A1800 ALPHA® Meter Family

ELSTER

Contents

Introduction

Elster Electricity has engineered the A1800 ALPHA meter family based on our extensive metering technology and global metering standards knowledge. The A1800 ALPHA family are world-class, highly accurate, robust, system-ready meters that are ideally suited for advanced commercial, industrial, and substation metering applications. Using an open protocol and supporting a variety of communications methods, the A1800 ALPHA meter family is integral to any metering system.

Figure 1. A1800 ALPHA meter family application pyramid
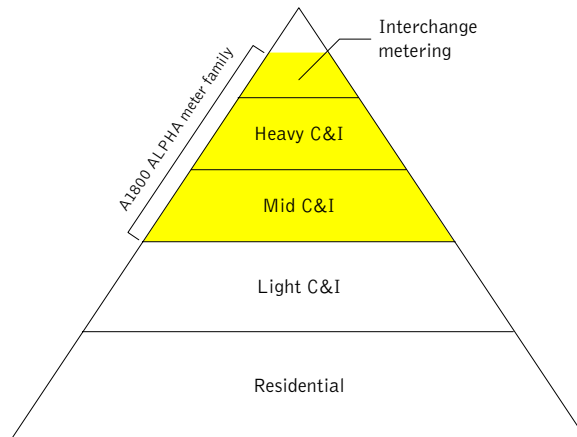
Table 1. Meter designations of the A1800 ALPHA meter family

Meter	Market segment	Class	Standard features	Optional features
1880	Interchange meter	0.2	See Elster for availability	
1860	Heavy C&I	0.2, 0.5	• 2 comm ports • 4 relays • external power supply • advanced metering (A) • TRueQ (Q) • load profiling (L) • instrumentation profiling (N)	• transformer loss comp (C) • extended 1MB memory (X)
1830	Mid C&I	0.5, 1.0	• 1 comm port • 4 relays • TRueQ (Q) • load profiling (L) • instrumentation profiling (N)	• advanced metering (A) • transformer loss comp (C) • extended 1MB memory (X)
1810	Mid C&I	1.0	• no comm port • no relays • TRueQ (Q)	• advanced metering (A) • load profiling (L) • instrumentation profiling (N) • transformer loss comp (C) • extended 1MB Memory (X)

System-ready Meter

Sophisticated in its system-ready capabilities, the A1800 ALPHA meter's easily upgradeable design offers our customers the flexibility to keep pace with their changing metering requirements and business growth.

Flexible communication options

NEW

The A1800 ALPHA meter's robust power supply supports communications options, including RS-232, RS-485, and internal modem, as well as future options developed by Elster and our business partners. With the capability to communicate simultaneously using up to 2 communication ports, the A1800 ALPHA meter removes the guesswork needed to support different communications needs. The meter's open protocol provides easy, remote access to the advanced functions of the meter.

The serial port provides communication speed up to 19,200 bps.

Optional internal industrial-grade modem

An optional, industrial-grade modem with wide temperature range performance is available.[1]

Application

Faster data reading to minimize download time of profile data

Figure 2. A1800 ALPHA meter

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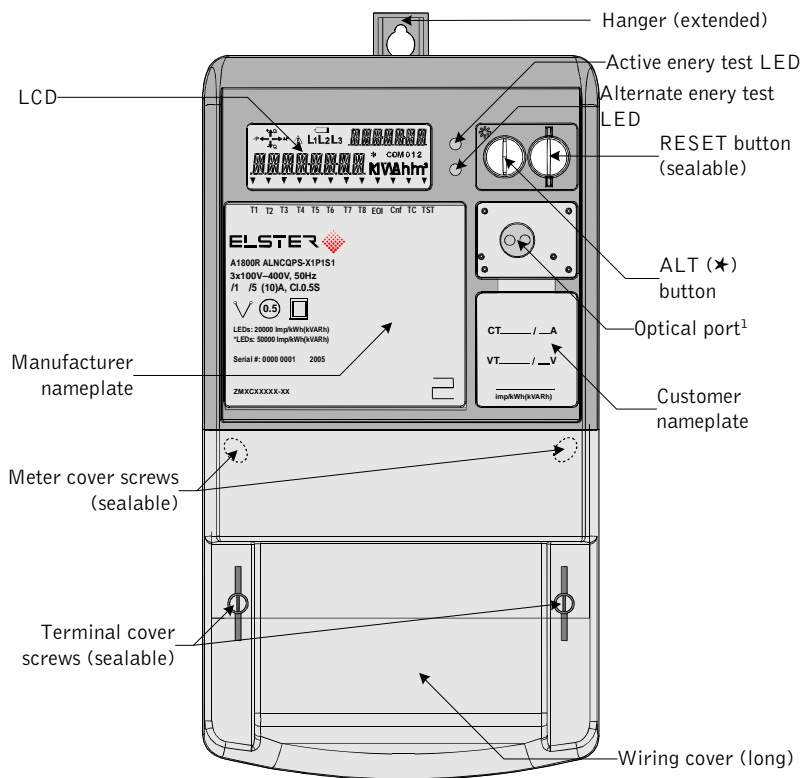
[1]   Contact Elster Electricity for feature availability.

Figure 3. A1800 ALPHA meter (transformer rated) - cover removed

RS-232 connector
(optional)*

RS-485 terminals
(optional)*

Pulse output relays

RS-485 terminals

TOU
battery

Battery
connector

Terminal removal
detector switch

RS-232
connector

Terminal connectors

Auxiliary
power supply
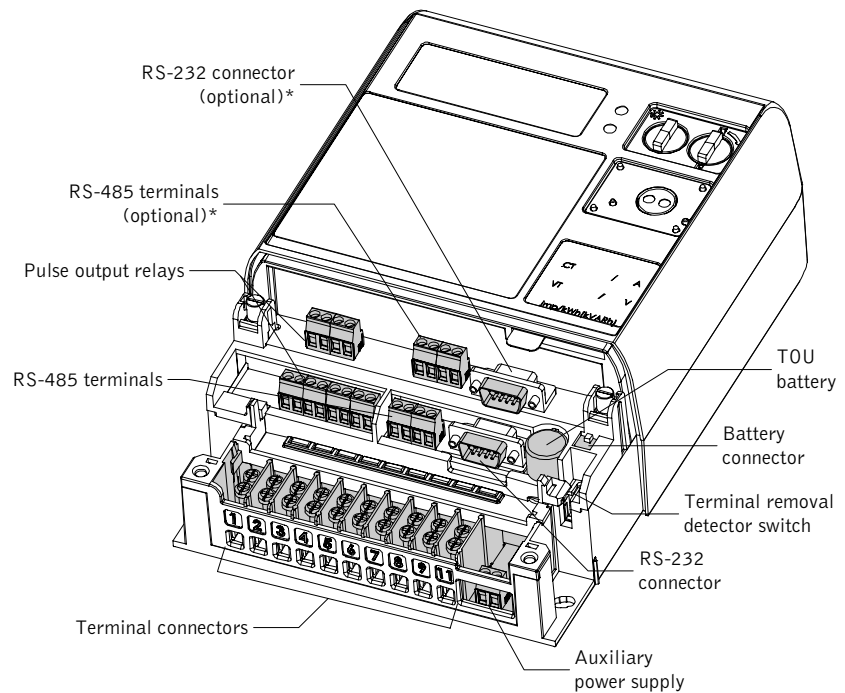
*Present when optional second communication port is installed

Enhanced Features and Functionality

Application

Reduce tampering and monitor power quality with TRueQ.

NEW

Tamper restraint and quality monitoring (TRueQ™)

Our TRueQ feature is an efficient, cost-effective means of monitoring tampering, power quality, and service status without the need of a separate and expensive external device. Elster's A1800 ALPHA meter comes standard with TRueQ-enabled. TRueQ may be programmed to test such parameters as high or low voltage, high or low power factor, high harmonic distortion, current imbalance, voltage imbalance, and voltage sags. Each of these measurements has programmable thresholds. The TRueQ log records the time of the TRueQ test failure and reports the identity of the failed test. When the condition that caused the TRueQ test failure ends, the meter records the time and the identity of the test.

The A1800 ALPHA meter family, combined with Elster Electricity meter support software, can help identify power distortion problems and their source. By using TRueQ, utilities can monitor exceptions to user-defined thresholds for items such as voltage, current, total harmonic distortion, and total demand distortion. The A1800 ALPHA meter can perform a variety of tests to measure and collect power quality data 24 hours a day, including the following:

■ continuously monitor 12 different power quality conditions (see Table 2)

■ generate real time alarms for violations

■ date/time stamp a log entry

■ a counter and a timer for each test to record the total number of occurrences and the cumulative time spent outside the threshold

Table 2. Available TR$_{ue}$Q tests

TR$_{ue}$Q	Test name	Configuration based upon
Test 1	Service voltage test	System service voltage test thresholds
Test 2	Low voltage test	A specified low voltage threshold
Test 3	High voltage test	A specified high voltage threshold
Test 4	Reverse power test & PF	Service current test thresholds
Test 5	Low current test	Service current test thresholds
Test 6	Power factor (PF)	A specified threshold for leading and lagging
Test 7	Second harmonic current test	A specified current threshold
Test 8	% Total harmonic distortion current	Specified THD percentage
Test 9	% Total harmonic distortion voltage	Specified THD percentage
Test 10	Voltage imbalance	Minimum high voltage threshold and imbalance threshold
Test 11	Current imbalance	Minimum high current threshold and imbalance threshold
Test 12	% total demand distortion	Specified TDD percentage

Application

Extended memory will allow for greater memory storage (for example, extensive load and instrumentation profiling),

Extended memory

A 1 MB extended memory board is available and must be specified at time of order.

Transformer and line loss compensation

The loss compensation functionality is available only on the following current transformer (CT) connected A1800 ALPHA meter configurations:

- 2-element
- 2 ½ element
- 3-element

A meter with loss compensation must first be programmed with the proper utility rate configuration using Elster Electricity meter support software just as you would with any other A1800 ALPHA meter. Next, a special programming step is performed to load the proper loss constants into the meter. This is done with special Windows–based software, *A1800 ALPHA Meter Loss Compensation Tool*.

To configure the loss compensation feature of an A1800 ALPHA Meter you must input the following values into the loss compensation software. These values are site specific and must be uniquely determined for each loss compensation application.

Parameter	Description
%LWFe	Iron watts correction percentage
%LWCu	Copper watts correction percentage
%LVFe	Iron vars correction percentage
%LVCu	Copper vars correction percentage
Meter current	Meter current when power transformer is operating at maximum rating
Meter voltage	Meter voltage when power transformer is operating at rated voltage

Calculation of loss compensation parameters is dependent on the location of the meter with respect to the power transformer. The rated voltage and rated current used in the calculations must represent the values on the same side of the power transformer as the meter is located.

- If the meter is located on the secondary side of the power transformer, then the rated voltage and rated current used in the calculations must be secondary values.

- If the meter is located on the primary side of the power transformer, then the rated voltage and rated current used in the calculations must be primary values.

Refer to the *A1800 ALPHA Meter Technical Manual (TM42-2410)* for details on configuring transformer and line loss compensation.

Optical Port (Available in ANSI or IEC Standard)

The A1800 ALPHA meter provides an optical port that can be ordered with either an ANSI-compliant or IEC-compliant interface. To use Elster Electricity meter support software to read or program the meter requires an optical probe connected to the PC and optical port. This probe connects the computer to the optical port on the meter, and the probe provides the required interface for communications.

For more information on ordering the UNICOM III Probe, contact your local Elster Electricity representative.

Optional batteries

The A1800 ALPHA meter supports up to two batteries. The main battery is under the meter's terminal cover (see Figure 4); the auxiliary battery is located under the meter's main circuit board (see Figure 5).

Figure 4. Optional main meter battery location

Optional main meter battery
(under terminal cover)
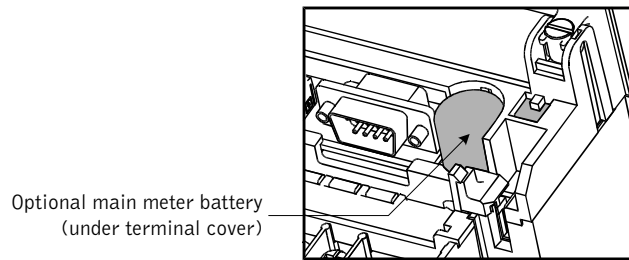
Figure 5. Optional auxiliary meter battery location

Optional auxiliary battery
(under main circuit board)
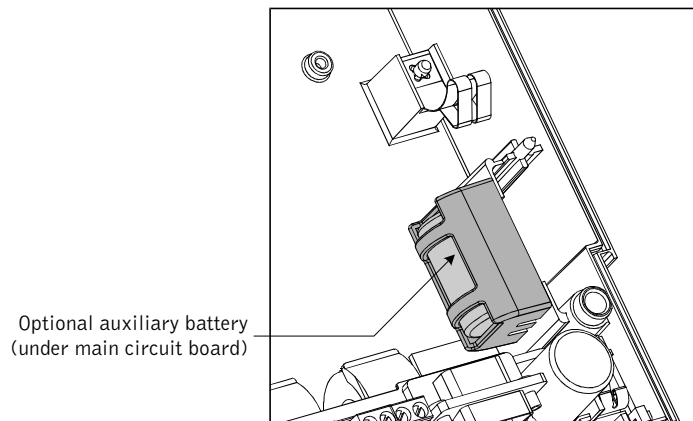
Optional auxiliary power supply

The auxiliary power supply is located under the meter's terminal cover. See Figure 3 for an illustration showing the location of these items.

LCD

The A1800 ALPHA meter is equipped with a 16-segment character liquid crystal display. The LCD is used to display meter data, status, warning, and error information. The LCD operates over a wide temperature range of -45 °C to +85 °C. The LCD is divided into different display regions, as shown in Figure 6. An optional backlit LCD is also available.[2]

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[2] Contact Elster Electricity for complete details.

Figure 6. A1800 ALPHA meter LCD
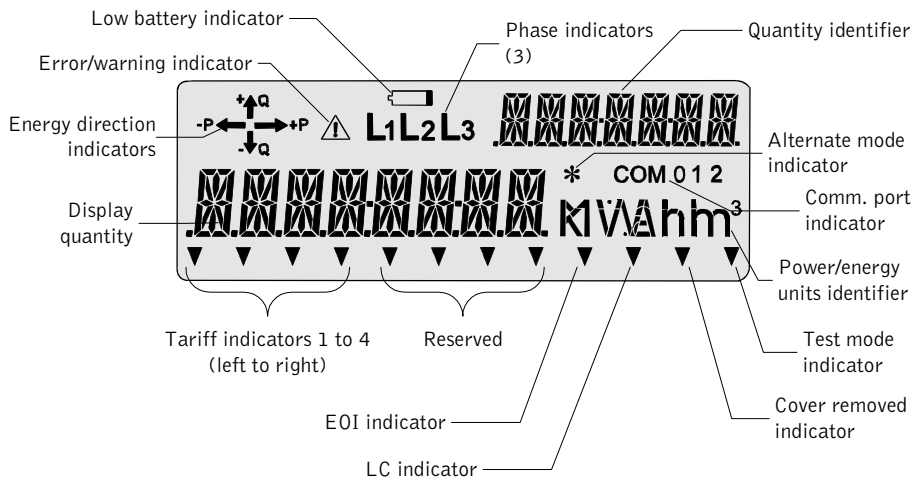
Displayable quantities

Using Elster Electricity meter support software, users can program which quantities are displayed on the LCD. The following summary shows the types of items that can be displayed. A full listing of the possible display quantities can be found in the meter technical manual or the software user guide.

Current billing period. Current billing period readings include the following information:

■ all time-of-use data

■ all available energy and demand readings

■ selected security and instrumentation data

The specific items measured and displayed are selected and programmed by the user with Elster Electricity meter support software.

Figure 7. Metered quantity - tariff 2 cumulative demand

Previous billing period readings. All of the data for the current billing period is automatically stored at the time of a demand reset, including all of the recorded time-of-use data.

Previous season readings. On a season change, all billing data is stored and is available for display.

Self read. The A1800 ALPHA meter can display data from all the self reads.

Figure 8. Metered quantity - tariff 2 delivered (self read)
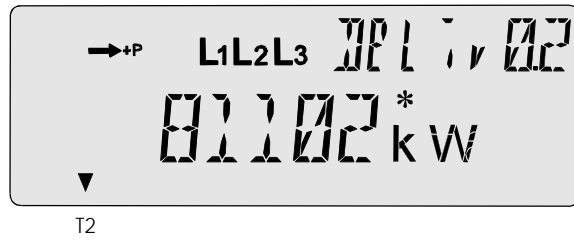
Revenue Protection

Multiple anti-tampering and advanced security features have been built into the A1800 ALPHA meter to ensure revenue protection for our customers. The meter's site diagnostic capability continuously monitors the service, verifying that all phases are present and that the wiring configuration is correct. Adverse or abnormal conditions, such as phase outages and reverse energy events, are logged. In addition to logging, the meter can generate an alarm. The meter can be programmed to record cumulative demand to help monitor potential tampering. The history log provides an audit trail of data-altering or program-changing events within the meter.

An "always run positive" security option enables the A1800 ALPHA meter to calculate the absolute energy value per phase. We also offer an optional write-protection hardware lock feature that disables the meter's ability to be re-programmed in the field.

Application
Cover detection switches record all opening and closing of covers by logging events with a time and date stamp.

Open cover detection switches

Removing the terminal cover or the main meter cover opens a detection switch and exposes the base electronic assembly, including the terminal connections. Each of the covers includes a plastic tab that when released activates the detection switch (Figure 9). When a detection switch is activated the **TC** (terminal cover) indicator on the LCD (Figure 10) will behave in the following manner:

■   turns on and remains on when the terminal cover is removed

■   blinks when the meter cover is removed

Figure 9. Terminal cover tamper detection switch

Cover closed   **Cover opened**

Figure 10. LCD indication of tamper detection

Lit = terminal cover open
Blink = meter cover open
TC

The event is logged with the date and time (even when the meter is not powered).

Site diagnostics

The meter's site diagnostic capability continuously monitors the service, verifying that all phases are present and that the wiring configuration is correct. Adverse or abnormal conditions, such as p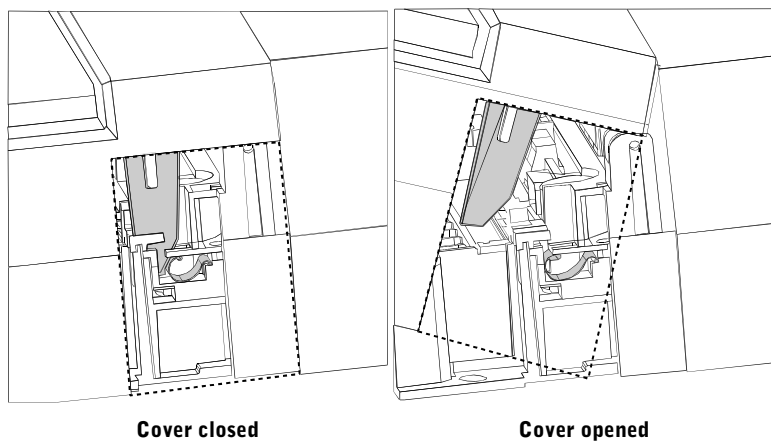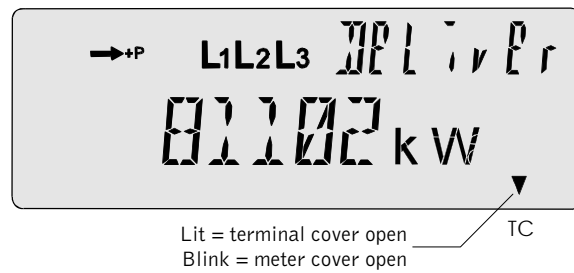hase outages and reverse energy events, are logged. In addition to logging, the meter can generate an alarm. See "Instrumentation profiling" on page 16 for details.

Reverse energy flow warning

The W1 000100 warning code indicates that reverse energy flow has been detected equivalent to the energy represented by 2 test LED pulses since the last reset. It may be an indication of tampering with the A1800 ALPHA meter installation. If reverse energy flow is expected, then this warning code can be disabled through Elster Electricity meter support software.

The code is cleared by these methods:

- performing a demand reset
- issuing the clear values and status command through Elster Electricity meter support software

Cumulative maximum demand

Using cumulative maximum demand, a demand reset adds the current maximum demand value to the cumulative maximum demand. Since the cumulative demand is not reset to zero, unauthorized demand resets do not cause a loss of the maximum demand data.

To determine the maximum demand for a billing period after a demand reset, subtract the previous cumulative demand value from the current cumulative demand value.

Always Positive™ energy measurement

The A1800 ALPHA meter can be ordered with an optional theft-resistant measurement feature, Always Positive, that records reverse energy flow as positive energy flow on a phase-by-phase basis. This feature can be used to deter power theft or minimize the effects of improper meter wiring. The following equation shows how total active power is calculated using theft-resistant measurement:

$$P_{total} = \left|P_1\right| + \left|P_2\right| + \left|P_3\right|$$

Theft-resistant measurement normally applies to registration of active energy. Apparent energy registers are calculated and signed normally. Instrumentation values, including +kWh and -kWh, are also signed normally. Therefore, instrumentation can be used to investigate the meter service wiring, while the theft–resistant measurement guarantees that active energy is properly registered.

Application
This feature makes sure the meter is installed correctly and generates an alarm if it is not.

Application
If the metered service is not expected to return energy, this warning may be an indication of tampering. Further investigation is recommended. In some cases, the A1800 ALPHA meter may need to be returned to the factory.

Application
This feature is used to calculate the previous maximum demand when the demand may have had an unauthorized reset.

Application
Prevent tampering and minimize the tampering's effect by forcing positive energy flow in the event of improper wiring.

NEW

> *Note:* *In the rare situation of extremely poor power factor, 2-element applications where the phase shift of the first element exceeds 60° will result in over-measuring of the first element energy and may result in incorrect overbilling.*

Operation of the LCD energy direction indicators is modified by theft-resistant measurement. With the theft–resistant option, the -P arrow is not used. The +P energy direction indicator is on continuously whenever kWh flow of any direction is detected.

Write prevention lock

Application

Prevent unauthorized meter configuration changes with this feature by locking the meter configuration at the factory.

If specified at time of ordering, by default, an A1800 ALPHA meter will not allow meter program parameters to be altered unless the meter is in program mode. see "Program mode (optional)" on page 20 for more details.

Three-level passwords

Application

Prevent unauthorized access to meter data and configuration using the extensive password protection feature.

Meter passwords, set by the utility, provide security against unauthorized communications to the meter. Communications cannot be initiated with the meter unless the user gives the correct password. The A1800 ALPHA meter uses three different passwords for granting specific access to data. One password allows "read only" access to meter data and prevents programming changes. A second password permits tasks required for billing data collection, such as adjusting the date and time, performing demand resets, and clearing any errors and warnings. A third password allows full programming capability for changing meter configuration parameters.

Security audit trail

Application

Obtain a complete audit trail of meter operations and incidents, an invaluable tool for obtaining evidence of unauthorized meter operation.

All A1800 ALPHA meter configurations (including the A1800D) provide audit trails for detecting potential tampering incidents. In addition to the history log and event log, which can be used to help determine possible meter tampering, the A1800 ALPHA meter can report such events as the following:

- number of manually-initiated demand resets
- number of days since last demand reset
- number of days since last pulse detected
- reverse energy flow
- number of failed password attempts

All A1800 ALPHA meters record a chronological history of programming changes to the meter.

Exceptional Environmental Performance

Meters are routinely subjected to a diverse range of harsh environments, including extreme temperatures and dust. Even meters installed in indoor industrial environments or inside cabinets can be exposed to severe conditions. Elster has addressed these demanding requirements by designing the A1800 ALPHA meter with many of the robust features used in our outdoor electronic meters.

Rugged enclosure

The A1800 ALPHA meter family is designed for indoor mounting. The cover assembly of the A1800 ALPHA meter exceeds the environmental requirements of IEC 62053-11. The A1800 ALPHA meter provides an IP54 degree of resistance from water, dust, and sand.

Encased in a rugged polycarbonate enclosure, the A1800 ALPHA meter functions reliably within a wide operating temperature range of -40 °C to +85 °C (inside the meter) and a wide operating humidity range of 0% to 100 % non-condensing.

Clear nameplate information

The A1800 ALPHA meter family provides ample nameplate information, protected under a plastic cover. The information is easy to read, indelible, and tamper-resistant. It will last as long as the meter and will not be affected by the UV light. The nameplate will also include barcode serial number information for easy stock control.

Technical Details

Accuracy class

The A1800 ALPHA meter meets or exceeds requirements of IEC standards.

Configuration	IEC 62053-22		IEC 62053-21		IEC 62053-23[1]	
	Class 0.2 S	Class 0.5 S	Class 1.0	Class 2.0	Class 2.0	Class 3.0
direct connect			✓	✓	✓	✓
transformer-rated	✓	✓			✓	✓

[1] Actual reactive energy accuracy is substantially better than required by the standard.

Terminal configurations

The A1800 ALPHA meter supports three terminal configurations:

- 100 A (120 A thermal) self-contained with voltage disconnect links
- 10 A transformer-rated (sequential)
- 10 A transformer-rated (symmetrical)

Wiring configurations. Refer to the wiring diagram on the nameplate of each meter for specific terminal assignments. All connections are equipped with combination-head screws that accept either a slotted or Phillips screwdriver.

Figure 11. Two–element, three–wire delta transformer connected
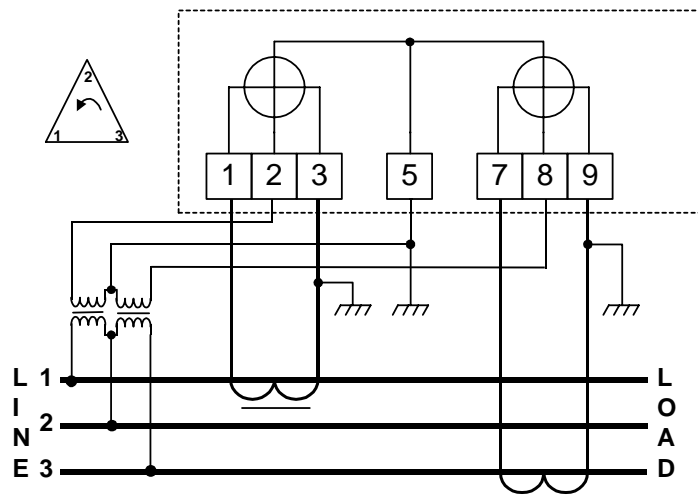
Figure 12. Three-element, four-wire current transformer, sequential connection
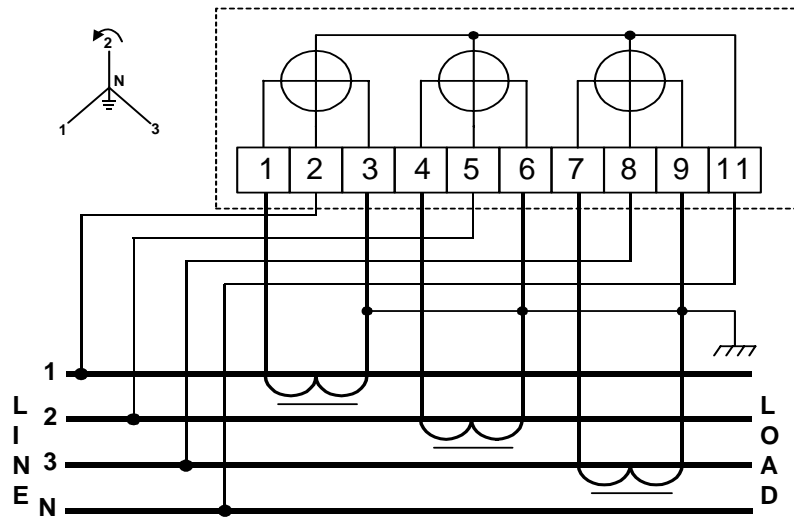
Figure 13. Three-element, four-wire current transformer, symmetrical connection
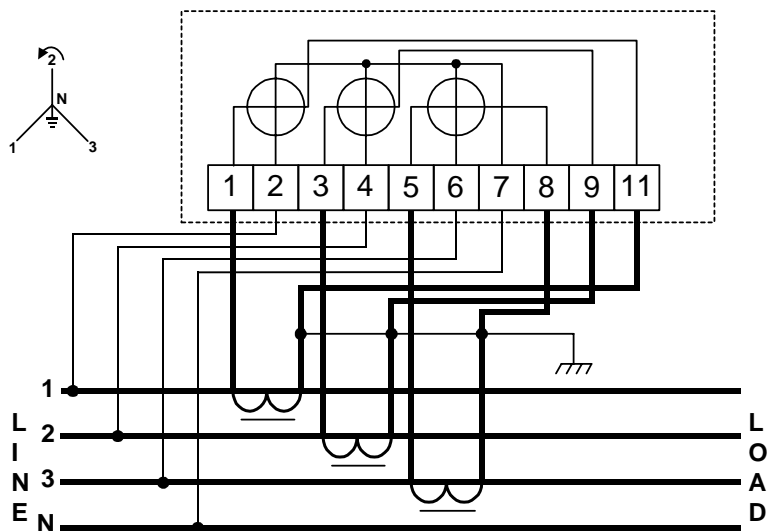
Figure 14. Three–element, four–wire instrument transformer, sequential connection
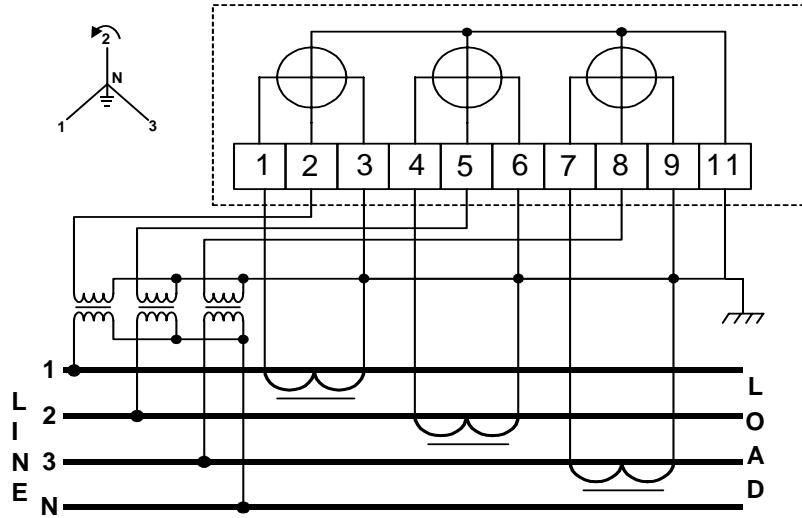
Figure 15. Three-element, four–wire instrument transformer, symmetrical connection
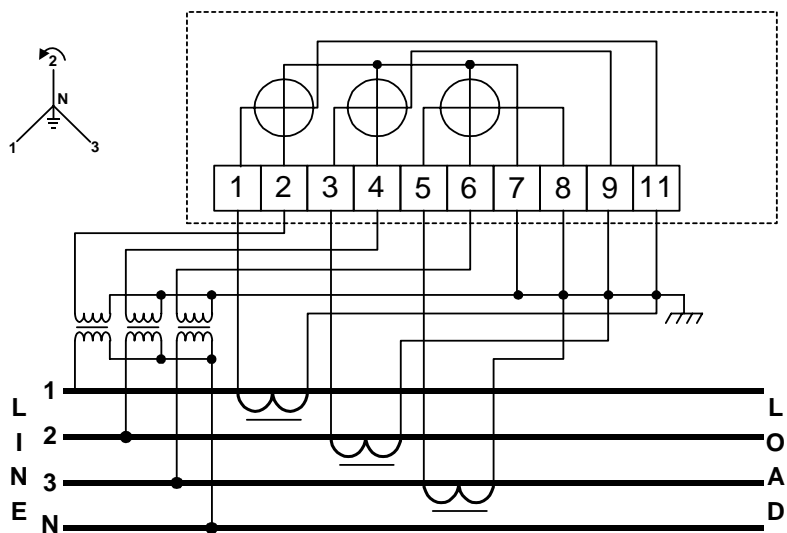
Figure 16. Two–element, three–wire delta or network connection
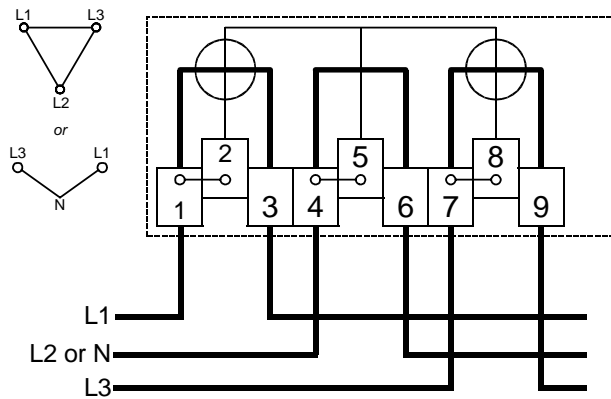
Figure 17. Three–element, four–wire wye or four–wire delta connection

Wide operating ranges

The A1800 ALPHA meter has the following wide operating ranges:

- voltage – 46 V to 528 V

- current – 1 mA to 10 A (CT-connected)
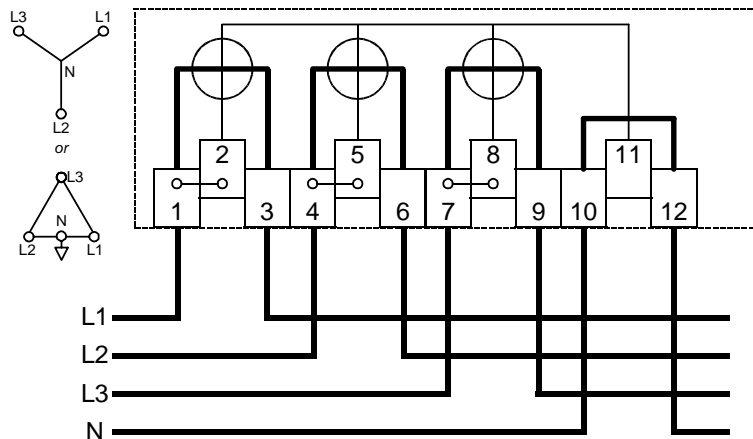
Application
Wide current and voltage ranges allow for reduced inventory stocking levels.

Four-quadrant metering

Four-quadrant metering allows measurement of active, reactive, and apparent energy in both the delivered and received directions. A1800 ALPHA meters with reactive or apparent metering capabilities can measure two quantities, one average power factor and two coincident values. When enabled with advanced four-quadrant metering, these meters offer six measured quantities, two average power factors and four coincident values.

Meter types

The A1800 ALPHA meter family is delivered factory-configured in the following basic meter configuration:

A1800R	VARh and VAR, VAh and VA[1], Wh and W on a TOU basis

[1] VAh and is measured by vectorial calculation using Wh and VARh on a continuos integration basis.

The following additional functions can be applied to the meter types:

Suffix	Description of function
L	Load profiling (LP)
N	Instrumentation profiling (IP)
C	Transformer and line loss compensation (LC)
A	Advanced four-quadrant metering (6 quantities)

Option boards

Some of the option boards available for the A1800 ALPHA meter are indicated below:

- output relay option board (2 relays)
- internal modem option board
- RS-232 option board
- RS-485 option board
- 1 MB extended memory board
- auxiliary power supply

Instantaneous service measurements

System instrumentation quantities are measured instantaneously and generally provided on a per phase basis. The instrumentation measurements are near instantaneous. Using Elster Electricity meter support software, instrumentation quantities may be placed in normal, alternate, or test mode display sequences. The alternate mode display sequence is recommended because it is generally not necessary for these quantities to be displayed at all times.

The meter's LCD can be programmed with Elster Electricity's meter support software to display primary instrumentation values.

Figure 18. System instrumentation kVA
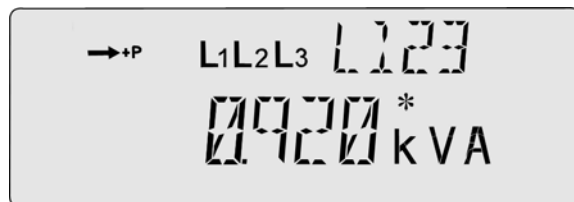
A1800 ALPHA meters can provide instantaneous measurements of the following values:

- Frequency
- System kW
- System kVA (arithmetic)
- System kvar (arithmetic)
- System power factor (arithmetic)
- System power factor angle (arithmetic)
- System kvar (vectorial)
- System kVA (vectorial)
- System power factor (vectorial)
- System power factor angle (vectorial)

- Phase voltages and currents
- Phase voltage angle relative to line 1 voltage
- Phase kW and kVA
- Phase kvar (vectorial)
- Phase current angle relative to line 1 voltage
- Phase power factor
- Phase power factor angle
- Phase 1st harmonic (fundamental) voltage magnitude
- Phase 1st harmonic (fundamental) current magnitude
- Phase 2nd harmonic voltage magnitude
- Phase 2nd harmonic current magnitude
- Phase 2nd harmonic voltage percentage
- Phase total harmonic current magnitude
- Phase total harmonic distortion percentage (voltage or current)
- Phase total demand distortion

Load profiling

In meters with load profiling capabilities (designated with the "L" option), the A1800 ALPHA meter can record up to 8 channels of information, using metered quantities as sources for load profiling.

Instrumentation profiling

Application

Identify tampering and monitor power quality using instrumentation profiling.

NEW

In meters with instrumentation profiling capabilities (designated with the "N" option), the A1800 ALPHA meter has 2 sets of instrumentation recorders. A set can record up to 16 channels of information about the conditions at the meter installation. Any instrumentation quantity can be recorded. Each channel can be configured to sample its selected quantity over the instrumentation interval and can record the results in one of the following ways:

|	
Minimum	The meter samples the selected quantity over the instrumentation interval. The minimum value of all the samples is recorded.
Maximum	The meter samples the selected quantity over the instrumentation interval. The maximum value of all the samples is recorded.
Average	The meter samples the selected quantity over the instrumentation interval. The average value of all the samples is recorded.
End	The meter samples the selected quantity over the instrumentation interval. The last value of all the samples is recorded.

Figure 19. Instrumentation profiling recording options
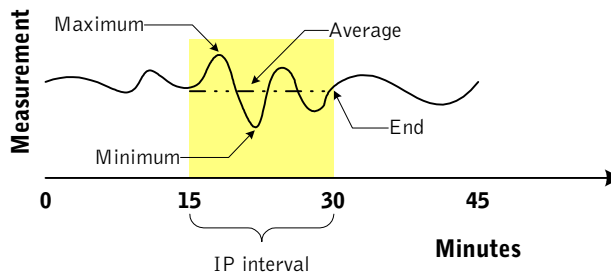
Each set of instrumentation profiling has its own, independent interval length that is configured separately from the demand interval length.

Relays

Application

Relays can be programmed to provide alarms on TRueQ events.

The A1800 ALPHA meter supports the installation of one or two option boards and one or both option boards can include relay outputs. The meter supports up to 6 relays (4 relays on the main circuit board and 2 relays on an option board), depending upon the communications options being used. For more information about relay outputs and communications, see the instructional leaflet that comes with the option board.

Figure 20. A1800 ALPHA meter - relay options

RS-232 connector (optional)*

RS-485 terminals (optional)*

Pulse output relays

RS-485 terminals

RS-232 connector

*Present when optional second communication port installed

Pulse output relay default values

A   B   C   D   E   F

A = Wh del
B = varh del
C = Wh rec
D = varh rec

E = EOI
F = LC

RS-485 connections

Tx+   Rx-

Tx-   Rx+

RS-232 connector

1● 2● 3● 4● 5●
6● 7● 8● 9●

1 = NC   6 = DSR
2 = Rx   7 = RTS
3 = Tx   8 = NC
4 = DTR   9 = NC
5 = GND
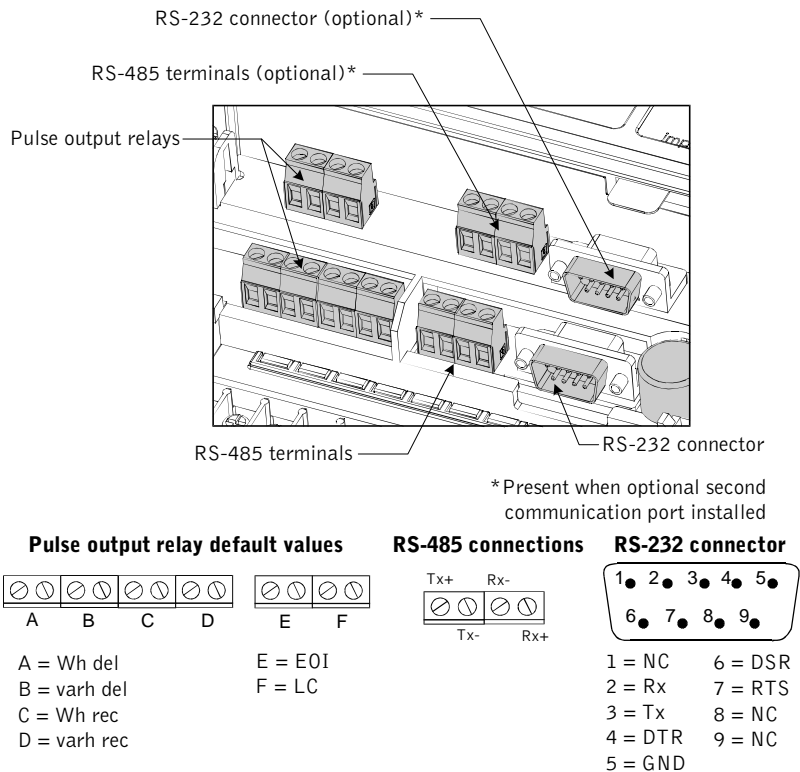
The output relays can switch up to 250 VAC or 350 VDC at up to 70 mA. See "Wiring configurations" on page 11.

With the A1800 ALPHA meter, all relay outputs are programmable using Elster Electricity meter support software. Sources for relay outputs are listed in Table 3.

Table 3. Sources for relay operation and output specifications

Relay source	Relay output specification
Energy pulse	For each pulse of the selected basic metered quantity (see "Billing data" on page 22), the relay will do either of the following: • toggle (that is, turn on and off) • pulse for a specified length of time
Load control	The relay closes when the demand exceeds the specified demand threshold, and it remains closed for the duration of the interval. The relay will open after the demand remains below the threshold for one full interval.
EOI indication	The relay closes for 5 seconds after the end of each interval or subinterval.
Demand forgiveness (cold load pickup)	The relay closes while demand forgiveness is in effect. The relay will open after the demand forgiveness time has expired.
TR$_{ue}$Q tests failure	Relay closes as long as the specified TR$_{ue}$Q tests continue to fail.
Specified errors, warnings, and meter events	The relay closes for as long as the specified errors, warnings, or events persist.
TOU switches to a specific rate	The relay closes for the duration of the specified rates.

Detailed Logs

NEW

All A1800 ALPHA meters are equipped with nonvolatile EEPROM. The standard storage space is 128 KB of main board memory. A small portion of this main board memory is permanently reserved (called *reserved memory*) by the meter to store the main billing and configuration information. The remainder of the memory, called *shared memory*, is used to store the logs and data sets.

Using Elster Electricity's meter support software, you can configure the number of entries for each log as well as specify events to be logged.

All the logs and data sets share the meter's shared memory. The sizes of each may vary to allow more room for a different log or data set. For example, self reads can store less data so that load profiling can store more memory.

History log

NEW

All A1800 ALPHA meter configurations can record alterations to meter programming in a history log. Each entry in the history log includes the following:

- ■ date and time

- ■ ANSI C12.19 table modified or procedure ID used

- ■ user ID of the person whose account edited the table or performed the procedure

Event log

All A1800 ALPHA meter configurations can record the date and time when meter events occur. Meter events include the following:

- power failures (start date & time and stop date & time)

- demand resets

- test mode (start date & time and stop date & time)

- time changes (the before and after times)

- TOU rate override (start date & time and stop date & time)

- event log reset

- per phase outage (start time and stop time)

- terminal cover opened (date & time)

- meter cover opened (date & time)

Self reads

Application

Self reads eliminate the need to schedule exact meter reader visits to the meter and still allow for consistent periodic reads at the same day of every month.

All A1800 ALPHA meters support up to 35 self reads. A self read records current billing data and stores it in memory. Self reads can be triggered by a scheduled calendar event or every demand reset. This data can be retrieved later for analysis or billing.

Voltage sag log

The meters also have a voltage sag log. The voltage sag log records the date, time, and phase of any detected voltage sag below a user-defined threshold. The meter recognizes sags in duration as short as 2 line cycles on any phase.

Metercat™

Metercat, Elster Electricity's meter support software, is a 32-bit application running under Microsoft Windows 95/98/NT/Me/2000/XP. Metercat gives users the ability to communicate with and program the A1800 ALPHA meter in a Windows environment. To provide for easier analysis, Metercat generates meter reading reports in HTML format. Users are assigned unique IDs and group level rights, providing flexible security in deployment. Additionally, Metercat comes with multiple language support.

Alpha Keys™

Alpha Keys software allows A1800 ALPHA meters to be upgraded with additional functionality. Upgrading with Alpha Keys software means the meter will not need to be returned to the factory, and new meters are not necessary for added functionality.

Table 4 lists the options that can be added to the meter using Alpha Keys:

Table 4. Configuration option upgrades

Additional function	Can be added to
Load profiling	A1800R
Instrumentation profiling	A1800RL
Transformer and line loss compensation[1]	A1800R
Advanced four quadrant metering	A1800R

[1] Contact Elster Electricity for availability.

Operating Features

Operating modes

The A1800 ALPHA meter operates in one of the following modes:

- normal
- alternate
- program (optional)
- test

As part of its standard function, the meter performs self tests to make sure it is operating correctly. The self test ensures that the A1800 ALPHA meter is functioning properly and that its displayed quantities are accurate. If the self test indicates an error exists, the LCD will display the error/warning indicator. The meter will attempt to function normally, but meter data may be suspect.

Normal mode. Normal mode is the default operating mode for the A1800 ALPHA meter. It is generally used to display billing data on the LCD. The meter is fully operational in this mode, and it will process and store data while the LCD scrolls through the normal display list quantities. Typically, the normal display mode cycle begins with an LCD test, which turns on all the display segments. The normal mode cycle then scrolls through all programmed display quantities before beginning the cycle again.

While in normal mode, the test LEDs and optical port transmit test pulses proportional to metered energy. See "Pulse outputs" on page 21 for more information.

Alternate mode. Alternate mode can be programmed with Elster Electricity meter support software to display a second set of quantities on the LCD. Alternate mode is most often used for displaying non–billing data, but it can be programmed to display any of the available quantities. This mode is activated in one of the following ways:

- pressing the ALT (✦) button on the A1800 ALPHA meter
- after power up (for one cycle of the alternate display list

    Note: This feature can be disabled using Elster Electricity's meter support software.

The meter is fully operational while in alternate mode. While in alternate mode, the test LEDs and optical port transmit test pulses proportional to metered energy (See "Pulse outputs" on page 21 for more information.) and the alternate display indicator displays.

If the LCD remains on a pulse line cumulative counter, the meter will exit the alternate mode at midnight. For the A1800D meter, which uses relative timekeeping, midnight may not be synchronous with a realtime clock.

Program mode (optional). If specified at time of ordering, by default, an A1800 ALPHA meter will not allow meter program parameters to be altered unless the meter is in program mode. Only some data and configuration parameters can be altered while the meter is in program mode. These alterable items must be specified during order entry and can include:

- communication parameters
- power quality parameters
- time of day (TOU or load profiling configurations)
- switch times (TOU configurations)
- special dates list (TOU or load profiling configurations)

NEW

Application
Program mode can only be entered by unlocking the hardware lock. This ensures that meters are installed and maintained with their originally-intended program, minimizing the opportunities for unauthorized reprogramming of the meter.

All other parameter changes require the meter to be in program mode. While in program mode, the test LEDs and optical port transmit test pulses identically as in normal mode. See "Pulse outputs" on page 21 for more information.

Test mode. Test mode displays test readings without affecting the present energy usage and billing data values in the A1800 ALPHA meter. Shorter demand intervals may be used in test mode to reduce demand test time and will not interfere with billing data. When normal mode is resumed, readings taken during test mode will be discarded, and present energy usage and billing data values will be restored.

Test mode is activated by issuing a command to the meter over the optical port using Elster meter support software. The command can include parameters that select the pulse source and pulse speed:

- pulse source options
    - kWh energy
    - alternate energy (kVARh for A1800R meters)

See "Pulse outputs" on page 21 for more information.

Pulse outputs

With A1800 ALPHA meters, all pulse outputs (optical port pulse outputs, test LEDs pulse outputs, and relay pulse outputs) are programmable using Elster Electricity meter support software. Table 5 lists the default values of pulse outputs for the A1800 ALPHA meter.

Table 5. Default pulse output settings

Legend		Normal	Alternate	Test
Pulse output: ⊓	**Optical port**	5000	2500	20,000
	Output type / Divisor	⊓ 8	⌐ 8	⌐ 1
Toggle output: ⌐	**Test LEDs**	5000	5000	40,000
	Output type / Divisor	⊓ 8	⊓ 8	⊓ 1
	Relays	5000	5000	40,000
	Output type / Divisor	⊓ 8	⊓ 8	⊓ 8

Push buttons

The A1800 ALPHA meter is equipped with two buttons: an alternate mode button and a RESET button. These buttons are located on the front of the meter (see Figure 21). The buttons are used to manually change the meter's operating mode and display.

Figure 21. Push buttons

ALT (✶) button

RESET button
(sealable)
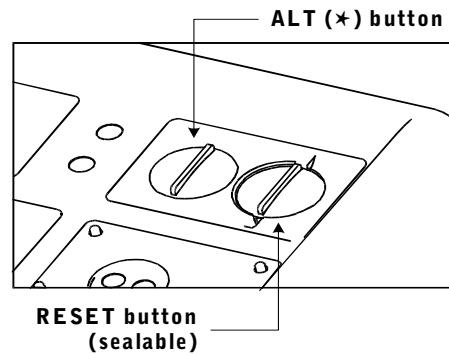
ALT button. Pressing the ALT (✶) button initiates the alternate mode display sequence. The button performs differently depending on the operating mode.

RESET button. The RESET button is typically used to perform a demand reset. The RESET button can be sealed to prevent unauthorized demand resets. Pressing the RESET button initiates a sequence of events to reset the billing demand to zero, starts a new billing period, and stores a complete set of billing quantities for the ending period in nonvolatile memory.

Demand reset lockout. After a demand reset, the register can be programmed to ignore subsequent manual demand resets for a specified time. This can prevent accidental, multiple demand reset operations.

Billing data

All A1800 ALPHA meters are capable of measuring delivered and received kWh and kW demand. The A1800K and A1800R meters can measure apparent and reactive energy and demand. The meter engine samples the voltage and current inputs and sends these measurements to the microcontroller. In the meter engine, each pulse is equal to 1 K_e, defined as one of the following:

■ secondary-rated Wh per pulse

■ secondary-rated varh per pulse

■ secondary-rated VAh per pulse

Basic metered quantities can be selected as a source for relay or optical pulse outputs. The remaining metered quantities are calculated from two or more basic metered quantities.

Table 6. Metered quantities by meter type

Metered quantity	A1800R
kVAh delivered (Q1 + Q4)	✓
kVAh Q1	✓
kVAh Q2	✓
kVAh Q3	✓
kVAh Q4	✓
kVAh received (Q2 + Q3)	✓

Metered quantity	A1800R
kVAh sum (del + rec)	✓
kvarh (Q1 - Q4)	✓
kvarh (Q1 + Q4)	✓[1]
kvarh (Q2 - Q3)	✓
kvarh (Q2 + Q3)	✓[1]
kvarh (Q3 - Q2)	✓
kvarh delivered (Q1 + Q2)	✓[1]
kvarh net	✓
kvarh Q1	✓[1]
kvarh Q2	✓[1]
kvarh Q3	✓[1]
kvarh Q4	✓[1]
kvarh received (Q3 + Q4)	✓[1]
kvarh sum (del + rec)	✓[1]
kWh delivered	✓[1]
kWh net	✓
kWh received	✓[1]
kWh sum	✓[1]

[1] Basic metered quantity (can be used to drive outputs)

Average power factor. The A1800 ALPHA meter can calculate and display average power factor. Average power factor is calculated and updated by the meter every second from the total energy values since the last demand reset.

The quantities used to calculate the average power factor are user-configurable. After each demand reset, the values used in the calculation are set to zero, and the average power factor is set to 1.000. Full TOU data is maintained for each power factor.

Demand calculation. Demand is the average value of power over a specific time interval. The A1800 ALPHA meter supports three different methods for demand calculation.

Rolling interval	Rolling demand is defined by two parameters: demand interval length and subinterval length. Both of these values are configured by Elster Electricity meter support software. Demand is calculated at the end of each subinterval, resulting in overlapping demand intervals.
Block interval	Block demand is a special form of rolling interval demand in which the subinterval is the same length as the demand interval.
Thermal time constant	The A1800 ALPHA meter can calculate demand based on a logarithmic scale that accurately emulates thermal demand meters.

Maximum demand. The A1800 ALPHA meter stores the highest demand value that occurs in a billing period, called the maximum demand. In addition to maximum demand, the A1800 ALPHA meter stores either cumulative or continuous cumulative maximum demand.

Coincident demand or power factor. Coincident values are values that occur during the same interval the demand reaches peak value. A1800 ALPHA meters can be programmed to trigger the recording of a coincident demand or power factor. The number of coincident values that can be captured by the A1800 ALPHA meter depends on whether or not the advanced four-quadrant metering option (-A suffix) is present.

- A1800R meters can record 2 coincident demand or power factor values.

- A1800RA meters can record 4 coincident demand or power factor values.

TOU data. A1800 ALPHA meters with TOU capabilities store energy and demand data for the total (single rate) in addition to the four TOU rates.

Demand forgiveness. Demand forgiveness is the time after a power outage when demand is not calculated or stored. Using Elster Electricity meter support software, the A1800 ALPHA meter has two programmable settings for demand forgiveness:

- the number of minutes a power outage must last to qualify for demand forgiveness (0 to 15 minutes)

- the number of minutes after a qualified power outage when demand is not calculated or stored (0 to 255 minutes)

Meter tools

The A1800 ALPHA meter can perform these series of tests to analyze the electrical service and verify its own operation:

- System instrumentation

- Tamper restraint and quality monitoring (TRueQ™)

- System service tests

- Meter self testing

System instrumentation. System instrumentation measurements provide nearly instant analysis of electrical service. Most of the >50 instrumentation quantities are true root mean squared (rms) measurements over an even number of line cycles, but others are compound quantities. Compound quantities require multiple measurements at slightly different times with the results from these multiple measurements. Instrumentation measurements are not billing measurements. Instrumentation quantities are immediate; billing is measured or averaged over time. Billing quantities measure all present phases; instrumentation quantities can measure each phase separately.

- frequency

- per phase current, voltage, kW, kVA, and kVAR

- per phase voltage and current angles (with respect to phase A voltage)

- per phase fundamental (1st harmonic) voltage and current magnitudes

- per phase 2nd harmonic current and voltage magnitudes

- per phase voltage and current percent Total Harmonic Distortion

- per phase harmonic current magnitude (sum of 2nd through 15th)

- system kW

- per phase PF and PF angle

- system PF and PF angle (arithmetic)

- system PF and PF angle (vectorial)

- system kVAR and kVA (arithmetic)

- system kVAR and kVA (vectorial)

- per phase 2nd harmonic voltage percentage

- per phase total demand distortion

System service tests. System service tests can be performed to determine the validity of the electrical service that the A1800 ALPHA meter is metering. The system service tests consist of a service voltage test and a service current test.

Service voltage test

The service voltage test is intended to assist in identifying the following:

- incorrectly wired or misapplied voltage transformers

- open or missing line fuses

The following are validated by this test:

- phase voltages

- phase voltage angles

- phase rotation

The meter measures each phase voltage and phase voltage angle and attempts to match the measurements to a stored list of valid services.

- If the service voltage test is successful, the validated service is shown on the meter's LCD and the meter will continue to the next display quantity in the sequence.

- If the test is not successful, a warning is set. Also, the LCD will indicate a service error by displaying SE plus a code on the LCD.

Figure 22. Service current test error
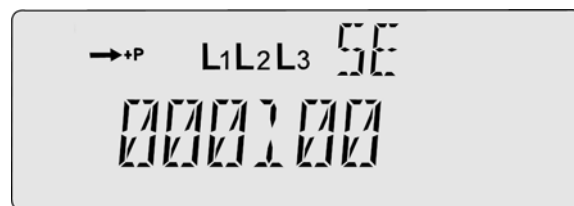
The following conditions can cause the service voltage test to fail:

- phase voltage angles not within ±15° of the expected service phase angles

- phase voltage magnitudes not within the tolerance of the nominal service voltages programmed into the meter with Elster Electricity meter support software

System service locking

Once a service voltage test has detected a valid service, it can be locked into the A1800 ALPHA meter memory. A locked valid service is used as a basis for future system service tests and TR$_{ue}$Q tests. The following information will be stored in the meter when the service is locked:

- service type identification

- nominal service voltage

- voltage phase rotation

- service voltage and current limits

- voltage sag detection threshold

The A1800 ALPHA meter can lock a valid service in either of these ways:

- smart autolock

- manual lock

To indicate that a service voltage test is complete, the LCD displays the following (an example is shown in Figure 23):

- phase rotation (for example, L1-2-3 or L3-2-1)

- voltage magnitude (for example, 120 or 240)

- service type showing the number of wires and the service type, for example:

    - 1L is a single phase service

    - 3Δ is a 3-wire delta service

    - 4Y is a 4-wire wye service

Figure 23. Sample service voltage test result
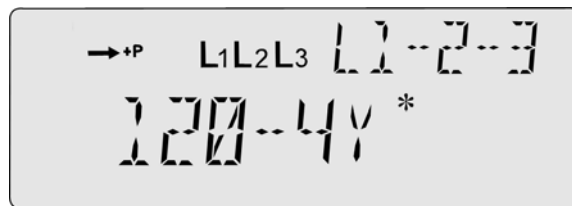
The voltage magnitude and service type appear surrounded by brackets when the service is locked.

Service current test

Application

The service current test can detect tampering of meters by flagging incorrectly wired meters.

The service current test validates system currents and is intended to assist in identifying the following:

- incorrectly wired or misapplied current transformers

- incorrectly wired sockets

- open or missing load-side fuses

If the service current test is successful, L1-2-3 OK is shown on the A1800 ALPHA meter LCD. The meter will continue to the next item in the display sequence. See Figure 4-8 for an example of a successful service current test.

*Figure 24. Service current test successful completion*
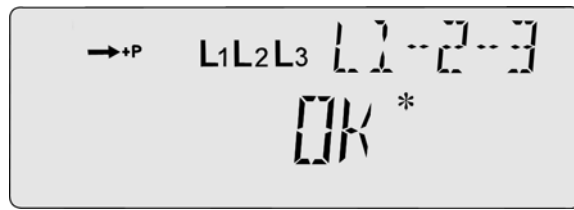
If the test is not successful, a warning is set. Also, the LCD will indicate a service error by displaying SE and a code, an example of which is shown in Figure 22.

Meter self testing. A1800 ALPHA meters are factory-calibrated and tested for years of trouble-free service. No field calibrations or adjustments are necessary to ensure accurate operation of the meter. It is normal, however, for the A1800 ALPHA meter to perform self tests. Self tests verify the meter is operating properly. Errors that are encountered are displayed on the LCD.

Technical specifications

Dimensions

Figure 25. Dimensions (in millimeters) - for reference only - do not use for construction
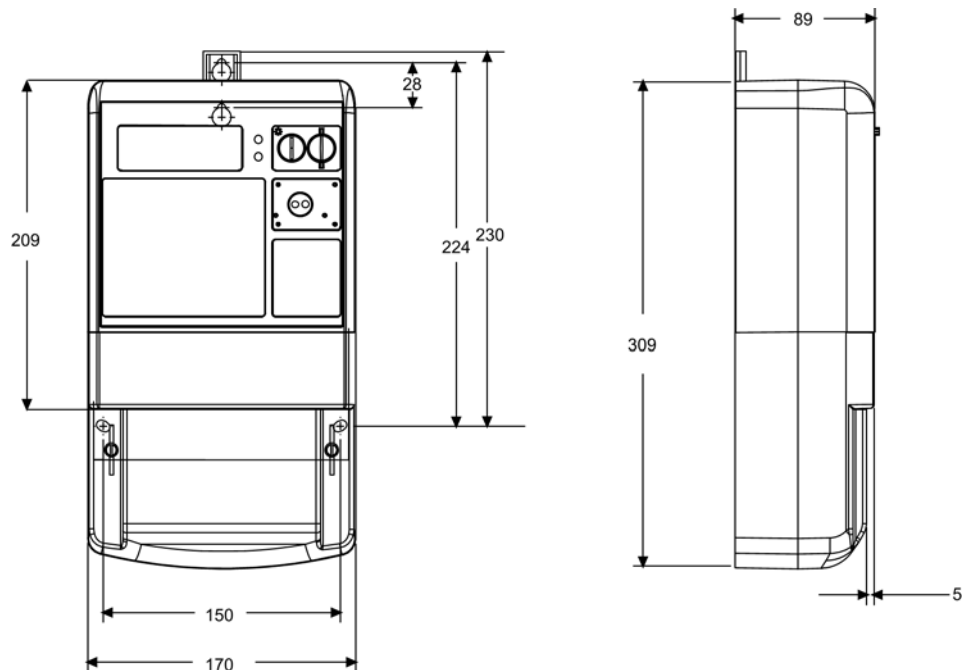
Absolute maximums

Voltage	Continuous 528 VAC	
Surge voltage withstand	*Test performed*	*Results*
	Oscillatory (IEC 61000-4-12)	2.5 kV, 60 seconds
	Impulse voltage test (IEC 60060-1)	12 kV @ 1.2/50 µs, ≥ 450 Ω 8 kV with option boards)
	AC voltage (insulation)	4 kV, 50 Hz for 1 minute
Current	Continuous at Class amperes	
	Temporary (0.5 seconds) at 2000 % of maximum meter current	

Operating ranges

Voltage

Nameplate nominal range	58 V to 415 V	
Operating range	49 V to 528 V	
Current	0.0 A to 10 A	
Frequency	Nominal 50 Hz or 60 Hz ± 5 %	
Temperature range	-40 °C to +85 °C inside meter cover -40 °C to +65 °C outside	
Humidity range	0 % to 100 % noncondensing	

Operating characteristics

Power supply burden	Less than 3 W		
Per phase current burden	0.1 mΩ typical at 25 °C		
Per phase voltage burden	0.008 W at 120 V	0.03 W at 240 V	0.04 W at 480 V
Accuracy	*Active energy*		*Reactive energy*
	0.2 % (IEC 62053-22) 0.5 % (IEC 62053-22) 1.0 % (IEC 62053-21)		2.0 % (IEC 62053-23) Actual accuracy is better than 0.5 %

General performance characteristics

Starting current

CT-connected	1 mA
Direct connect	< 40 mA (I_b = 5 A)

Creep 0.000 A (no current)	No more than 1 pulse per quantity, conforming to IEC 62053 requirements
Internal clock accuracy	Better than 0.5 seconds/day (while powered), conforming to IEC 62054-21
Outage carryover capacity	$LiSOCl_2$ battery rated 800 mAhr, 3.6 V and shelf life of 15+ years. 5 years continuous duty at 25 °C.
	Supercapacitor (optional) is expected to provide carryover power for all normal power outages for a period of at least 24 hours at +25 °C and a minimum of 30 minutes at +85 °C. The battery is not under load except when supercapacitor is discharged or when a programmed meter is stored for an extended period without line power. Based on this low duty cycle, the projected life of the battery in normal service is expected to be greater than 20 years.

Communications rate

Optical port	1200 to 28,800 bps	Physical components meet IEC 62056-21 or ANSI C12.18
Optical port protocol	ANSI C12.18 and C12.19	
Serial ports	1200 bps to 19,200 bps	
Serial port protocols	ANSI C12.21 and C12.19	