\*kvar)(09-11-01 00:00)  
4.6.0\*03(0\*kvar)(09-11-01 00:00)  
1.2.0\*03(0\*kW)  
2.2.0\*03(0\*kW)  
3.2.0\*03(0\*kvar)  
4.2.0\*03(0\*kvar)  
1.8.1\*03(78592.2\*kWh)  
1.8.2\*03(43985.4\*kWh)  
1.8.3\*03(38160.3\*kWh)  
2.8.1\*03(1958.9\*kWh)  
2.8.2\*03(0.0\*kWh)  
2.8.3\*03(0.0\*kWh)  
3.8.1\*03(46.0\*kvarh)  
3.8.2\*03(0.0\*kvarh)  
3.8.3\*03(0.0\*kvarh)  
4.8.1\*03(1621.3\*kvarh)  
4.8.2\*03(898.1\*kvarh)  
4.8.3\*03(780.1\*kvarh)  
1.6.1\*03(0\*kW)(09-11-01 00:00)

```

1.6.2*03(0*kW)(09-11-01 00:00)
1.6.3*03(0*kW)(09-11-01 00:00)
2.6.1*03(0*kW)(09-11-01 00:00)
2.6.2*03(0*kW)(09-11-01 00:00)
2.6.3*03(0*kW)(09-11-01 00:00)
3.6.1*03(0*kvar)(09-11-01 00:00)
3.6.2*03(0*kvar)(09-11-01 00:00)
3.6.3*03(0*kvar)(09-11-01 00:00)
4.6.1*03(0*kvar)(09-11-01 00:00)
4.6.2*03(0*kvar)(09-11-01 00:00)
4.6.3*03(0*kvar)(09-11-01 00:00)
1.2.1*03(0*kW)
1.2.2*03(0*kW)
1.2.3*03(0*kW)
2.2.1*03(0*kW)
2.2.2*03(0*kW)
2.2.3*03(0*kW)
3.2.1*03(0*kvar)
3.2.2*03(0*kvar)
3.2.3*03(0*kvar)
4.2.1*03(0*kvar)
4.2.2*03(0*kvar)
4.2.3*03(0*kvar)
!
ETX
v

```

## Programming Mode

The following printouts give examples of reading and updating the device date and time in programming mode. The default password of 9 is used.

### Get Device Date and Time

```

---->
/?1!

<----
/SAT6EM72000654321

---->
ACK 061

<----
SOH P0 STX ( ) ETX V

---->
SOH P1 STX (9) ETX _

<----
ACK

---->
SOH R1 STX 0.9.1( ) 0.9.2( ) ETX .

<----
STX (174635) (100209) ETX /

---->
SOH B0 ETX u

```

### Set Device Date and Time

```

---->
/?1!

```

<-----  
/SAT6EM72000654321

----->  
ACK 061

<-----  
SOH P0 STX ( ) ETX V

----->  
SOH P1 STX (9) ETX \_

<-----  
ACK

----->  
SOH W1 STX 0.9.1(175000) 0.9.2(100209) ETX \_

<-----  
ACK

----->  
SOH B0 ETX u