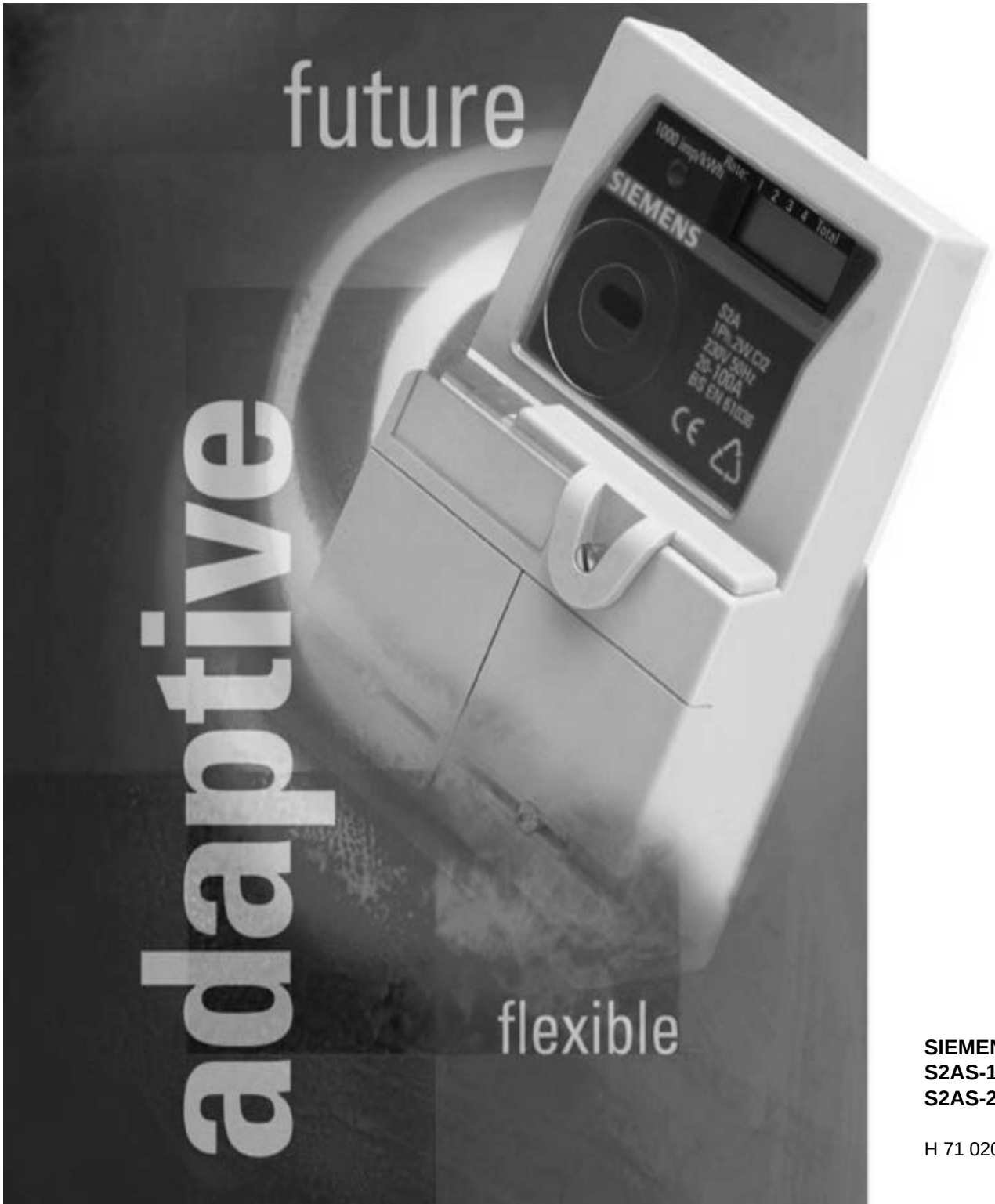
SIEMENS

S2AS-100 / 200

Solid state single phase meter

User manual



SIEMENS
S2AS-100
S2AS-200

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Revision history

Information about document indexes, revision and corrections carried out respectively.

Index	Date	Name/phone	Comments
-	17.09.1999	D. Opitz - 2892	First issue

Introduction

Range of validity

The present user manual applies to the basic version of the meters:

- **S2AS-100** (for single phase two wire system with installer switch)
- **S2AS-200** (for single phase two wire system without inst. switch)

Explanations without specific type details apply to both types.

Purpose

The user manual contains all the information required for application of the meters for the intended purpose. This includes:

- Provision of knowledge concerning characteristics, construction and function of the meters
- Information about possible dangers, their consequences and measures to prevent any danger
- Details concerning the performance of all work throughout the service life of the meters (parametrizing, installation, commissioning, operation, maintenance, shutting down and disposal)

Target group

The contents of this user manual are intended for technically qualified personnel of energy supply companies responsible for the system planning, installation and commissioning, operation, maintenance, decommissioning and disposal of the meters.

Conditions

The user of this manual has received instruction in basic electrical principles, in particular the various principal types of circuit for energy measurement.

Subdivision

This user manual is divided in a logical manner suitable for learning and application, i.e. the individual chapters follow the sequence of information probably required during the various phases of the service life of the meters. This provides the following structure:

- Chapter 1 Description of unit
- Chapter 2 Safety
- Chapter 3 Construction and Function
- Chapter 4 Control elements and displays
- Chapter 5 Programming / Interrogation Interface
- Chapter 6 Installation and commissioning
- Chapter 7 Data readout
- Chapter 8 Metering testing
- Chapter 9 Detection of faults
- Chapter 10 Decommissioning, disposal

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1 Description of unit

1.1 Review

1.1.1 General Review

View of meter:

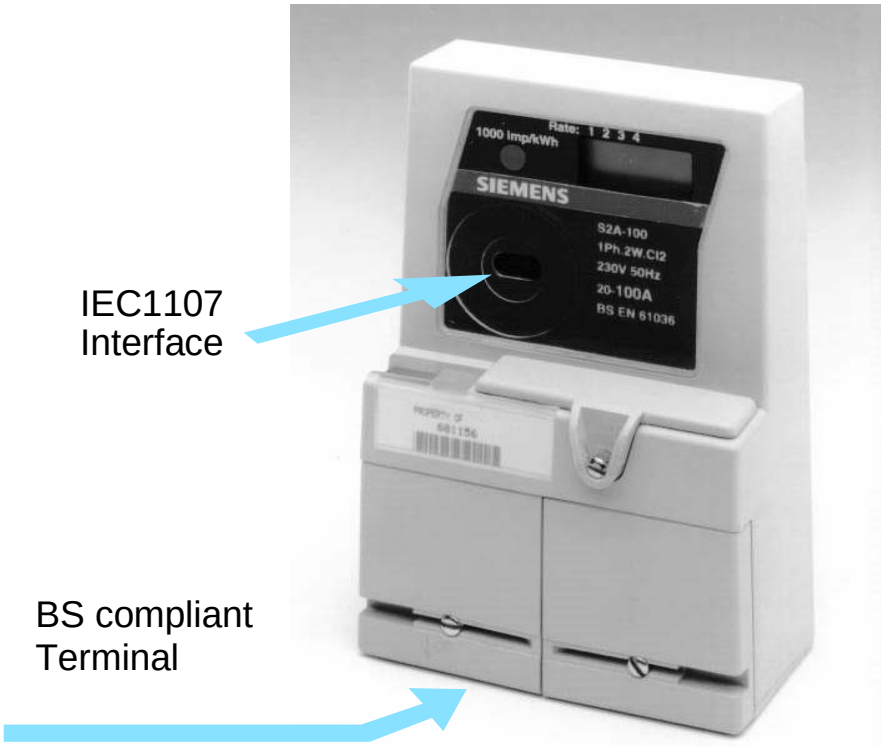


Fig.1 General view of meter

Residential metering

The S2AS meters form a family of solid state single phase meters to cover the whole range of residential metering applications. Single or two rate register, pulse output and communcation interface according IEC 1107. The meters can be used for currents up to 100 A.

The meter is equipped with features to enable the detection of fraud attempts. The meter has a reverse energy register as well as a register recording the number of power-on hours it sees.

A unique feature is the low power consumption which helps to reduce the network losses

Modular design

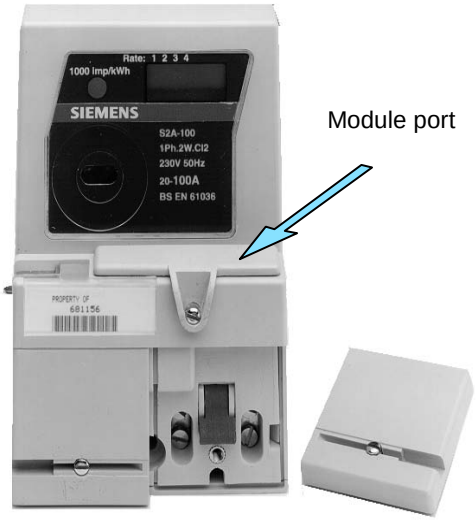
The meter fulfils the requirements of today's metering practice, while the design concept is already prepared to cope with tomorrow's needs in a fully liberalised market. Future requirements can be realised in the form of external circuits incorporated in a module unit that can be adapted to the basic meter (adaptive meter concept).

Case

The meter is housed in a polycarbonate case designed for the easy fitting of add-on modules. Through its small size and low weight the S2AS meter saves costs in logistics.

1.1.2 Type designation

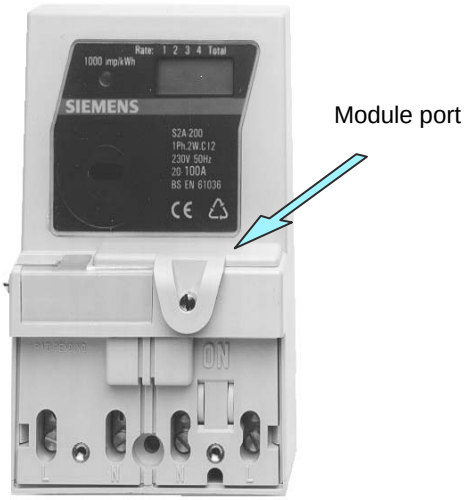
S2AS-100



Meter with installer switch
The installer switch allows the supply to the premises to be disconnected without drawing the main fuse or disconnecting cables

S2AS-200

Meter without installer switch



1.2 Technical Data

1.2.1 Voltage Values

Rated Voltage

- Nominal as per IEC 61036..... 230V ± 10%
- Range for mains input voltages ..... 0.8 up to 1.15 x Un

Note:

1. The meter is fully operational within 4 seconds of the application of a voltage supply in the above range
2. The meter will power down and inhibit all operations if the mains voltage falls below 150VAC.
3. Between ISO V and 184 V operation is not guaranteed, however the meter will not malfunction, corrupt stored data or register spurious consumption and will power up or down cleanly once the mains input voltage rises above or below these values.
4. The requirements specified in 2 and 4 above, are independent of the rate of change of the mains input voltage.
5. The meter will remain operational for mains voltage interruptions of up to 0.2 seconds. For interruptions of greater than 0.2 seconds, the meter may power down and up again but shall do so without malfunction, corrupting data or registering spurious electricity consumption.

1.2.2 Current Values

Basic current Ib .....either 10A or 20A

Maximum Current Imax.....either 80A or 100A

Maximum measuring range.....up to 120A without exceeding 5% error

Creep inhibit circuit operating .....at approximately 40mA

Note: Current sensing is by means of a shunt.

1.2.3 Frequency values

Rated frequency 50Hz

1.2.4 Power Consumption

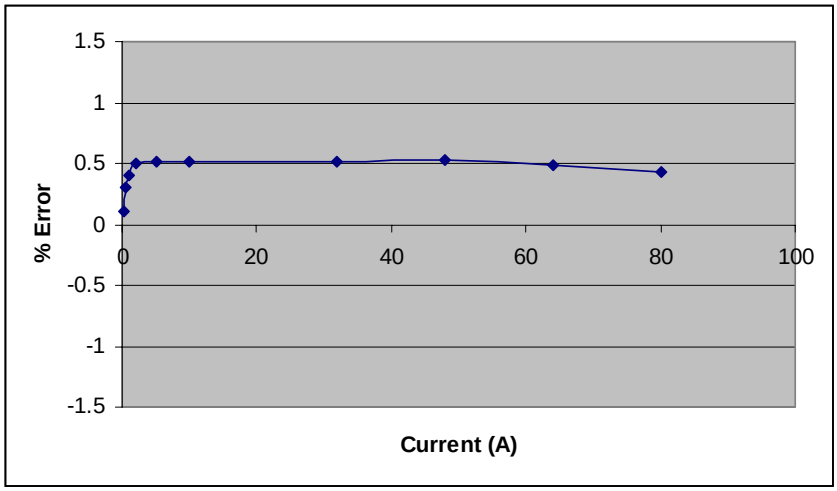
- voltage circuit burden ..... less than 0.5W and 9VA. Typically 0.4 W
- VA burden of the current circuit at Imax .....less than 0.25W / 0.25 VA

1.2.5 Measuring accuracy

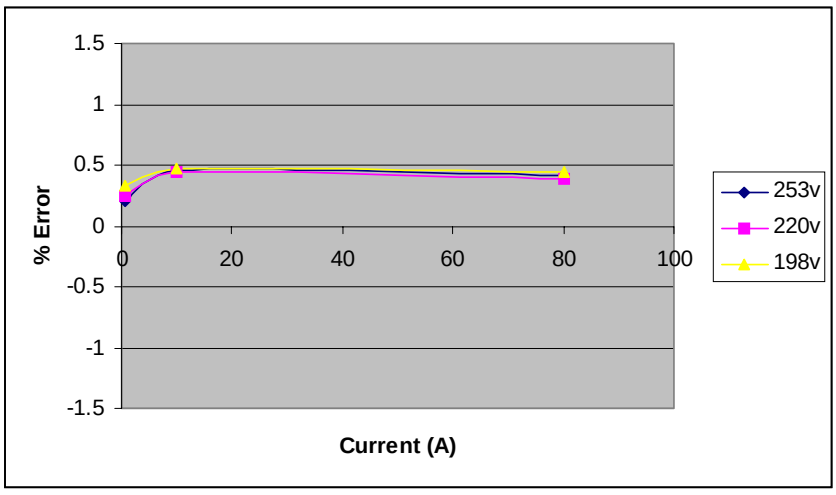
Accuracy

- Accuracy class to IEC 61036 ..... class 2

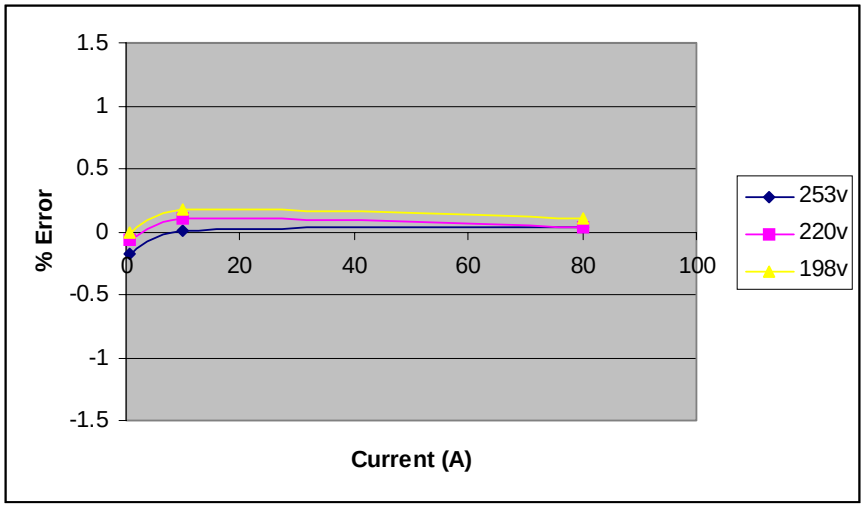
Unity Power Factor at 20°C environmental temperature



Unity power factor



Power Factor = 0.5 Lagging



1.2.6 External influences

Temperature range

- Operation ..... -10 °C to +45 °C
- Storage ..... -25 °C to +70 °C

Temperature Coefficient

Current (A)	PF	Mean Temp Coefficient %/K
1	1	-0.009
2	0.5	-0.016
10	1	-0.015
10	0.5	-0.0019
80	1	-0.016
80	0.5	-0.005

Insulation requirements class 2 ..... 4kV*

(*withstand capability between the voltage and current terminals, including the auxiliary terminals and all metal/conductive parts which the consumer can touch)

Climatic / Type Approval .....according to IEC 61036 and OFFER*

*(UK Office of the Electricty Regulator) additional requirements for type approval of certified meters and indoor meters

Electromagnetic compatibility

- Electrostatic discharges ..... to IEC 61000-4-2
  - Contact discharges ..... 8 kV
- Electromagnetic high frequency fields ..... to IEC 61000-4-2
  - 27 MHz up to 500 MHz ..... at least 10 V per m
  - 100 kHz up to 1 GHz ..... typical 30 V per m
- Line transients ..... to IEC 61000-4-
  - for current and voltage circuits ..... 2 kV
  - for auxiliary circuits > 40 V ..... 1 kV
- Radio interference suppression ..... to IEC/CISPR 22 class B

1.2.8 Output Values

Display

- Type ..... liquid crystal display LCD
- Digit size 6mm
- Number of positions 8

The S0 pulse output

- Pulse rise/fall time ..... ≤ 5mS
- Mark duration ..... ≥ 80mS
- Space duration ..... ≥ 30mS
- Maximum open circuit voltage 27V
- Pulse Scaling ..... 1‘000 Pulses/kWh
- Current 27mA
- Pulse length 280ms
- Maximum line length ..... 0.5 m

Note: It is available on two auxiliary terminals on the bottom of the S2AS-100 version of the meter. Note that these output terminals are polarised.

1.2.9 Opto- Interface according IEC 1107

Programming / Interrogation Interface (“Opto Port”)

- Type ..... bi-directional communication interface
- Standard ..... protocol complying with IEC 61107

Subsequent communication at >4800 baud may be utilised by add-on modules.

- Opining rate .....C-a and C-b with 300 baud
- Subsequent rate by use of add on modules .....> 4800 baud
- Application .....
  - tariff programming and meter interrogation
  - reading communication

1.2.10 Dimensions

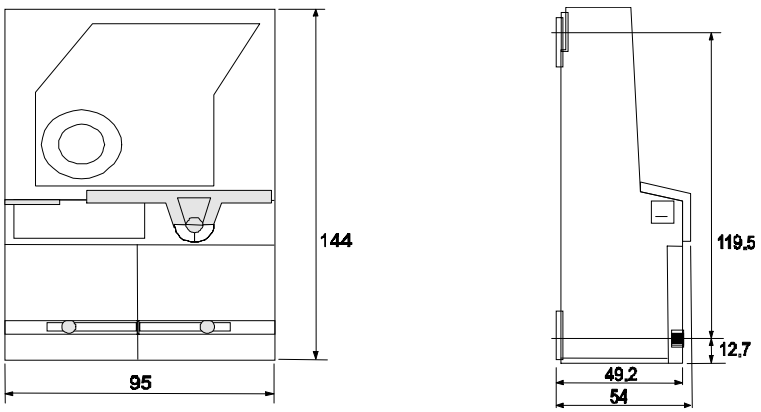
Weight.....450 g

External Dimensions .....

- Width.....95 mm
- Heigth .....144 mm
- Depth .....54 mm

Suspension .....

- Heigth .....119.5 mm
- Width.....47.5 mm



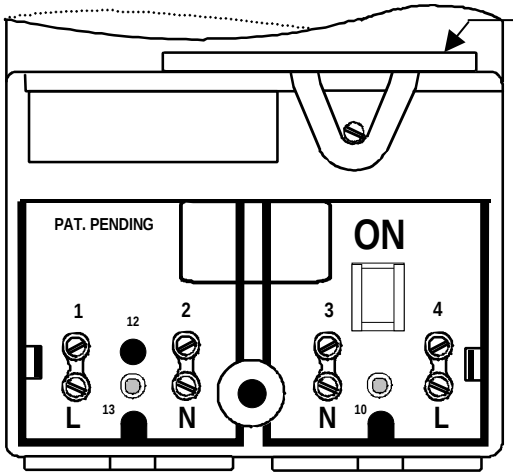
Normal configuration: short split terminal door
Option available with long terminal door

1.2.11 Connections

Terminals

- Type ..... screw type terminals
- Diameter normal..... 8.5 mm
  special ..... 9.5 mm
- Screw dimensions ..... M6 x 14
  - head diameter ..... max. 6.6 mm
  - cross-slot ..... type Z, size 2, to ISO-4757-1983
  - slot ..... 0.8 +0.2/+0.06 mm
- Tightening torque .....max. 3 Nm

Terminal block front view



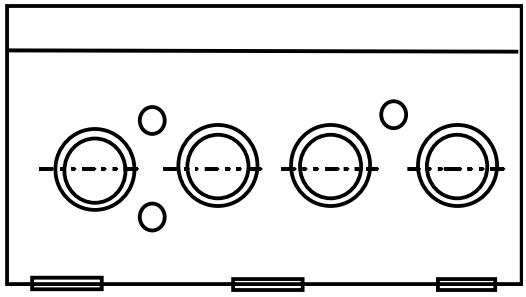
Module port

The module port provides line and neutral connections for the supply to the external module.

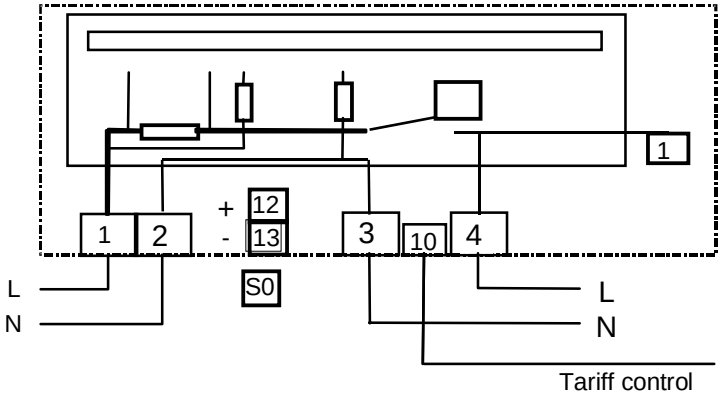
The module port power consumption will be recorded by the meter.

The acces could be proteted by a lead or a brass seal.

Terminal block below view



Connection diagram



2 Safety

2.1 Safety information

Attention is drawn as follows in the individual chapters of this user manual with classified word symbols and pictographs to the relevant danger level, i.e. the severity and probability of any danger:

WARNING For a possibly dangerous situation, which could result in severe physical injury or fatality.

CAUTION For a possibly dangerous situation, which could result in minor physical injury or material damage.

NOTE For a possibly dangerous situation, in which the product or an article in its environment could be damaged and for general details and other useful information to simplify the work.

In addition to the danger level, all safety information also describes the type and source of the danger, its possible consequences and measures to counteract the danger.

2.2 Responsibilities

The owner of the meters – normally the power supply company – is responsible that all persons engaged on work with meters:

1. Have read and understood the relevant sections of the user manual.
2. Are sufficiently qualified for the work to be performed.
3. Strictly observe the safety regulations (according to section 0) and the operating information in the individual chapters.

In particular, the owner of the meters bears responsibility for the protection of persons, prevention of material damage and the training of personnel (Siemens Metering Ltd. provides training courses for this purpose on specific equipment; please contact the relevant agent if interested).

2.3 Safety regulations

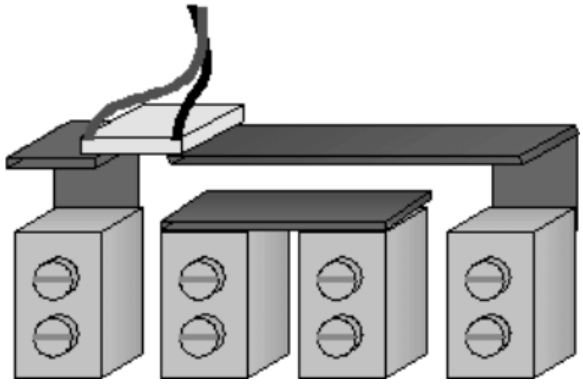
The following safety regulations must be observed at all times:

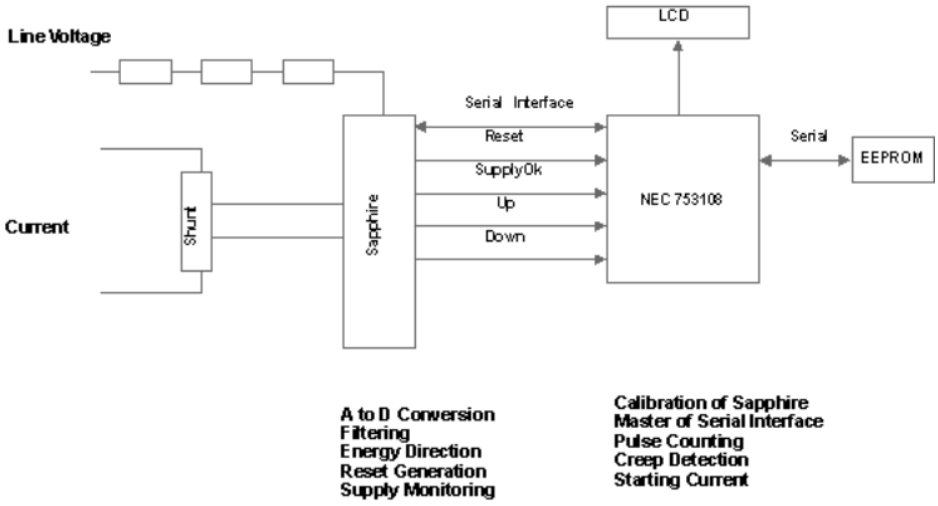
- The meter connections must not be under voltage during installation or when opening. Contact with live parts is dangerous to life. The relevant preliminary fuses should therefore be removed and kept in a safe place until the work is completed, so that other persons cannot replace them unnoticed.
- Local safety regulations must be observed. Installation of the meters must be performed exclusively by technically qualified and suitably trained personnel.
- The meters must be held securely during installation. They can cause injuries if dropped.
- Meters which have fallen must not be installed, even if no damage is apparent, but must be returned for testing to the service and repair department responsible (or the manufacturer). Internal damage can result in functional disorders or short-circuits.
- The meters must on no account be cleaned with running water or with high pressure devices. Water penetrating can cause short-circuits.

3 Construction and Function

3.1 Metering Principle

The metering principle is composed of two major items, the shunt and the 'Sapphire' ASIC. The shunt is used to sense the current flowing through the meter and the signal form, together with a voltage signal is fed into the ASIC which then calculates the instantaneous power.





The use of the ASIC together with a majority of Surface Mounted Devices enables a high level of integration to be achieved. These factors are crucial to provide a meter of high accuracy and high reliability.

3.2 Reset and Initialisation

The meter does not use any battery back up of RAM, so in order to protect data during power loss, information is stored in EEPROM memory. Data is only held in RAM during mains operation and is transferred to non-volatile memory on either specified changes or at Power down.

Error detection and correction techniques are implemented to enable data recovery in the event of partial memory failure.

3.2.1 Normal Reset

The normal initialisation procedure will be divided broadly into two parts, dependent whether the restart is from a break in power or as a result of a reset pulse only (e.g. watchdog reset or false reset due to noise).

On Power - Up

The meter monitors the supplies at power - up and commences metering within 4 seconds of application of power within operating limits.

An hour counter is registering the operating time of the meter. This counter is zeroed during product initialisation and is incremented at the end of each hour. The register has a 20 year capacity before overflow.

The active rate, as determined by the external contact, current rate register and pulse register are restored from EEPROM and verified.

The meter begins its Creep test, if enabled by the tariff software. The LED is turned ON and the Creep annunciator shall flash until a meter pulse has been detected.

On False Reset

A processor reset does not affect RAM. There is no need to re-initialise data as above.

The processor keeps track of false resets

3.3 Power Down Operation

The presence of power to the unit is indicated by more than three voltage peaks in a period. When the unit detects power failure, the meter will enter the Power-Down routine. The purpose of this routine is to ensure that all critical data is stored safely in EEPROM, record power loss, false reset data and power up hours.

Once the supply has been detected as removed, an on-board capacitor provides sufficient power to allow the meter to continue to operate for long enough for the meter to,

Turn off all current consuming devices, including LED and display.

Any outstanding writes to non-volatile memory are completed.

The critical registers and information are saved to EEPROM.

When the power returns, the processor will follow the normal power-up process.

3.4 Memory Access

The following areas of the meter are accessible, with appropriate access security mechanisms, via the IEC1107 interface.

1. Microprocessors RAM (read)
2. Microprocessors RAM (write - selected areas)
3. Non-volatile memory (read)
4. Non-volatile memory (write - selected areas)

Access security is enforced as follows:

1. All write accesses are protected by a security algorithm specific to the meter.
2. Writing to energy registers is not possible and is protected by a locking mechanism.
3. Areas such as the calibration table are protected by software locks which are locked following factory calibration. Software locks may only be locked via the programming interface, never unlocked.
4. It is also possible to inhibit the write facility to

- all addresses (read only mode)
- all addresses except the active rate selection

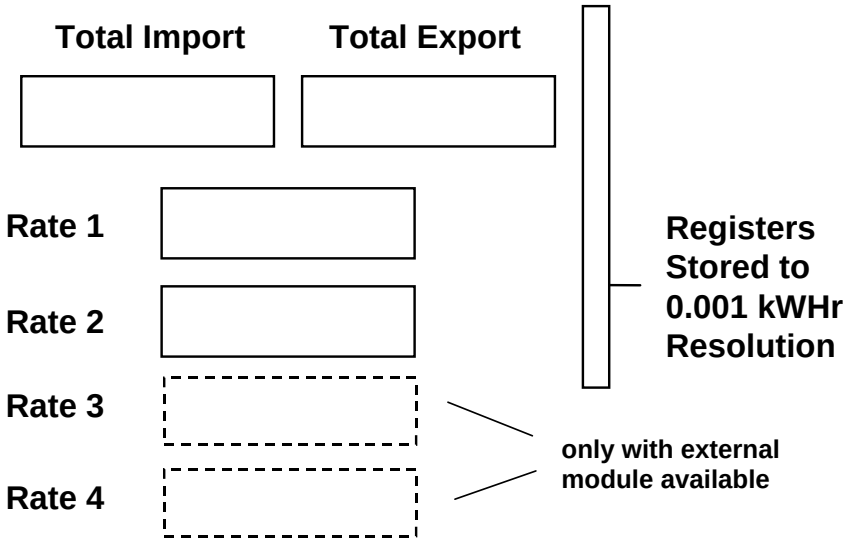
These 2 instances cover the requirement that meter definition (single rate, double rate) shall not be modified once the meter has been certified.

3.5 Metering

The meter accumulates energy into the active rate, total and profiling registers. Each register is maintained to 1/1000 kWh.

3.5.1 Register Model

The following diagram illustrates the register model for the meter, indicating the main readings available to the customer.



3.5.2 Auxiliary input terminal

The maximum input current on the rate change auxiliary input terminal is 80mA. The maximum peak reverse voltage is 500VAC.

Inputs are ignored until stable for 500ms ≅ milli seconds (i.e. 500ms of continuous application of the input waveform or 500mS of continuous non-application of the input waveform is required).

WARNING

For S2AS-100 and S2AS-200, in order to ensure correct activation of the switched rate, the AC waveform applied to the two rate switching terminal must be in phase with the circuit which the meter is measuring.i.e. If the meter is measuring Red phase, it **must** be switched by red phase voltage.

In addition the meter must be programmed for external rate switching as opposed to software rate selection.

3.5.3 Total Register

A “total register“ holds the total accumulation of all the rate registers. This is a separate register - not a calculated register. There are, in fact, two separate total registers - one for import energy and one for export energy. An option in the tariff software allows export energy to be added and displayed to the forward total (or Import) register. In all cases, the export and import registers are physically maintained separately.

The resolution of the total register is 9 decimal digits, but only 6 may be displayed at a time. The number of decimal places displayed is programmable as 0, 1 or 2. If no decimal are displayed, only 5 full digits can be displayed on the LCD for the S2AS-100 and S2AS-200.

3.5.4 Active Rate selection

The active rate selection is via an external contact or via the module communications interface.

3.6 Configuration File

The meter configuration file is a collection of data that determines the operation of the user alterable options in the meter. These include the following,

- Reverse detect enable
- Creep detection
- Display format
- Display sequence
- Preferred baud rate
- Leading zero blanking

4 Control elements and displays

4.1 LCD Display

4.1.1 Display specification

The display consists of a number of annunciators and six seven segment displays.

The display cycles round all the displays that are enabled. The rate of cycling of each display item is programmable in 1 second steps up to 16 seconds per display item.

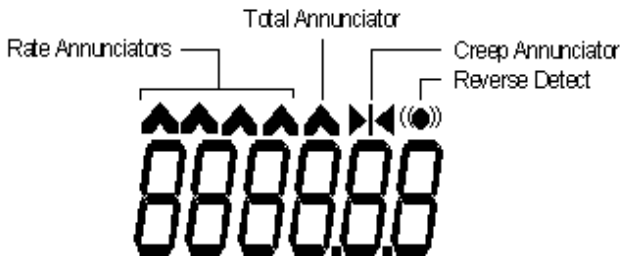
Upon the application of power to the meter, the start up display sequence is initiated. After 30 minutes the display sequence reverts to the Normal display sequence. The display items and cycling rates of the startup and normal displays, are separately programmable via the configuration software.

The annunciators indicate which rate register is currently being viewed.

A custom liquid crystal display provides all user information. No user input is required. The LCD display consists of a 6 digit seven segment display and several annunciators.

A table controlling the display sequence is stored in EEPROM as part of the meter configuration and can be made programmable via the opto-port. It can also be locked so that a meter is delivered into a non modifiable configuration (one or double rate, etc.). This table contains a list of the display options selected for that meter configuration.

A variety of information is presented on the LCD display. Some parameters are shown digitally while others are indicated by means of annunciator symbols



4.1.2 Normal Displays

Displays of register contents etc. are shown using a six digit display. Annunciator chevrons situated above the display indicate which rate or Total register is currently displayed.

The order of the displays can be made programmable.

Leading zeroes may be suppressed if desired.

Register Displays

These consist of the total and 4 rate register displays. Each register may be enabled individually. A two Rate meter could thus use any combination of the 4 rate registers (e.g. 1 and 2 or 1 and 4).

The active rate is indicated by a flashing chevron with a 0.5 second period, while the corresponding register is being displayed.

The number of digits (5 or 6) and decimal points (0,1 or 2) is programmable using the configuration software. Please note that if no decimal point is displayed, only 5 digits can be displayed for the S2AS-100 and S2AS-200.

4.1.3 Dial Checks

For dial checks, the resolution of all registers may be programmed to two decimal places.

4.1.4 Annunciators

Rate 1,2

A chevron ^ points to the rate register currently being displayed. This will flash when the active rate is being displayed.

Total

A chevron ^ indicates when the total register is being displayed.

Creep

The creep annunciator ⊳|⊲ flashes after power - up until the unit has detected a pulse from the metering element.

Reverse Detect

The Reverse detect annunciator **((●))** (if enabled) is displayed when potential fraud is detected and indicates reverse power flow through the meter.

4.2 Switch Control

4.2.1 SAS-100

The S2AS-100 meter has a 100A main contactor, which controls the flow of current through the meter. The switch can be operated either by the toggle switch located under the right hand terminal cover, or by the action of a solenoid situated in the application module when fitted.

Manual operation may only be used to open the switch when it is closed or open a switch that has been closed by the application module. This prevents possible fraud by reconnection of the main switch.

4.2.2 S2AS-200

This version does not have any contactor

4.3.1 Tariff ID

This is a 16 bit word programmed by the tariff generation software. Which may be used to identify the programmed tariff.

4.3.2 Meter Serial Number

This is the meter serial number programmed by the factory

5 Programming / Interrogation Interface

5.1 Optical Communication Port

The Optical port is compatible with IEC1107 mode C-a and C-b for baud rates of 300, 600, 1200, 2400, and 4800. The port only responds to external commands and may not initiate communications.

The optical port is used for examining and/or changing the contents of meter memory, and programming the meter serial number, etc. It may also be used for on-site meter reading. In order to carry out these functions, a PC or handheld unit with appropriate software must be connected to the optical port using a standard Flag optical probe.

Some areas of memory are write protected to prevent fraud and minimise the possibility of corruption. In addition some areas of memory are protected by a write-once software lock which can be set preventing further software write accesses. Such lock, once set, may only be unlocked by initialising the meter.

6 Installation and commissioning

WARNING Dangers can arise from live electrical installations to which the meters are connected. Touching live parts is dangerous to life. All safety information should therefore be strictly observed without fail.

6.1 Introduction

The following personal and technical conditions must be fulfilled for installation and commissioning of the meters:

- The work described below must only be performed by technically qualified and suitably trained persons.
- These persons must be familiar with and observe the normal local safety regulations.
- The details in chapter 2 "Safety", in particular the safety regulations, as well as all information concerning safe operation in this chapter, must be strictly observed.
- A check should be made before starting work that the material and tools required are all present (as in section 0).

6.2 Material and tools required

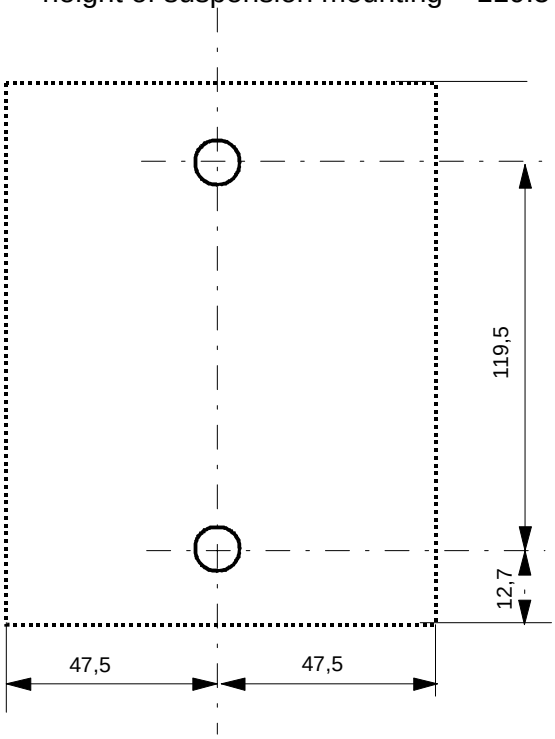
The following material and tools are required for installation of the meters:

- Correct meter (according to type designation and characteristic data on the dial) with intact meter seal (calibration seals)
- Correct meter connection diagram (on backside terminal cover)
- Fixing screws for fitting the meters on meter boards or similar device
- Factory seals
- Screwdriver suitable for fixing screws
- Screwdriver suitable for thrust screws of phase connections
- Sealing pliers for company own seals
- Drilling machine for fixing holes if necessary
- Phase tester or universal measuring instrument
- Buzzer

6.3 Mounting the meter

WARNING The connecting wires at the place of installation must not be live when fitting the meter. Touching live parts is dangerous to life. The corresponding preliminary fuses should therefore be removed and kept in a safe place until work is completed, so that they cannot be replaced by anyone unnoticed.

1. Find the correct meter position for mounting the meter.
2. Set the meter suspension eyelet in the relevant position.
3. Check with a phase tester or universal measuring instrument whether the connecting wires are live. If so, remove the corresponding preliminary fuses and keep them in a safe place until installation is completed, so that they cannot be replaced by anyone unnoticed
4. . Mark the two fixing points
   – horizontal base of suspension = 47.5 mm
   – height of suspension mounting = 119.5



Drilling plan

5. Drill the two holes for the fixing screws Unscrew the meter terminal cover.
6. Unscrew the meter terminal cover.
7. Fit the meter with the two fixing screws on the mounting surface provided.

6.4 Connecting meter

WARNING The connecting wires at the place of installation must not be live when fitting the meter. Touching live parts is dangerous to life. The corresponding preliminary fuses should therefore be removed and kept in a safe place until work is completed, so that they cannot be replaced by anyone unnoticed.

The electrical connections to the meter should be made as follows according to the connection diagram:

1. Check with a phase tester or universal measuring instrument whether the connecting wires are live. If so, remove the corresponding preliminary fuses and keep them in a safe place until installation is completed, so that they cannot be replaced by anyone unnoticed.

Connecting the phase connection lines

2. Shorten the phase connecting wires to the required length and then strip them.
3. Insert the phase connecting wires in the relevant terminals (the terminals are numbered as shown in the connection diagram) and tighten the terminal screws firmly (torque max. 3 Nm).

NOTE Insufficiently tightened screws at the phase connections can lead to increased power losses at the terminals and therefore to undesirable heating. A contact resistance of 1 mΩ causes a power loss of 10 W at 100 A !

Connecting the signal inputs and outputs

4. Shorten the connecting wires of the signal outputs to the required length and strip them (wires and strands up to 2.5 mm^2 can be connected).

WARNING The insulation of the connecting line must extend as far as the terminal indentation, i.e. there must be no further bare part of the connecting line visible above the terminal. Touching live parts is dangerous to life. The stripped part of the connecting wire should be shortened if necessary.

6.5 Check of connections

NOTE Only a properly connected meter measures correctly !
Every connection error results in a financial loss for the power company !

Before putting into operation the following points must be checked again and corrected if necessary:

1. Has the correct meter (identification number) been installed at the measuring point of the relevant consumer ?
2. Are all thrust screws for the phase connections and neutral tightened sufficiently ?

3. Check whether the neutral and the life conductor are not interchanged?

6.6 Commissioning and functional check

WARNING The preliminary fuses must be replaced to put the meter into operation and for the functional check. While the terminal cover remains unscrewed there is a danger of contact with the connecting terminals. Touching live parts is a danger to life. For any modifications to the installation therefore the preliminary fuses must always be removed again and kept in a safe place until completion of work, so that they cannot be replaced by anyone unnoticed.

NOTE If no mains voltage is yet present, commissioning and functional check must be performed later.

The installed meter should be put into service and checked as follows:

1. Insert the preliminary fuses removed for installation. The meter is switched on.

2. Check whether the operating display appears correctly (no error message).

3. Screw on the terminal cover if the meter is operating correctly. Otherwise first locate and eliminate the error.

4. Seal the terminal cover with utility seals.

7 Data readout

This can be made a bi-directional communication interface to allow tariff programming. It can also only able reading communication.

The interface serves for the automatic datareadout of the meter.

The interface comprises an infra-red receiver/transmitter pair mounted behind a window in the external case.

After receipt of a spurious or erroneous input on this interface, a delay of one character frame is enforced before further input is accepted.

The interface and communications protocol comply with IEC1107 , mode C-a and C-b with an opening data rate of 300 baud. Subsequent communication at >2400 baud may be utilised by add-on modules.

8 Meter Testing

8.1 Calibration link

NOTE The meter has NO calibration link

For meter testing purposes traditionally meters are fitted with calibration links enabling to electrically separate the voltage and current circuits. For testing purposes a number of meters are then supplied with the same voltage in parallel and with the same current in series.

The current measuring part of the S2A meter is based on the shunt principle. For technical reasons with a shunt meter current and voltage circuits cannot be separated because its measurements circuits are directly connected to the line voltage.

Single phase meters based on the shunt principle can be tested as follows:

- on a single position test console
- on a test console fitted with a multi-secondary voltage transformer which provides for each meter to be tested its own galvanically separated voltage supply. Such multi-secondary voltage transformers may be fitted to existing test console.

Multi-secondary voltage transformers may be supplied from:

MTE Meter Test Equipment AG
Gubelstr. 22
6300 Zug

CH- Switzerland

Phone: ++41 41 724 24 48
Fax: ++41 41 724 24 25

8.2 Calibration LED Output

The meter is fitted with a red LED which flashes to indicate the flow of metered energy. The LED is controlled by the meter software. It is disabled during Power down. The LED on period is 80mSec.

The LED emits light in the visible spectrum at a wavelength of between 620nm and 675 nm. The brightness from the aperture in the dial plate is not less than 100µCd, visible over a cone of at least 30^{O} half angle.

9 Detection of faults

9.1 Error Messages

Three error messages occur on the display. These are indicated on the display by the word ‘Error” followed by a numeric code.

Error	Reason
2	Failure to write to EEPROM
4	Bad checksum on Serial No. and calibration data
5	Corrupt Meter registers and backup copies

9.2 Tamper / Fraud

The meter is equipped with a number of features to enable the detection of fraud attempts. Additionally, it also provides information that may be used in conjunction with data collected by an add-on module, to indicate the existence of a possible fraud attempt.

The meter records the number of power-on hours it sees. These may be compared with those sampled by add-on modules where these also record such information. Any discrepancies may indicate a possible fraud attempt.

9.3 Watchdog and Exception Handling

The meter incorporates a glitch counter. The watchdog counter must be zeroed before it times out in order to prevent a watchdog reset. When the watchdog times out, the microprocessor is reset and a watchdog reset procedure is executed. A counter is maintained in EEPROM of the number of watchdog resets. This may be used for diagnostic purposes.

9.4 Reverse Detect

When a pulse is signaled to the meter export register (reverse power), the reverse pulse count is incremented. This count is cleared every 30 minutes, however if the count exceeds 16 pulses, the reverse flag is set in the meter status word and the reverse detect annunciator (if programmed) will be displayed on the LCD display.

Once on, this annunciator can only be turned off again by resetting the reverse detect flag via the programming interface.

9.5 Creep

The creep annunciator is activated following a power on. It goes out when a pulse is detected in either direction. The Creep inhibit circuit operating at approximately 40 mA.

9.6 Mains Failure

The meter detects impending supply failure by constantly monitoring mains voltage. If it detects voltage below a certain threshold or no zero crossings, this initiates the supply failure routine. In this event, all non-essential power consuming activities are disabled within 40mS and the critical areas of the processors internal RAM are saved to EEPROM.

9.7 Failure Tolerance

The meter has been designed to give a high resilience to supply transients, processor crashes or watchdog resets and to ensure that in the event of these occurring there is no loss or corruption of the tariff or energy registers. Look at Technical Data chapter 1.2 as well.

9.8 Energy Register Locking

The energy registers are unmodifiable by external means, once the meter case has been sealed.
A lock variable in internal memory is set during factory initialisation. This prevents subsequent writing to energy registers via the optical port. A software lock also prevents writing to the areas of memory which hold calibration data.

10 Decommissioning, disposal

NOTE For the disposal of meters observe the local disposal and environmental protection regulations in effect without fail.

Components	Disposal
Printed circuit boards, LCD display	Electronic waste: disposal according to local regulations.
Metal parts	Sorted and taken to collective materials disposal point.
Plastic components	Sorted and taken to recycling (regranulation) plant or if no other possibility to refuse incineration.