ProMeter

Product Presentation

CEWE INSTRUMENT

CONTENTS

CONTENTS

1 General

1.1 Procedure when contacting Cewe Instrument ProMeter user support by phone or fax

Get the following information about the problem before calling or sending a fax

1. Meter type number
2. Serial number
3. Program version (can be found last in display sequence 2)
4. A detailed description of the problem symptoms

Contact the customer support department

Telephone 46 155 77500
Telefax No. 46 155 77596

1.2 Copyright

Mail address
Cewe Instrument AB
Box 1006
S-61129 NYKÖPING
SWEDEN

Cargo address
Cewe Instrument AB
Nyköping Strand
NYKÖPING
SWEDEN

1.3 Disclaimer

This installation manual covers all types of ProMeter energy meters. Some of the descriebed features and instructions may not be applicable to all types.

2 General description of the ProMeter

2.1 The ProMeter

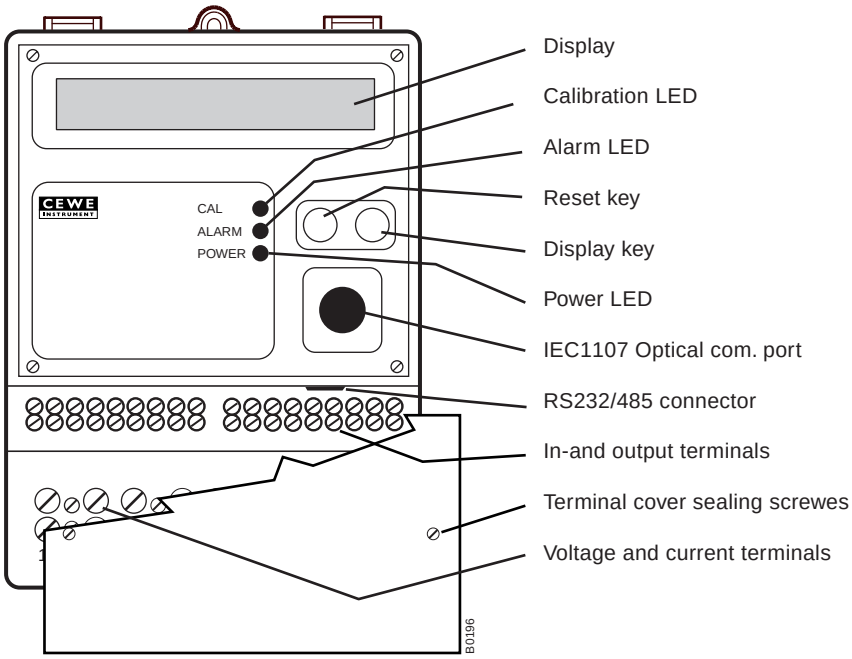

Figure 2-A

2.2 What can the ProMeter do for the user?

2.2.1 Measure energy

The ProMeter can measure

- active energy (kWh)
- reactive energy (kvarh)
- apparent energy (kVA)

The measured energy is accumulated in energy registers for import and export energy directions. Apparent energy is calculated independently for each phase and the absolute values are added for the total.

2.2.2 Receive and accumulate in registers pulses from other sources

The ProMeter can receive and accumulate energy pulses from other meters into special registers. This enables one ProMeter to act as a three-input data concentrator and record energy from other (simpler) meters.

2.2.3 Calculate sums of registers into special summation registers

The ProMeter has two summation registers. The sums can be formed by the energy registers from active, reactive and apparent energy and the registers from the three inputs. These terms may be added to or subtracted from each other. Every term can also be supplied with a factor in order to one another.

2.2.4 Split energy into tariffs (Time Of Use)

All quantities in accumulating registers can be subdivided into separate registers according to a tariff schedule allowing up to five seasons with eight different daytypes. Each daytype can use eight different rates and do eight rate switching events per day.

Annual tariff schedules can be created and stored up to seven years in advance. In the tariff calendar fixed and moving holidays and daylight savings time changes can be pre-set.

2.2.5 Calculate maximum demand

ProMeter can be set up to calculate up to five different maximum demand values and store in five different MD registers. The MD's to be calculated can be selected from active, reactive or apparent registers for both energy directions or from one or more of the three pulse inputs registers. These MD's can also be calculated from one or both of the two summation registers.

2.2.6 Split max. demand values into tariffs

Maximum average power demand (MD) can be set to sort periodical (with presettable period) MD's into tariff registers, following a tariff switching schedule of its own. Four tariffs can be preset and three different MD:s can be recorded.

2.2.7 Control tariffs (also in other meters) or be controlled by external signals

The ProMeter can use four relay outputs to create binary coded tariff control signals for controlling the tariff registers of other (slave) meters.

The three ProMeter opto inputs can be programmed to accept binary coded tariff control signals from another tariff controlling device e g tariff switching clock or another ProMeter for switching tariffs.

2.2.8 Store and provide periodical invoicing data

If meter readings are required at precise times, the ProMeter offers the feature of billing registers. These registers are used to take a "snapshot" i.e. a copy of selected accumulating and MD registers at predetermined times, and store these separately for later reading. Up to thirteen times can be pre-set each year. Two previous periods can be stored. The data for the oldest billing period will be overwritten when data for a new period is saved at the end of the present billing period.

2.2.9 Configurable

The ProMeter has many features and every user may not want to use all possible features or standard settings. Most users will want the ProMeter to do what he or she requires, no less and no more. For this reason it is possible to select which meter functions and settings that shall be used. This is decided by configuring the ProMeter, where the ProWin configuring software is used to set all meter parameters to create the desired functions and settings. The ProMeter is then "tailor-made" for each user's requirements

The ProMeter may be read and configured either via an optical port (IEC1107, FLAG) on the front panel or via an optional RS-232/RS485 serial port. The ProWin software runs on a PC with MS Windows and can be used to alter the factory settings.

2.2.10 Security

The security system in the ProMeter and ProWin software consists of three password levels. For changing anything in the meter at all, the meter password must be known. In addition there is a password necessary for changing the configuration. For calibration another password must be known, and a programming jumper inside the meter must be moved to the calibration position.

The meter cover is provided with sealing screws, as is the terminal cover.

2.2.11 Communicate with the user/operator for configuring and reading the ProMeter LCD-display using front panel keys

The LCD display consist of two lines each with 16 characters. All information is displayed as text with quantities and units. Optionally displaying of register codes according to the DIN 43863-3, EDIS, can be configured. The ProMeter can be configured to display only those quantities required. They can be programmed to be displayed in any order.

There are three different display sequences available. They can be separately configured, e.g. sequence one can be set up to display all information of interest for the consumer, and sequence two can likewise display information of interest for the power utility. In sequence three, the contents of the last stored billing registers can be read on the display.

The information in one display sequence can be stepped through by pressing the display key. Changing to another display sequence is also done with the display key.

2.2.12 Optical data communication interface IEC 1107

All versions of ProMeter are equipped with an opto port complying with IEC 1107 for communicating with a PC through an IR opto communications head connected to the PC. The opto head which is magnetic attaches to the opto port on the meter front panel. The software protocol is also IEC1107.

2.2.13 RS232 / RS485 serial communication interface

Some versions of ProMeters are equipped with a RS232 or RS485 serial communications port.

Configuration of the ProMeter functions and settings as well as reading data from the ProMeter can be done via this port. 5 volts, 300 mA is available for powering a modem.

The RS232 port can be connected via a serial lead or modems to communicate with a computer.

The RS485 port can be used to create a local network, enabling several ProMeters to communicate with a computer via one communications channel, by addressing individual meters in the network (multidropping).

2.2.14 Transmit and receive pulse information, alarms etc.

Some of the different versions of the ProMeter are equipped with solid state relay outputs for pulsing or stationary control signals, and opto-isolated pulse or level sensing inputs.

These output functions can be freely configured to provide energy pulses, control signals for tariff control, control signal for load switching, alarm signals, energy direction and a user selectable remote control function. The remote control output function is controlled by sending a command to the ProMeter on a serial communication link (IEC1107 or RS232/RS485).

The input functions can be configured for counting external pulse signals into accumulating registers, used as control inputs for tariff selection, ending demand period or ending a billing period.

2.2.15 Front panel LED indicators

The CAL LED is used when performing a calibration or checking the meter accuracy. It emits a light pulse frequency proportional to the power level, and consequently every pulse corresponds to a certain amount of energy. The constant (pulses per kWh) can be pre-set. The CAL LED can be switched to indicate active, reactive and apparent energy with the display key.

The Alarm-LED has two functions. When it is flashing it indicates that an (predetermined) alarm condition is present. If it is on continuously it indicates that a brown-out condition is present. This means a serious under-voltage.

The Power LED simply indicates that the ProMeter Power supply is working and the meter is alive.

2.2.16 Display instantaneous values for currents, voltages, power factor, phase angle.

In addition to the conventional data from the energy registers, instantaneous values can be read for the following electrical quantities:

Current in each phase

All phase - phase voltages

All phase - neutral voltages

Power factor

Phase angle

Frequency

Active power in each phase

Total active power

Total reactive power

Total apparent power

These values are calculated each second, based on data sampled during the previous second. This means that the instantaneuos values are available for reading with a delay of 1-2 seconds.

2.2.17 Perform load control

Predicts end of MD period maximum demand and disconnects load to keep end of period MD within the allowed power limits. The calculations are based on basic (non-switchable) load, switchable load and disconnect level. Switching hystereses can be set to avoid switching oscillations.

2.2.18 Diagnose installation/connection errors

Voltage phase sequence and correct connection of the currents can be checked on the display.

2.2.19 Store event and error messages

Events and error conditions can be stored in an events and error register. Some of the events to be recorded are configurable with the ProWin software. All entries in the register do have a number and a description specifying the event or error that has occurred and when. Some conditions can be set to switch on the front panel Alarm LED. Reading and resetting the register can be done on the display or with the ProWin program. Resetting also switches the Alarm LED off.

2.2.20 Store average periodical consumption (MD's) for longer periods.

Some versions of ProMeter are equipped with a large capacity non-volatile memory for data-logging purposes. This memory allows periodical average power values (maximum demands) to be stored for longer times.

Up to five logging channels may be used to record power averages.

Approximate storage capacity:

Number of logging channels					
MD periods	**1**	**2**	**3**	**4**	**5**
15 minutes	4 months	3 months	2.5 months	2 months	1,5 months
30 minutes	9 months	6 months	5 months	4 months	3 months
60 minutes	18 months	13 months	10 months	8 months	6 months

2.2.21 Correct for measuring and power transformer errors and losses

Measuring (instrument) transformers have errors that add to the system inaccuracy. If these errors are known it would be worthwhile to correct for these errors in order to maintain a better system measuring accuracy, or simply avoid replacing the measuring transformers when upgrading the system accuracy.

Sometimes the system energy selling point and the most convenient or economical position in the system for measuring the energy are not the same. For example, the commercial interface for a generator station selling the energy may be on the HV side of the line transformer. The most economical place to measure the energy is on the LV side of the power transformer, because of the cost for measuring transformers. To measure and sell the energy in different places in the system requires some means of accounting for the losses between these two positions, i.e. the power transformer losses.

Some versions of the ProMeter can perform these corrections and compensations for measuring transformer errors and power transformer losses.

Correction for measuring transformer errors, CT's and VT's can be done for phase angle error and magnitude error.

Compensation for power transformer losses can be done for iron losses (magnetisation losses) that are more or less constant, and copper losses (resistive losses) that varies as the square of the current.

2.3 Characteristics that makes the ProMeter a better meter!

The ProMeter is a fully digital energy meter using a powerful microcomputer and an accurate AD-converter to sample the phase voltages and currents. These samples contain all the information required to calculate instantaneous quantities like volts, amps, power, power factor, and phase angle, and integrated quantities like active, reactive and apparent energy. All calculations are made numerically through the microcomputer software.

The ProMeter has a large number of features. Which of these and how the features are used, is user selectable. By using the ProWin software the ProMeter can be tailored to the need of the user for most applications encountered.

3 Versions and type designations

The ProMeter series of energy meters are used for measuring active, reactive and apparent energy in 3-phase systems.

3.1 Accuracy Classes

The ProMeter is available in three accuracy classes:

ProMeter 2000 series	accuracy class 1	IEC1036
ProMeter 3000 series,	accuracy class 0.5S	IEC687-92
ProMeter 4000 series,	accuracy class 0.2S	IEC687-92

ProMeters are available for use either 3- or 4-wire networks.

In each series four main versions of the ProMeter are available:

Basic meter measuring and displaying the following parameters:

current in all phases
all phase - phase voltages
all phase - neutral voltages
power factor
phase angle
frequency
active power in each phase
total active power
total reactive power
total apparent power
total active energy (Import and Export)
total reactive energy (Import and Export)
total apparent energy

Tariff meter, which has the same features as the basic meter, and maximum demand plus the facility to sort the energy into 8 rates and calculate 5 maximum demand values according to a programmable tariff schedule, or controlled by an external signal.

Data logging meter, which has the same features as the tariff meter, plus extra memory to store maximum demand values over a longer time period. Up to five different types of demand values (channels) can be stored. These can be chosen from import and/or export of active, reactive or apparent energy as well as values from one or more of the three pulse inputs and summation registers. Demand periods can be between 5 and 60 minutes and the memory can store about 13.500 values.

Economy version of ProMeter with basic software functions, four relay outputs and without real time clock and battery. The functions are preconfigured, and the only user configurable functions are transformer ratios and output pulse constants.

3.2 Type designations:

Standard versions: **ProMeter** **3 3 4 3**

Accuracy class:

2 = Class 1
3 = Class 0.5S
4 = Class 0.2S

Measuring principle:

2 = 2-element (3-wire) measuring
3 = 3-element (4-wire) measuring

Hardware options:

0 = no options
1 = 4 solid state relay outputs
2 = 6 solid state relay outputs
3 opto isolated inputs
3 = RS232 serial port, isolated
4 = 6 solid state relay outputs
3 opto isolated inputs
RS232 serial port, isolated
5 = RS485 serial port, isolated
6 = 6 solid state relay outputs
3 opto isolated inputs
RS485 serial port, isolated
8 = Economy version, no RTC
4 solid state relay outputs

Software options:

1 = Basic functions
2 = Basic functions
Tariffs and max. demand
3 = Basic functions
Tariffs and max. demand
Data logging (max. demand storage)

3.3 Specification

Some of the listed specification data may not apply to certain versions of the ProMeter.

3.3.1 Accuracy

3.3.1.1 Electricity meter quantities

Class 1	Active energy according to IEC 1036 (ProMeter 2000) Reactive energy class 2.0
Class 0.5S	Active energy according to IEC 687-92 (ProMeter 3000) Reactive energy class 1.0
Class 0.2S	Active energy according to IEC 687-92 (ProMeter 4000) Reactive energy class 0.5

3.3.1.2 Instantaneous measurements

Volts, Amps, W, VAr, VA, PF, Phase angle, Frequency

Better than two times the Class figure.

3.3.2 Input data

3.3.2.1 Current circuit

Measuring current (I in)	1,2 or 5 A
Measuring range	1-200% of I-in
Frequency	45-65 Hz (Class 0.2S 45-55 or 55-65 Hz)
Burden	< 0.2 VA/phase
Overload	continuously 2 x I-in, during 10 sec 10 x I-in during 1 sec 40 x I-in
Starting current	< 0.1 %(IEC687) <0.2 % (IEC1036) of I-in

3.3.2.2 Voltage circuit

Measuring voltage (U in)	3-wire system: 100,110,115,120, 230 V 4-wire system: 57.7/100, 63.5/110, 66.4/115, 69.3/120, 127/220, 133/230, 138.6/240, 220/380, 230/400, 240/415 V
Measuring range	80-115 % of U-in
Frequency	45-65 Hz (Class 0.2S 45-55 or 55-65 Hz)
Burden (standard aux supply)	< 2 VA/phase < 3 VA/phase with RS-232 port
Burden (separate aux supply)	< 0.2 VA/phase
Max overload voltage	1.3 x U-in (limited by protection varistors)

3.3.2.3 Auxiliary supply

Standard aux supply	Connected to measuring voltage inputs.
Separate aux supply Uaux	48, 60, 110, 125, 230 V DC 110 V AC, 230 V AC
Normal operating voltage range	80-120% of Uaux
Burden	< 6 VA (9 VA with RS232/485 port)
Max overload voltage	1.3 x Uaux (limited by protection varistors)

3.3.3 Temperature range

Working temperature range	-10°C – +55°C
Storage temperature range	-40°C – +80°C

3.3.4 Safety

Isolation voltage: According to IEC 687/1036 paragraph 5.4.6.3

Important: Live parts inside meter cover.

Always disconnect all wires carrying dangerous voltages before opening the meter cover

Separate safety cover for the voltage and current terminals.

3.3.5 EMC

Inputs:	4 kV, 50 Hz, 1 min	
Radio frequency interference	According to IEC 801-3	10 V/m, 27-500 MHz
Transients	According to IEC 801-4	2 kV, 15 ms/300 ms
Electrostatic discharge	According to IEC 801-2,	15 kV
Radio frequency emission	According to CISPR 14.6,	0.15-300 MHz
CISPR 14.7,	30-300 MHz	
Surge voltage test	According to IEC 255-4	6 kV. 1.2 us / 50 us

Meets all European Union CE-marking requirements and additionally passes the EN50082-2 HF immunity, 150 kHz - 80 MHz, 10 V injected into the connecting wires

3.3.6 Relay outputs

Type	Solid state relay (MosFET, bi-directional)
Relay output rating	0.2 A, 110 V AC/DC (Varistor protected)

3.3.6.1 Pulse outputs

Pulse length	24, 40, 80, 160, 320 ms selectable steps 24 – 999 ms presettable (With some ProWin versions)
Maximum pulse frequency	Depending on pulse width, max. duty cycle 50 %

3.3.6.2 Status output

Pulse signal	End of demand period
Relay open—closed	Rate control, Alarm, Remote control, (Load control)

3.3.7 Opto isolated inputs

Type	Opto coupler
Voltage (AC or DC)	48-220 V (24-110 V on special order)
Burden	Input resistance 20 kohm (5.4 kohm)

3.3.7.1 Pulse inputs

Pulse signal	Energy
Pulse length	24, 40, 80, 160 ms Maximum pulse frequency depending on pulse width, maximum duty cycle 50%
Pulse length max.	400 % of nominal length (can be disabled)
Pulse length min	50 % of nominal length

3.3.7.2 Status inputs

Pulse signal	End of demand period, End of billing period
Steady signal on—off	Rate control

3.3.8 Display

Standard LCD STN display with extended operating temperature range -20 – +70°C

Two lines with 16 characters/line

Character height 8 mm

Extended temperature range -20 – +70°C

Minimum Display Life expectancy 100 000 hours at 25°C

3.3.9 IEC1107 communications port

Hardware	IEC1107 (9603 second edition) optical communications port
Communications protocol	IEC1107 (9603 second edition) ProWin protocol (for ProWin software only)
Baudrate	300 - 2400 baud (4800 baud from softw.ver 1.0)

3.3.10 Serial communications port

Hardware	RS232 or RS485 serial comport
Connector	D-Sub 9 pin female
Communications protocol	IEC1107 (9603 second edition) (addressable for multidrop) ProWin protocol (for ProWin software only)
Handshaking	Not supported
Baudrate	300 - 2400 baud(and 4800, 9600 baud from softw.ver 1.0)
Modem power supply	5 V 300 mA

3.3.11 Real time clock

Accuracy	< 20 sec/month, crystal controlled
Clock Battery	Type Lithium, automatically recharged/trickle charged
Backup Capacity	min> 4 months
Backup Capacity	typ 1-1.5 years
Recharged from empty	72 hours
Battery life expectancy	Minimum 12 years to half recharging capacity

3.3.12 Data storage for configuration registers and data logging:

Non-volatile memory (Eeprom)

3.3.13 Terminal cover detector

IR reflective detector for detecting removal of terminal cover and tampering attempts.

3.3.14 Data logging approximate storage capacity.

Number of logging channels

MD periods	**1**	**2**	**3**	**4**	**5**
15 minutes	4 months	3 months	2.5 months	2 months	1,5 months
30 minutes	9 months	6 months	5 months	4 months	3 months
60 minutes	18 months	13 months	10 months	8 months	6 months

3.3.15 Connection

Current connections	max. 25 mm²
Voltage connections	max. 4 mm²
Pulse inputs	max. 4 mm²
Pulse outputs	max. 4 mm²
Serial port RS232	9-pole D-sub
Serial port RS485	9-pole D-sub and D-sub to terminal block adapter.

3.3.16 Dimensions

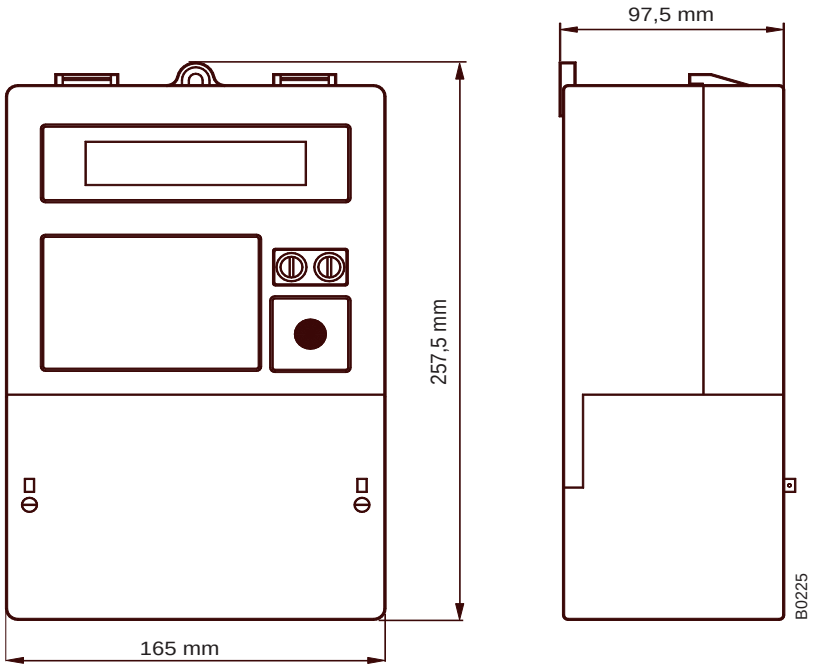

Figure 3.A

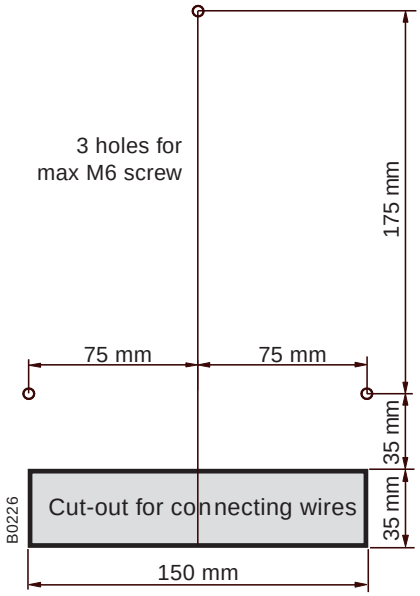

Figure 3.B

Weight 2.3 kg

3.3.17 Protection class

IEC529 IP 53

3.3.18 Materials and components

Parts	Material	Trade name (example)	Self-exting.
Meter case parts	PC-ABS	GE Cycoloy 2950	ULV0
Terminal block	PPO +10%GF	GE Noryl GFN1SE1	ULV0
Meter cover	PC	GE Lexan 141 transparent	ULV0
Small parts	PC	GE Lexan 141 IR-filter	ULV0
PC boards	FR4 GF epoxy		ULV0

4 Working principle

4.1 Hardware

The ProMeter is a fully digital energy meter, employing analogue-digital (AD-) conversion of the voltages and currents in the electricity system and calculating all quantities mathematically. The heart of the ProMeter is a very powerful microprocessor, which handles AD-conversion, calculation, handling and storing data to various registers, as well as all communications via display, digital I/O and serial communication ports, optical and/or RS-232/RS485.

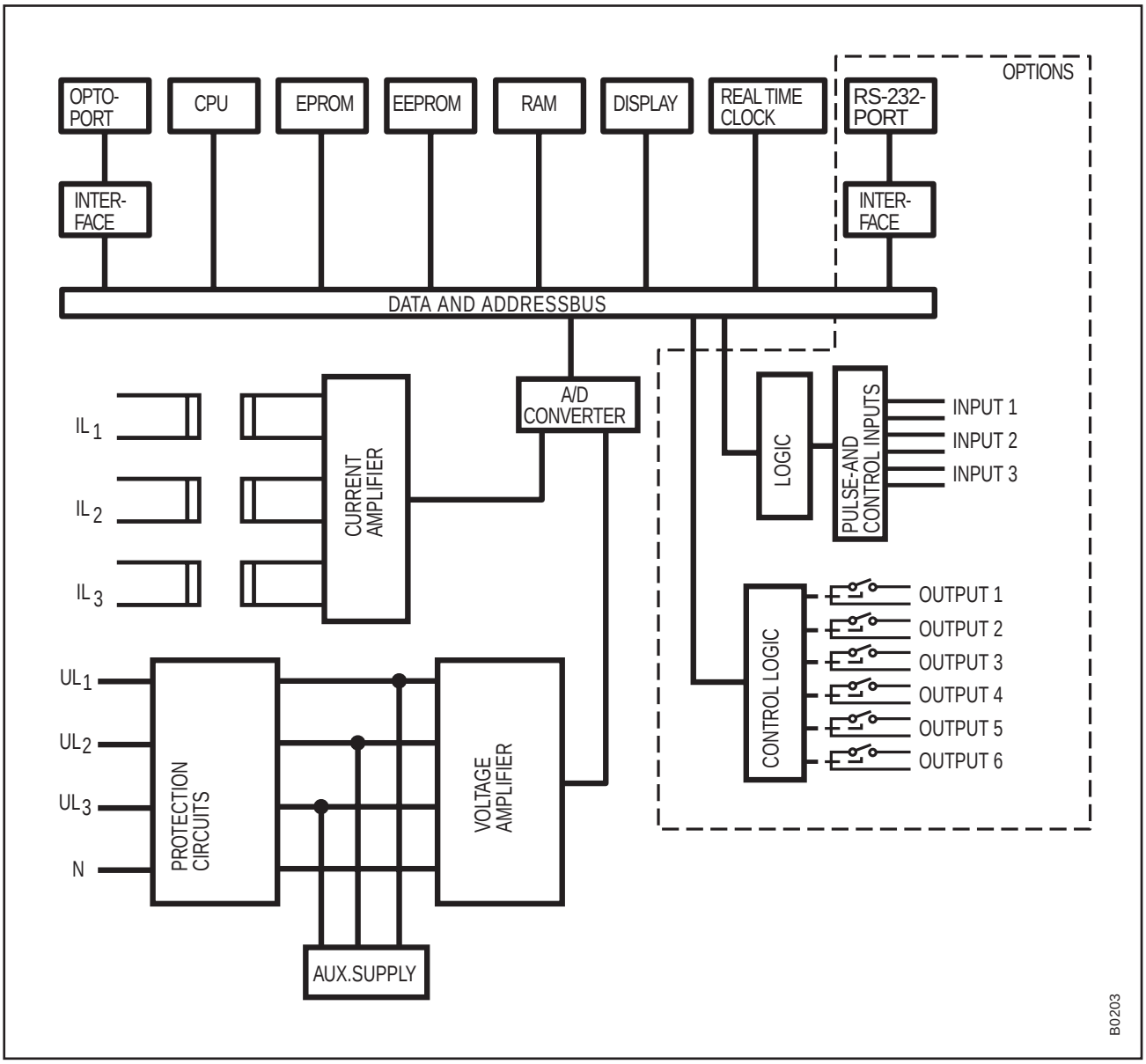

Figure 4.A

4.2 Software

The software in the ProMeter consists of a large number of functionality modules supported by corresponding functionality in the configuration software ProWin. The main software functions are:

CONFIGURATION					
Measuring	**Registers**	**Communication**	**Security**	**Control**	**Information**

4.2.1 Measuring

AD-conversion	Calibration correction	Transformer correction	Energy calculation	Instantaneous values	Connection analysis

4.2.2 Registers

Accumulating energy registers	Pulse input registers	Tariff registers	Billing registers	Summation registers	Demand values	Data logging register

4.2.3 Communication

Local display and keys	Opto isol. pulse and control inputs	Solid state relay outputs	IEC1107 serial comm. port	RS232/485 serial comm. port	IEC1107 comm. protocol	ProWin comm. protocol

4.2.4 Data integrity and security

Passwords	Alarms	Power-fail protection

4.2.5 Control

Real time clock, calender	Load control	Remote relay control

4.2.6 Information

Owners name and ID numbers

5 Support software and accessories

5.1 Software

5.1.1 ProMeter reading software

Available ProMeter reading software from Cewe Instrument AB are:

ProWin

Software for local or remote configuring and reading the registers in the ProMeter

Proread

Simple software for reading the data storage memory (data logging feature of the ProMeter xx43). Complements the ProWin.

EnerBase

Software for automatic scheduled meter reading and SQL database management.

5.1.2 Third-party software

From	Software
D&C Belgium	EIS
Pilot Systems UK	OMS and Chirps
UTS	MV90 (with TIM tim_cewe.exe)

5.2 Accessories

Designation	Article number
Opto reading head	7406
Power adapter for opto reading head	7407
RS232-LAN-adapter	7496
RS232 Modem adapter 5V – 9V	7495
Serieal lead RS232	7408
RS485 connection adapter	7403

5.3 Panel mounting kit

Article No. 7492 (replaces 7402)

6 Tests and approvals

6.1 Performed by the SP Swedish National Testing and Research Institute

SP
Box 857
S-501 15 BORÅS
SWEDEN

To the following standards:

- EN60687:1992 (IEC 687-92) class 0.2S and 0.5S
  "Alternating current static watt-hour meters for active energy"

- EN61036:1992 (IEC1036) class 1.0
  "Alternating current static watt-hour meters for active energy"

- EN61268:1996 (IEC1268) Class 2
  "Alternating current static var-hour meters for active energy"

Tests have also been done in part for the following standards:

- EN61036:1996 (IEC1036) class 1.0
  "Alternating current static watt-hour meters for active energy"

- EN61038:1996 Time switches for tariff and load control. Applicable parts according to accuracy requirements for the real time clock.

Test reports:
97F12032 EMC-tests
98F12510 Metrology

6.2 Approval by OFFER, Great Britain

Approvals by OFFER are done to the same standards as the SP approval, largely based on the SP test reports.

Cewe Instrument AB

Box 1006 • SE-611 29 Nyköping

Tel: +46 155 775 00 • Fax: +46 155 775 97

e-mail: info@ceweinstrument.se