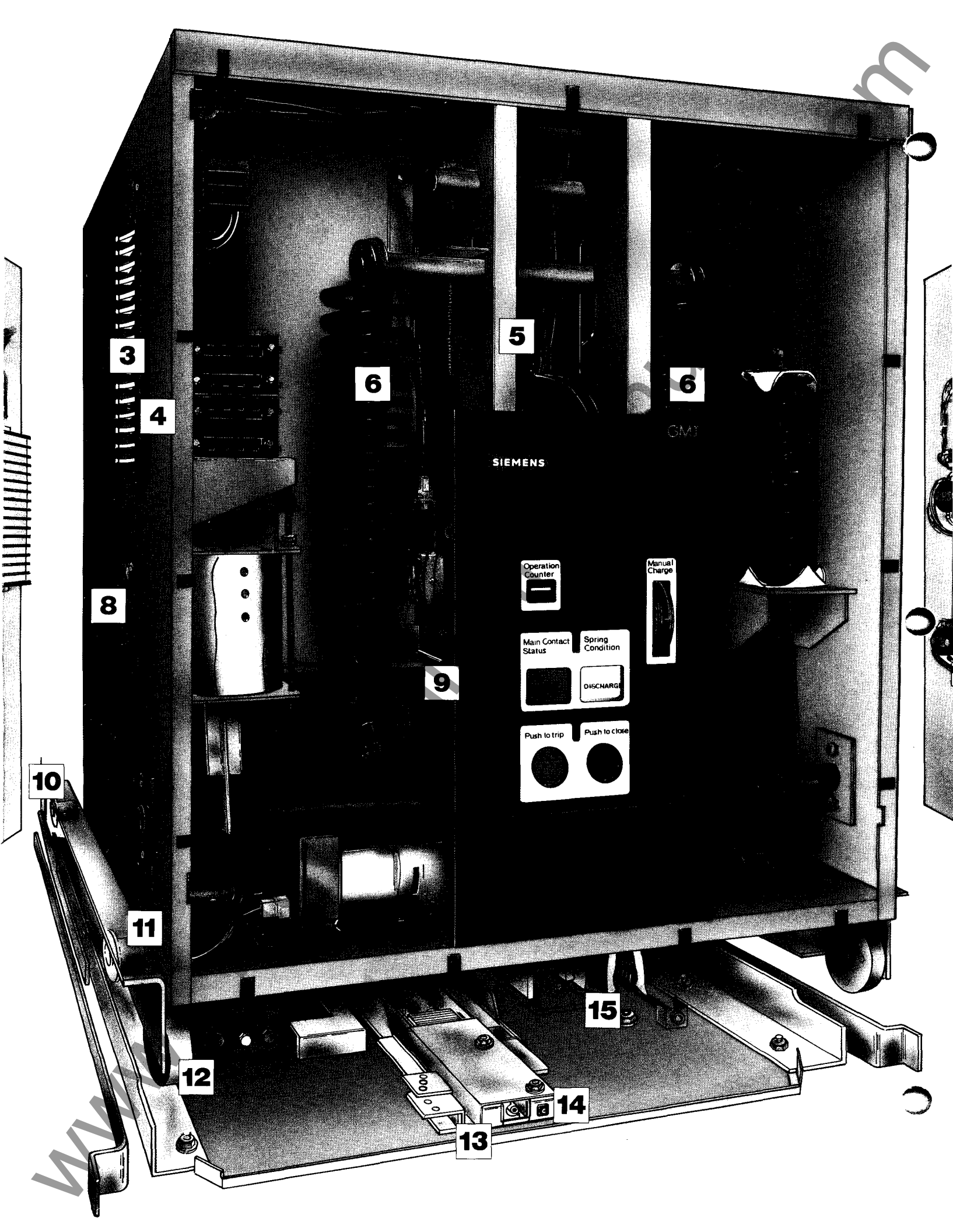


SIEMENS

GM Stackable Medium Voltage Metalclad Switchgear



SG3109-01



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SIEMENS

GM1

Operation Counter

Manual Charge

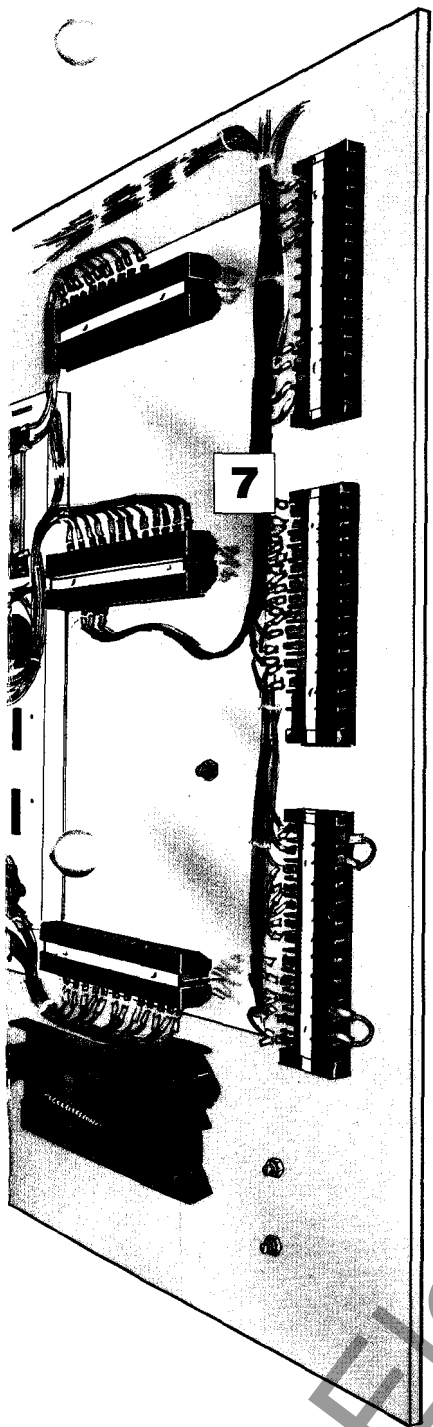
Main Contact Status

Spring Condition

DISCHARGE

Push to trip

Push to close



The GM design significantly reduces on-going maintenance costs.

- Vacuum interrupter requires no service - withstands 30,000 mechanical operations, 100 full current interruptions and has a ten year shelf life.
- Interrupter mechanism has no slides or pivots to wear or that require lubrication.
- Simple inspection process for contact wear.
- Single size primary stabs in all rating cells simplify ground testing.
- GMI breakers in lower cells rollout directly on the floor.
- GMI breakers in upper cells rollout on extension rails.
- GMI operator mechanism is front mounted; all adjustments are accessible without tipping or reorienting the breaker in any way.
- The need for most adjustments has been eliminated; mechanism is manufactured for precise fit and consequently requires little, if any, adjustment.
- Floor mounted racking mechanism is out of the way, eliminates chain drives and adjustments, doesn't interfere with sidewall wiring or maintenance.

- Auxiliary trays rollout on self-contained extension rails.
- Bus bars are tightened from the front of the GM cabinet through an access panel in the upper rear of each lower cell.
- All customer wiring terminates on dedicated terminal blocks.
- Simplified bus barrier system allows quick access when required.
- Racking mechanism is self-contained and can be easily removed and reinstalled.
- Spare or replacement parts fit precisely; many are interchangeable among breaker frame ratings.
- Bus bars are encapsulated to minimize possibility for contamination or deterioration.
- Silver-plated copper or tin-plated aluminum bus bar joints assure efficient contact.
- Tin-plated copper bus optional.
- 4000A fan-cooled breaker rating available.

The GM design offers stacking versatility; e.g. stack auxiliaries four high, or two high over or under a circuit breaker.

GMI Ratings				
Voltage-MVA Class		Continuous Current		
		1200	2000	3000
4.16 kV	-250	X	X	
	-350	X	X	X
7.2 kV	-500	X	X	X
13.8 kV	-500	X	X	
	-750	X	X	X
	-1000	X	X	X

1200A or 2000A	1200A or 2000A	AUX	VENTED AUX	AUX
1200A or 2000A	AUX	1200A or 2000A	3000A	AUX

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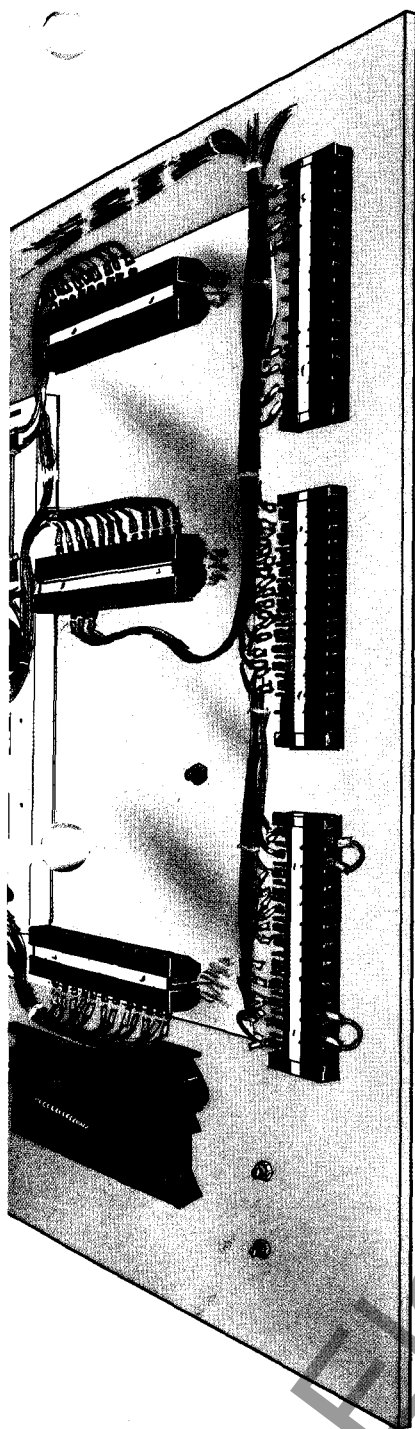
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GM MV Metalclad Switchgear – The Standard Of Quality Design And Precision Craftsmanship.

Siemens engineers have utilized proven vacuum interrupter technology, state-of-the-art design and manufacturing processes and some down to earth Yankee ingenuity to create a truly elegant design. The result is a new generation of safety and convenience in metalclad switchgear.

GM is rugged, reliable, quality. And provides great value both today and tomorrow.

As you become familiar with the GM design concept and execution, you'll see how Siemens has improved application flexibility, lowered capital costs, lowered maintenance costs, increased safety and improved reliability.

The backbone of the GM switchgear is the Siemens vacuum interrupter. Its unique contact design and construction, coupled with superior vacuum technology, has been proven in more than 100,000 breakers. The Siemens vacuum interrupter provides quick separation without restriking, but with low chopping currents and minimal contact erosion. The typical

Siemens interrupter will endure over 30,000 mechanical operations, 20,000 operations at rated current, 100 interruptions at rated short-circuit current, and has a shelf life in excess of ten years.

GMI circuit breakers have been designed to eliminate the need for most adjustments. The operator is front mounted, easily accessible. Breakers in lower cells rollout on the floor; in upper cells, on provided extension rails. And on-going maintenance costs have been slashed.

The GM switchgear design is logical and effective. Customer wiring is isolated from internal switchgear wiring. The racking mechanism is floor mounted, doesn't interfere with side walls or customer wiring. The buses are easily accessed from front and rear. A single "universal spare" breaker can serve an entire installation.

The GM series of stackable MV metalclad switchgear represents significant advance in design, product reliability and customer convenience. Find out more. Call Siemens today.



The constant radius of primary stabs facilitates smooth, effortless racking.



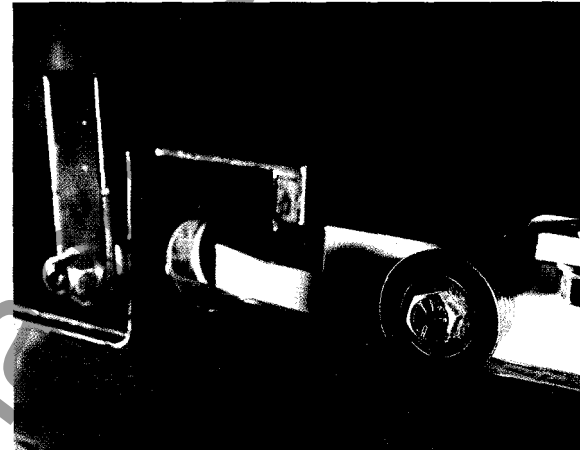
Siemens vacuum technology is maintenance free. The typical tube endures 30,000 mechanical operations and 100 full current interruptions.

GM design reduces capital costs and maximizes application flexibility.

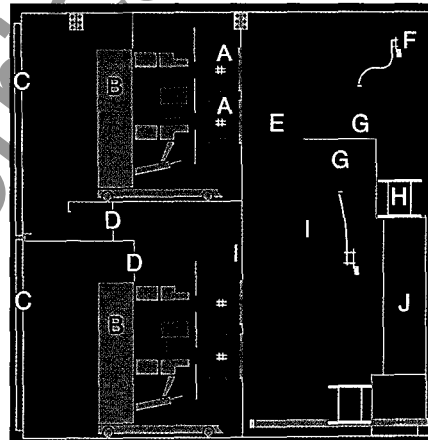
- Application flexibility often reduces the number of vertical sections required for a given installation.
- Minimizes floor space required
- 1200 and 2000 amp breakers are stackable "2-high"
- Cell below 3000A breaker can be used for an auxiliary tray.
- Auxiliary trays are stackable four high even with CPTs.
- Each cell allows ample space for door mounted devices.
- Vertical bus bar configuration reduces depth of gear.
- Multiple standard bus bar configurations eliminate most custom design requirements.
- Wiring paths allow complete flexibility for positioning breakers, CPTs, fuses, etc.
- Reduces spare breaker inventory.
- Many parts are interchangeable among breaker frame ratings — reduces spare parts inventory.
- Cubicles and breakers manufactured and tested in a single location for quality assurance and greater reliability.

GM design maximizes safety.

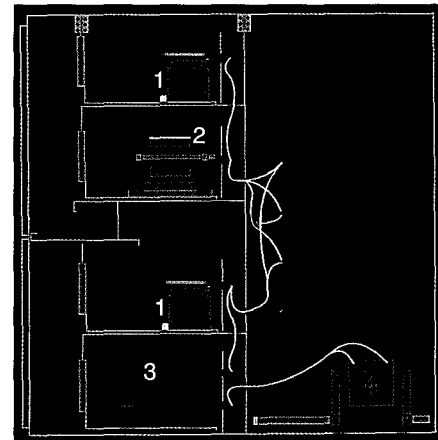
- Meets applicable ANSI, NEMA, IEEE standards
- Floor mounted racking mechanism and "tiedown hooks" securely hold breaker in place against short circuit forces during interruption.
- Shutters for primary stabs require breaker to be present in order to open (in contrast to racking screw driven systems).
- Shutters are grounded metal.
- Interlocks prevent inserting racking crank unless breaker is open.
- Closed door racking standard.
- Remote racking available.
- Floor rollout; upper extension rails.
- Front mounted mechanism - all adjustments and maintenance are performed without reorienting breaker.
- Each auxiliary tray features safety interlocks
- Each auxiliary uses self-contained drawout rails
- Mechanical interlocks prevent loading an under-rated breaker into a higher-rated cell.
- Special funnelling guides circuit breaker into proper alignment when reinserting.



Precision wheel set assures alignment within the cubicle and operates the metal shutters. In the connect position, the rear wheel set is held captive by tie-down hooks and secures the breaker against electrodynamic forces.



- A. CT
- B. 1200A or 2000A Vacuum Circuit Breaker
- C. Relay/Instrument Panel
- D. Secondary Device Panels
- E. Main Bus Compartment
- F. Outgoing Cable Lugs
- G. 3 EF Surge Limiters
- H. Ground Sensor CT
- I. Removable Barrier
- J. Power Cable Trough



- 1. Rollout VT
- 2. Rollout CPT or VT
- 3. Rollout CPT, VT or Fuses
- 4. Stationary Mounted Control Power Transformer (Over 15kVA Single Phase, All Three Phase Units)

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SIEMENS

Electronic Metering Package

4700 Power Meter

Instructions
Installation
Operation
SG-6018



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Important Bulletin

4700 Power Meter Rev B Release

New features for the 4700 Power Meter

Siemens will be releasing a new version of the 4700 Power Meter digital power instrumentation package in February 1992. This new Rev B release of the 4700 Power Meter has been given a number of new hardware features which improve performance, simplify wiring, improve the isolation of some inputs, and provide an upgrade path for new features under development.

The general operation of the new Rev B will remain identical to the earlier Rev A; however, Rev B differs significantly in appearance and wiring requirements from the earlier Rev A release. These differences are outlined below.

New attractive look

The new Rev B version has also been given a new look, with a wide black molded bezel surrounding the faceplate (on models with a front panel display). To further differentiate between the new Rev B version and the earlier Rev A, the label found on the rear panel of the unit will indicate:

PRODUCT REV: B

Important similarities and differences between Rev B and Rev A

Mounting

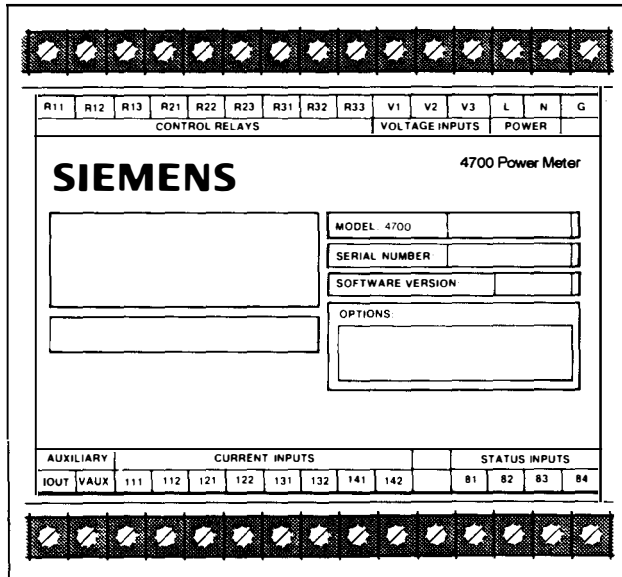
Mounting requirements for the new Rev B are identical to Rev A.

Wiring

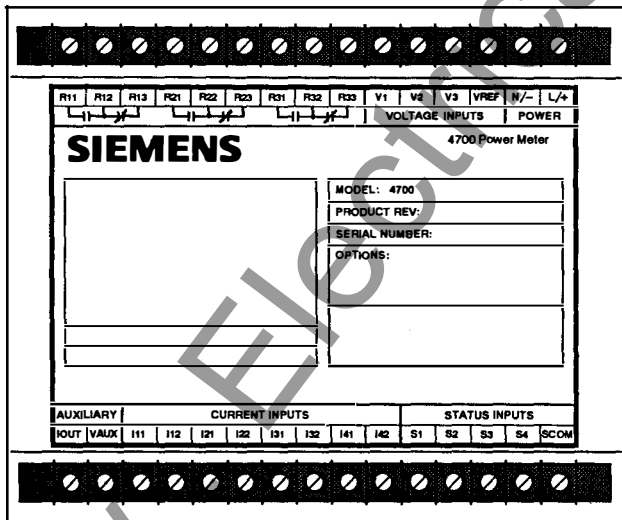
Changes in wiring installation for Rev B are minor, **but it is important that these new requirements be followed correctly for safe, accurate, and reliable operation of the 4700 Power Meter.**

- a) Connection to switchgear chassis ground is now made to a chassis ground lug attached to one of the mounting studs (or holes, in the case of a -TRAN model) on the chassis of the meter.
- b) A voltage reference terminal (VREF) has been added. This input is used as the zero voltage reference terminal for the phase voltage readings, and is independent of the 4700 Power Meter earth ground connection. The connection point for this input is dependent on the system configuration. This is illustrated in detail in the 4700 Power Meter Rev B manual.
- c) Status input terminals have been repositioned. An S^{COM} terminal has been added as the status input supply/ground common, providing improved isolation for the status inputs. This input is connected either to ground or to a suitable supply voltage, depending on the specific application. This configuration simplifies wiring and allows for greater flexibility when using the status inputs for sensing of dry contact conditions or voltage levels.
- d) Power supply terminals (L/+ and N/-) have been repositioned on the terminal strip.

The rear panel diagrams below illustrate terminal positions and functions for Rev A and the new Rev B.



Rev A Terminal Blocks



Rev B Terminal Blocks

Rev B ordering

Orders taken for the 4700 Power Meter after December 31, 1991 will automatically be filled with the new Rev B version, unless otherwise specified. The earlier Rev A version will still be available from Siemens; however, we recommend the new Rev B version, to take advantage of the new performance provided.

For more information, please contact your local Siemens sales representative, or contact Siemens directly at:

Siemens Energy
& Automation, Inc.
Electrical Apparatus Division

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Raleigh, NC 27626
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Description

The 4700 Power Meter is a microprocessor-based instrumentation package for low, medium or high voltage electrical equipment and substations. It is a state-of-the-art alternative to traditional analog electro-mechanical metering devices. The unit is economical and very simple to install and operate. It requires no external transducers. The 4700 power meter replaces up to 12 traditional analog devices with a single package.

Performance Features

The 4700 Power Meter offers major improvements in accuracy, communications capability, data logging, control capability, ease of use, and cost compared to traditional analog components or first generation digital metering systems. The 4700 will operate as a stand alone switchboard, switchgear, motor control center or substation instrument, and it serves as a data collection point for Siemens Access Electrical Distribution Communication System.

The unit is based around a 12 MHz, 16 bit microcontroller chip. This provides very high computational throughput, allowing the unit's sophisticated software to process information in real time. The unit is self contained and its readings and set up parameters are maintained in nonvolatile memory.

Displays and Measurements

In the display version of the product, the user may view the readings from the easy-to-read alphanumeric display consisting of:

- 4 digit voltage display phase indication
- 4 digit amperage display
- 8 digit power function display.

The unit may be configured to operate in Wye (Star), Delta, or Single phase voltage modes. The following measurements are available:

- Current on each phase
- A fourth current input
- Line to line voltages
- Line to neutral voltages
- Frequency
- Power factor
- kVA
- kW
- kVAR
- kW Demand

- V_{aux} (auxiliary voltage input)
- Total MWhr
- Total MVARhr

Minimum and maximum values for each of the readings are also available. The unit may be set to take snapshots of all readings at user-definable intervals and maintain them in nonvolatile memory. The snapshot data is read using the serial communications output.

Auxiliary Voltage Input

All 4700 models provide an auxiliary voltage sense input which allows an additional external voltage (1.25 VAC max.) to be monitored and its value displayed.

Auxiliary Current Output

An optional analog current output can be programmed for 0 to 20 mA or 4 to 20mA current output proportional to any measured parameter.

Communications

All 4700 power meters support optional plug-in communications cards which allow remote access to the device data. One card supports both RS-232C and RS-485 communications. A second communications card provides 500V galvanic isolation and supports only RS-485. If the 4700 power meter is ordered without a communications card, it may be field-retrofitted at a later date.

Using the RS-485 mode, up to 32 units may be controlled. The distance limitation for RS-485 using minimum 22 gauge shielded twisted pair cable is 4000 feet.

Control Relays

The 4700 power meter can optionally provide three control relays which may function as:

- Alarm relays and setpoint relays which operate as a function of any measured parameter for demand, power factor, or load control.
- Remote control relays, operated by command via the communications bus.
- kWhr/kVARhr pulse outputs.

Status Inputs

The 4700 power meter can also provide four optional status inputs which can each be used to sense the state of an

external contact. The status of these inputs can be viewed and logged by a Power Monitor™ display and monitoring unit or other computer using the communications option.

Logging Capability

The 4700 power meter can provide up to three data logs:

- **EVENT Log.** This log records events such as power up, parameter changes, alarm conditions, relay changes, and status input changes. The 50 most recent events may be retrieved from this log. The event log can only be read using the communications option.
- **SNAPSHOT Log.** This optional log contains voltage, current, and all power values which are recorded at user-defined time intervals. The 100 most recent snapshots may be retrieved from this log using the communications option.
- **MIN/MAX Log.** This log records the extreme values for voltages, currents, power, and other measured parameters. Min/Max data can be read using the integral display or using the communications option.

All log entries (events, snapshots, and min/max values) are time stamped to the second.

System Applications

Because of its unique measurement, storage, set point (load shedding) and display characteristics the 4700 power meter should be considered for use in:

1. Utility Installations
2. Industrial Buildings

3. Office Buildings
4. Commercial Buildings
5. Hospitals
6. Telephone Exchanges
7. Factories
8. Pulp Mills
9. Saw Mills
10. Shopping Centers
11. Large Stores
12. Hotels
13. Substation Metering
14. Co-generation Systems
15. Chemical Process Plants
16. Multi User Sites where allocation of electrical costs is desirable
17. Any other installation which uses significant amounts of electrical energy.
18. Any other locations where remote monitoring and control is needed.

Catalog Identification

Appendix E shows the available catalog numbers and related features and options.

Location

The 4700 power meter should be mounted in a dry, dirt free environment away from heat sources and very high electric fields. Temperatures should not exceed 50°C (122°F) or fall below 0°C (32°F).

Mounting

Appendix A provides the mounting dimensions for the 4700 power meter.

The standard 4700 power meter with display may be panel mounted for easy access and viewing, and provides four mounting studs to facilitate this. A 5 inch depth is required behind the front panel.

The 4700 power meter without display can be mounted flush against any flat surface. The unit provides four mounting holes for this purpose (these replace the four mounting studs of the display version 4700 power meter). The unit can also be mounted through a display version 4700 power meter panel cutout, if desired.

Power Supply

The standard 4700 power meter can be powered by 85 to 132 Volts AC (47 to 440 Hz) or 110 to 170 Volts DC, both at 0.2 Amps. This unit can be powered from a dedicated fused feed, or it may be powered by the voltage source which it is monitoring, as long as it is a 120 Volt system. Optional power supplies are available for 24 VDC, 48 VDC, and 240 VAC.

Wiring

Connections to the 4700 power meter are made to two terminal strips located on the rear of the unit. Appendix A provides 4700 power meter terminal block dimensions. Ring or spade terminals are recommended for all connections.

Phasing and polarity of the AC current and voltage inputs and their relationship is critical to the correct operation of the unit. **Figures 1 to 5** in the "Installation" section of this manual provide wiring diagrams to ensure correct installation.

PT and CT Transformer Selection

For proper monitoring, correct selection of CTs and PTs (if required) is critical. The following paragraphs provide the information required to choose these transformers.

PT Selection

Whether or not potential transformers (PTs) are required depends on the nature of the system being monitored, the voltage levels to be monitored, and the model of the 4700 power meter. The 120VAC (full scale) input model* may be used for direct connection to 120/208 systems, or for use with PTs that have a 120 Volt secondary. The 277 VAC (full scale) input model* may be used for direct connection to 277/480 Volt systems, and, 350 VAC (full scale) input model* may be used for direct connection to 350/600V systems. If system voltages are over 350/600, PTs are required.

Potential transformers are used to scale down the system L-N (Wye) or L-L (Delta) voltage to 120 Volts full scale, which is the nominal full scale input of the 4700 power meter. The PTs are selected as follows:

- Wye (Star): PT primary rating = system L-N voltage or nearest higher standard size. PT secondary rating = 120 Volts.
- Delta: PT primary rating = system L-L voltage. PT secondary rating = 120 Volts.

PT quality directly affects system accuracy. The PTs must provide good linearity and maintain the proper phase relationship between voltage and current in order for the Volts, kW, and PF readings to be valid. Instrument Accuracy Class 1 or better is recommended.

*Refer to Appendix E for 4700 power meter model numbering and options information.

CT Selection

The 4700 power meter uses current transformers (CTs) to sense the current in each phase of the power feed. The selection of the CTs is important because it directly affects accuracy.

The CT secondary rating is always 5 Amps with a burden capacity greater than 3 VA.

The CT primary rating is normally selected to be equal to the Amp rating of the power feed protection device. However, if the peak anticipated load is much less than the rated system capacity then improved accuracy and resolution can be obtained by selecting a lower rated CT. In this case the CT size should be the maximum expected peak current +25%, rounded up to the nearest standard CT size.

Other factors may affect CT accuracy. The length of the CT cabling should be minimized because long cabling will contribute to inaccuracy. Also, the CT burden rating must exceed the combined burden of the 4700 power meter plus cabling

plus any other connected devices (burden is the amount of load being fed by the CT, measured in Volt-Amps).

Overall accuracy is dependent on the combined accuracies of the 4700 power meter, the CTs, and the PTs (if used). Instrument accuracy Class 1 or better is recommended.

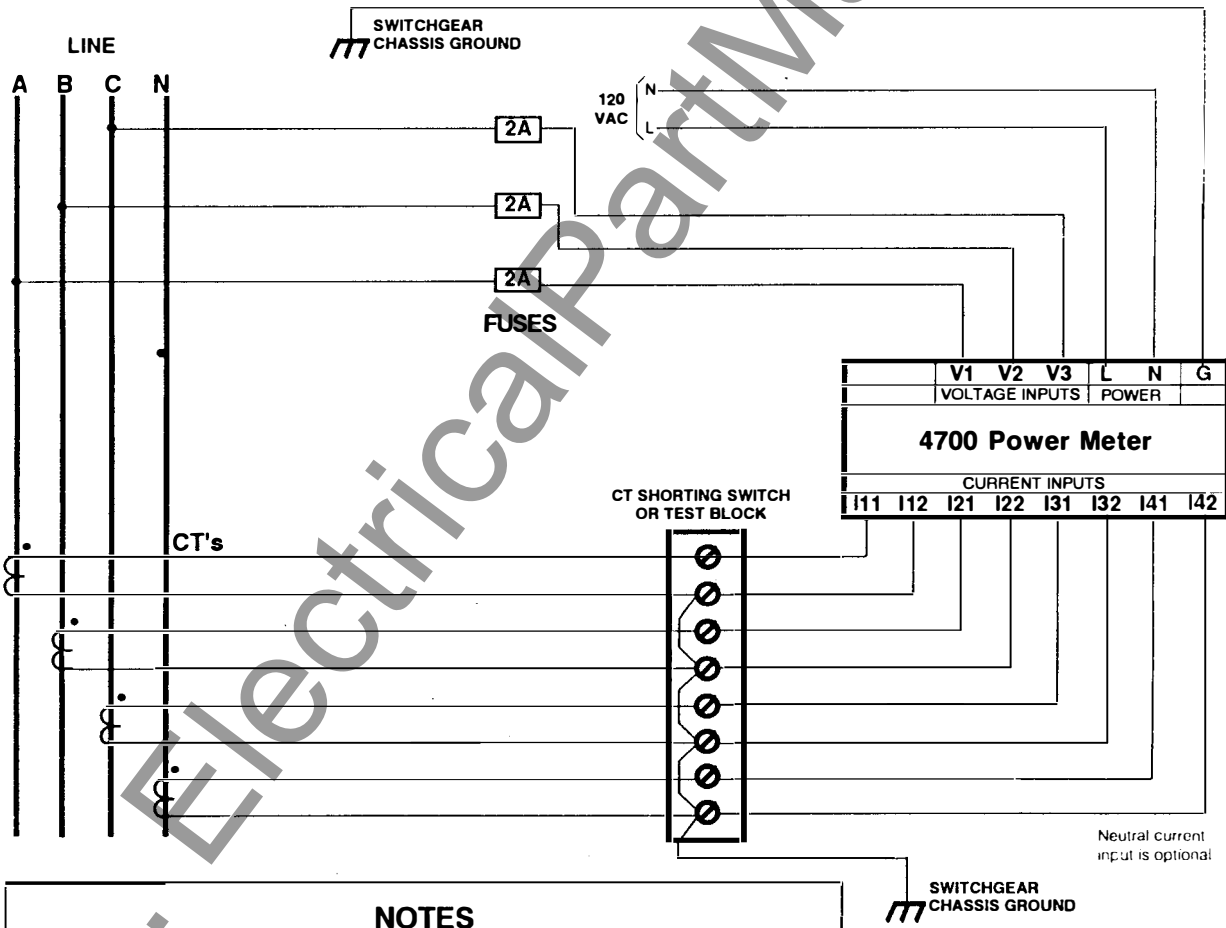
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Connection for Three Phase Wye (Star) 4 Wire Systems

Figures 1 and 2 provide wiring diagrams for WYE system configuration. The VOLT MODE of the 4700 power meter should be set to "0" for 4 wire systems (see "General Operation" on Field Programming).

The 4700 power meter senses the line to neutral (or ground) voltage of each phase. If the power system to be monitored is a 120/208 Volt system, a standard 120 VAC input model meter can be used with direct sensing of each phase. If the system is a 277/480 Volt system, a 277 VAC input model meter may be connected directly. Refer to Appendix E for 4700 power meter model numbering and options information.

The wiring diagram for these configurations is shown in Figure 1 below.

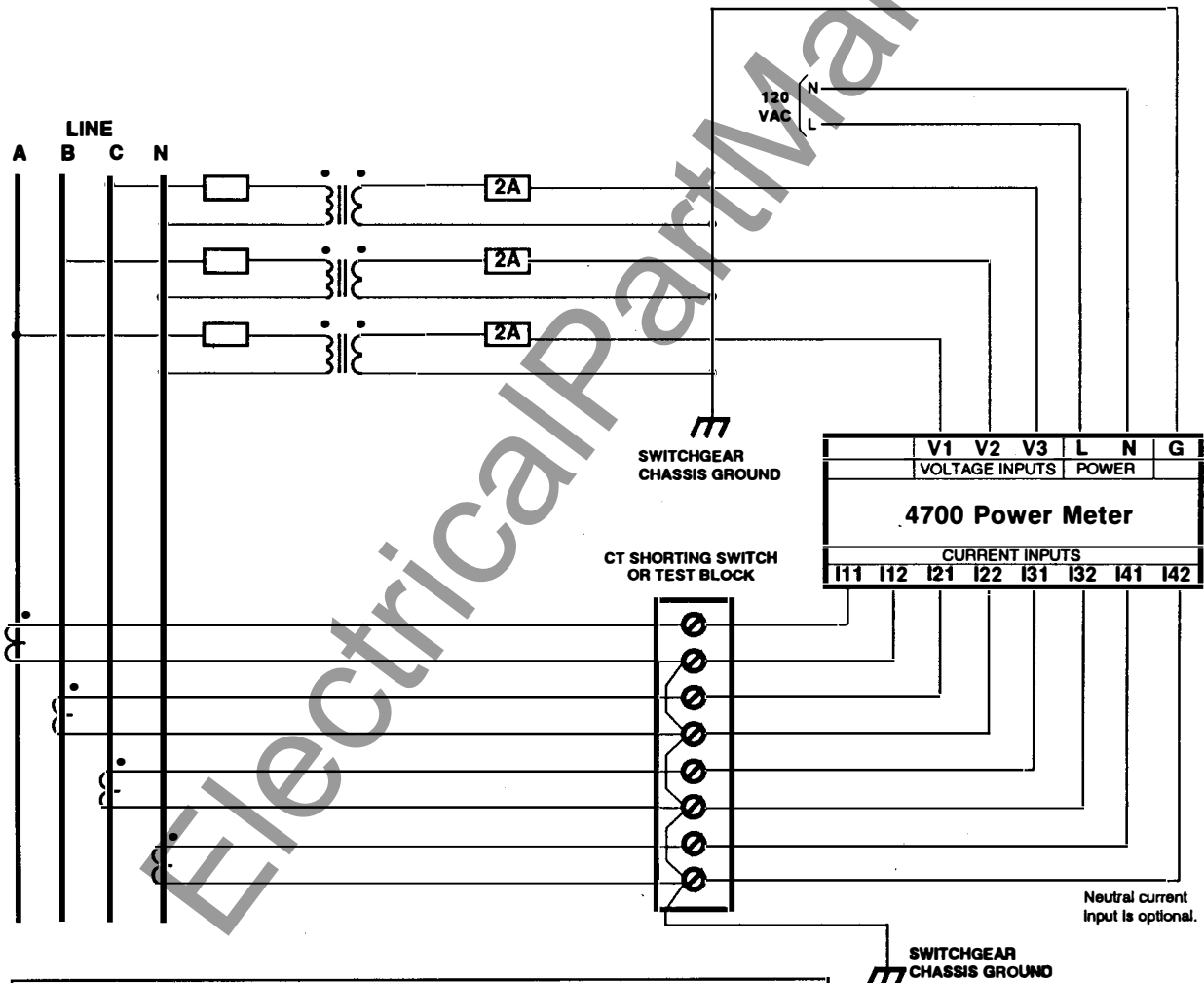


- NOTES**
- VOLT MODE = 0 (WYE MODE)
 - Use 120 VAC (full range) input model for 120/208 Volt systems. Use 277 VAC (full range) input model for 277/480 VAC systems. Use 350 VAC (full range) input model for 350/600 VAC systems (refer to Appendix E).
 - Only relevant 4700 power meter terminal block connection points are illustrated.

Figure 1. 4-Wire Direct Connection for 120/208 Volt, 277/480 Volt, or 350/600 Volt Systems.

For system voltages over 350/600 Volts, PTs must be used. When PTs are used, both the PT primary and secondary must be wired in a Wye (Star) configuration as shown in **Figure 2** below. Voltage sense leads should be protected by breakers

or fuses at their source. If the power rating of the PTs is over 25 Watts the secondaries should be fused. Wiring must be exactly as shown for correct operation.



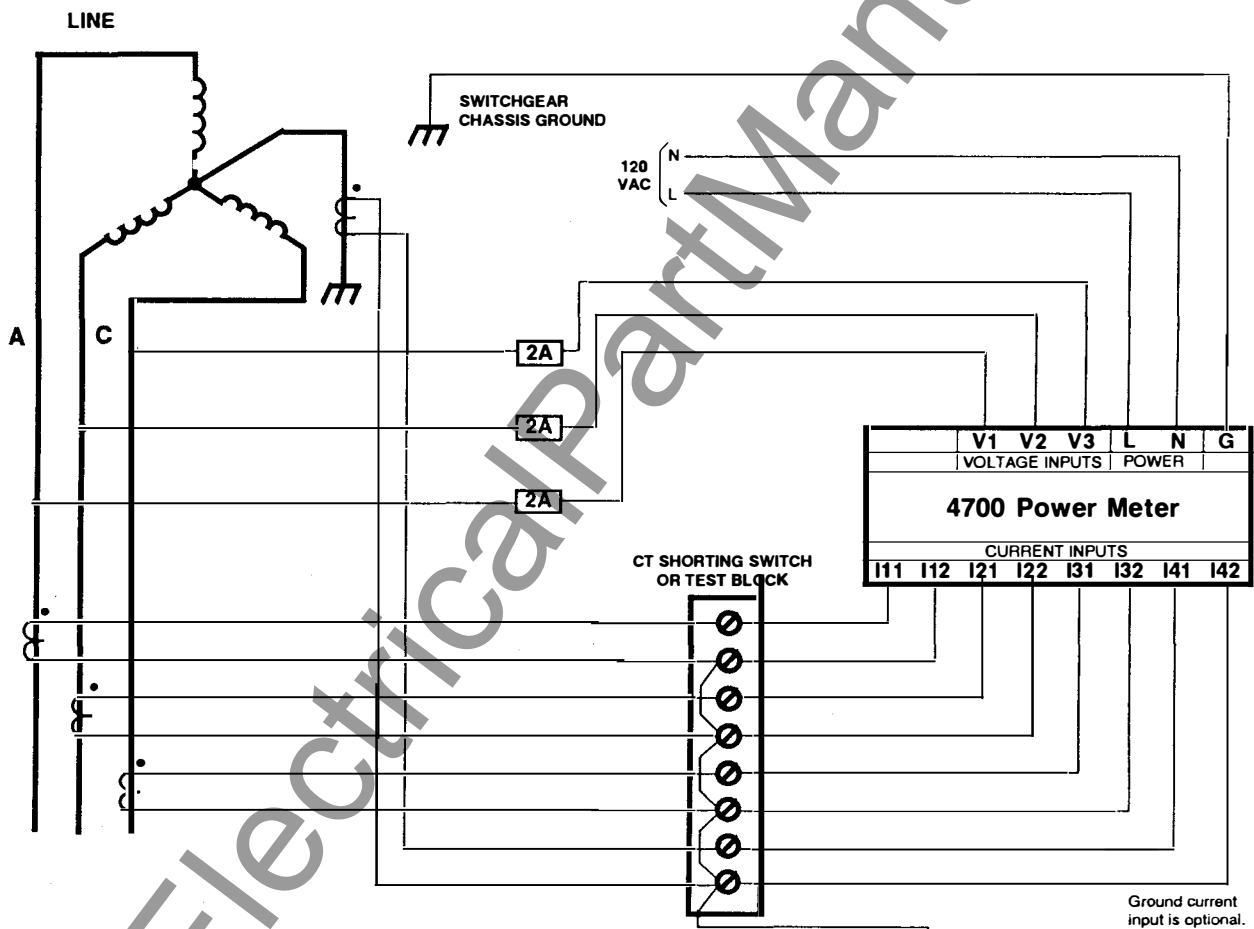
- NOTES**
1. VOLT MODE = 1 (WYE MODE)
 2. Use 120 VAC (full range) input model (refer to Appendix E).
 3. Only relevant 4700 power meter terminal block connection points are illustrated.

Figure 2. 4-Wire Wye (Star) Connection Using PTs.

Connection for Three Phase 3 Wire Systems

When the Star point of a 3 wire system is grounded, the 4700 power meter may be connected directly without the use of

PTs (provided the voltages are within the input range of the unit). This configuration actually represents a 3 wire Wye system. Direct connection is shown in **Figure 3**. The VOLTS MODE should be set to "0".

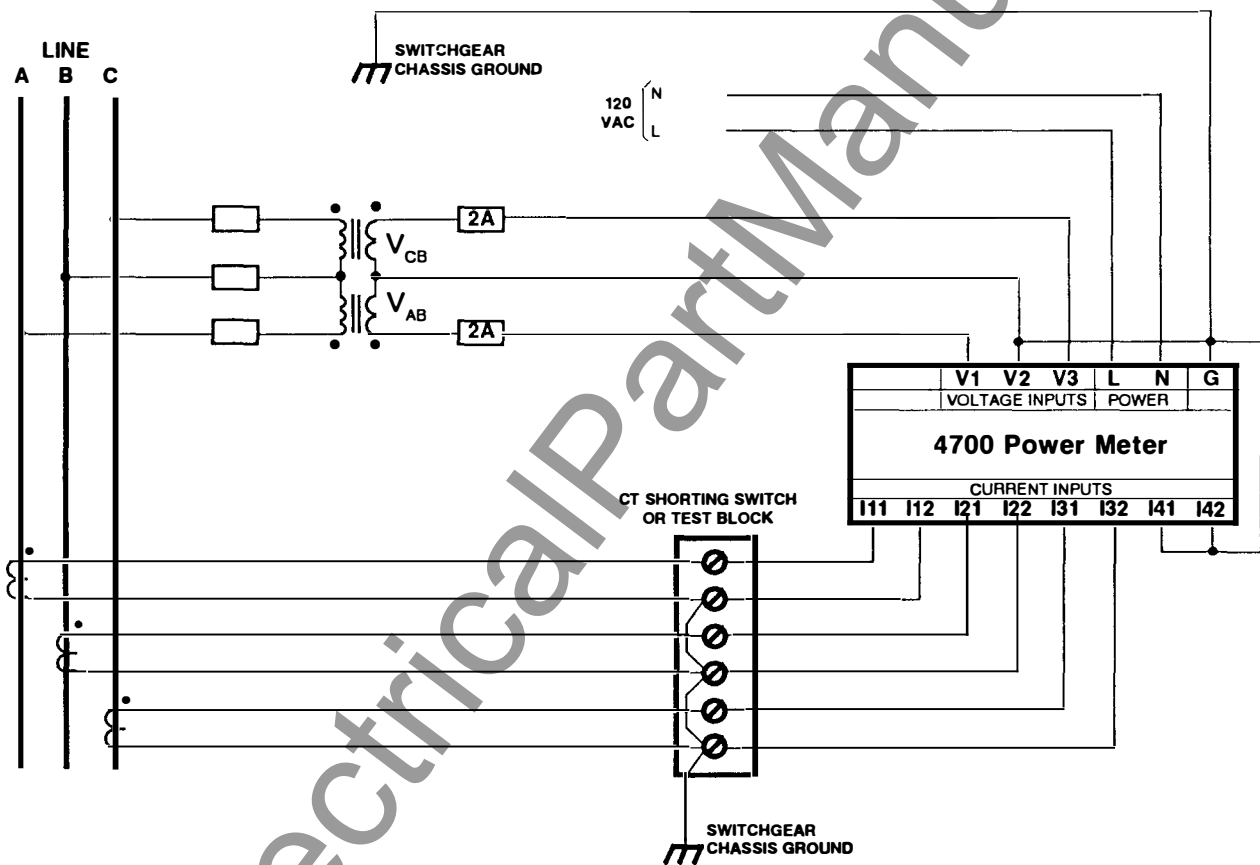


- NOTES**
1. VOLT MODE = 0 (WYE MODE)
 2. Use 120 VAC (full range) input model for 120/208 Volt systems. Use 277 VAC (full range) input model for 277/480 VAC systems. Use 350 VAC (full range) input model for 350/600 VAC systems (refer to Appendix E).
 3. The line transformer neutral must be equipotential with the SWITCHGEAR CHASSIS GROUND for this meter configuration to operate properly.
 4. Only relevant 4700 power meter terminal block connection points are illustrated.

Figure 3. 3-Wire Direct Connection for 120/208 Volt, 277/480 Volt, or 350/600 Volt Systems.

When configured for ungrounded (floating) Delta operation, the 4700 power meter requires PTs and senses the L-L voltages between each of the phases. VOLTS MODE of the 4700 power meter should be set to "1". In the open Delta

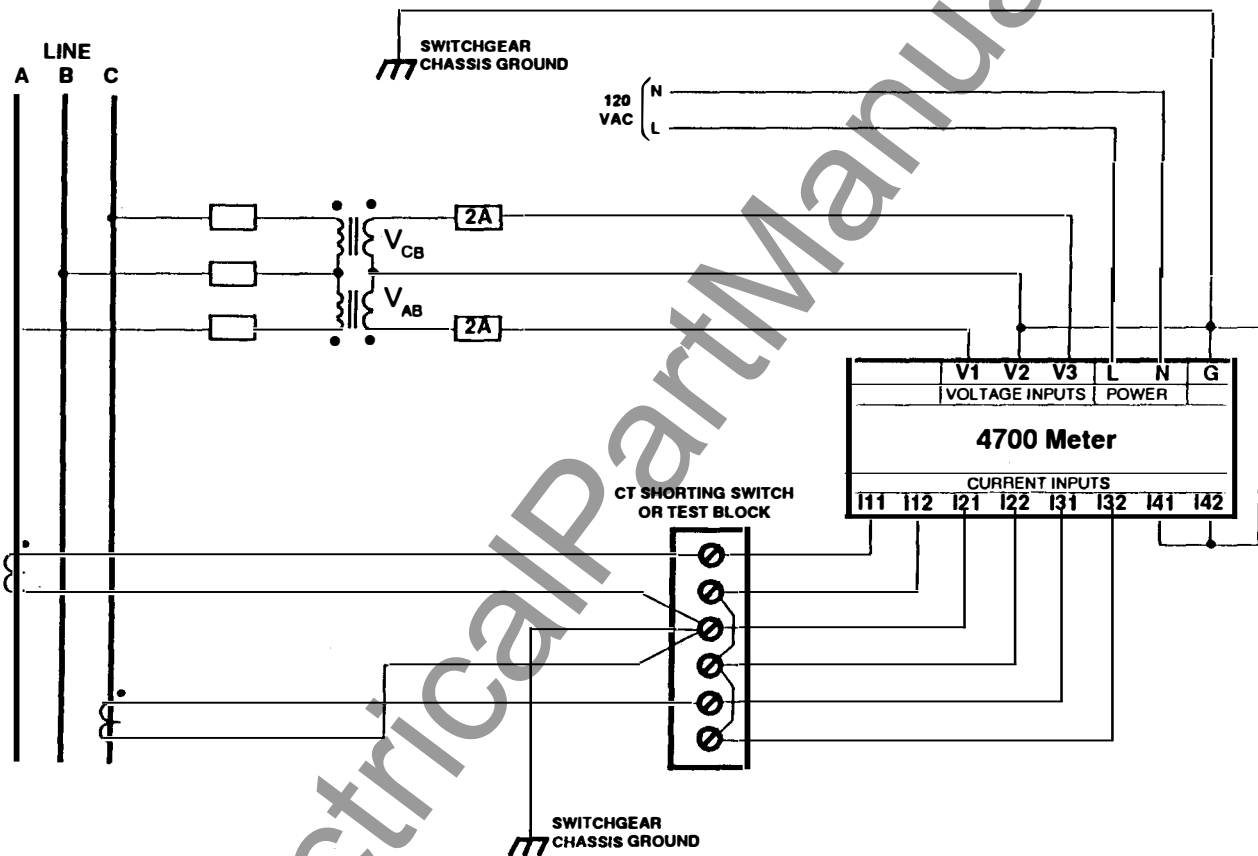
configuration, the 4700 power meter may be connected in either of two ways: using 2 or 3 CTs. **Figure 4** below shows ungrounded Delta connection using 3 CTs.



- NOTES**
1. VOLT MODE = 1 (DELTA MODE)
 2. Use 120 VAC (full range) input model (refer to Appendix E).
 3. Only relevant 4700 power meter terminal block connection points are illustrated.

Figure 4. Open Delta System Connection Using 2 PTs and 3 CTs.

Figure 5 below shows ungrounded Delta connection using 2 CTs.



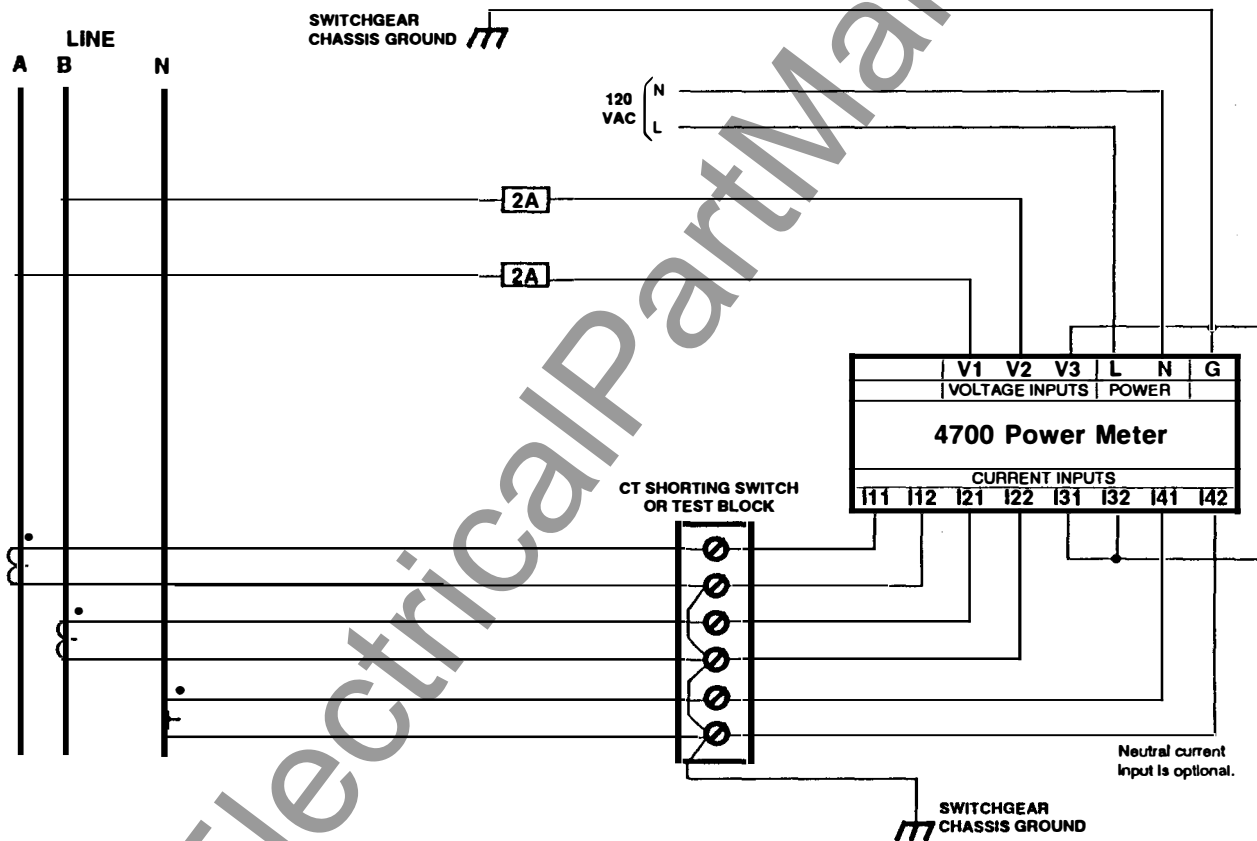
- NOTES**
1. VOLT MODE = 1
 2. Use 120 VAC (full range) input model (refer to Appendix E).
 3. Only relevant 4700 power meter terminal block connection points are illustrated.

Figure 5. Open Delta System Connection Using 2 PTs and 2 CTs.

Connection for Single Phase 3 Wire Systems

Wiring for single phase systems is performed by connecting the two 120 VAC phases (each 180 degrees with respect to each other) to the V₁ and V₂ inputs of the 4700 power meter,

and the outputs of the two corresponding current transformers to the I₁ input pair and I₂ input pair. This is illustrated in **Figure 6** below. Note that the V₃ input and I₃ input pair are unused and should all be grounded. For single phase systems, the VOLT MODE of the 4700 power meter should be set to "2".





- NOTES**
1. VOLT MODE = 2 (SINGLE PHASE MODE)
 2. Use 120 VAC (full range) input model for 120/240 Volt systems (refer to Appendix E).
 3. Only relevant 4700 power meter terminal block connection points are illustrated.

Figure 6. Single Phase 3-Wire Direct Connection

Ground Connection

The ground connection, "G", to the 4700 power meter serves as the measurement reference point, as well as the chassis ground connection for the meter. This lead must be connected to earth ground.

A good, low impedance chassis ground is essential for accurate measurement. It is also necessary for the 4700 power meter surge and transient protection circuitry to function effectively. Do not rely on metal door hinges as a ground path.

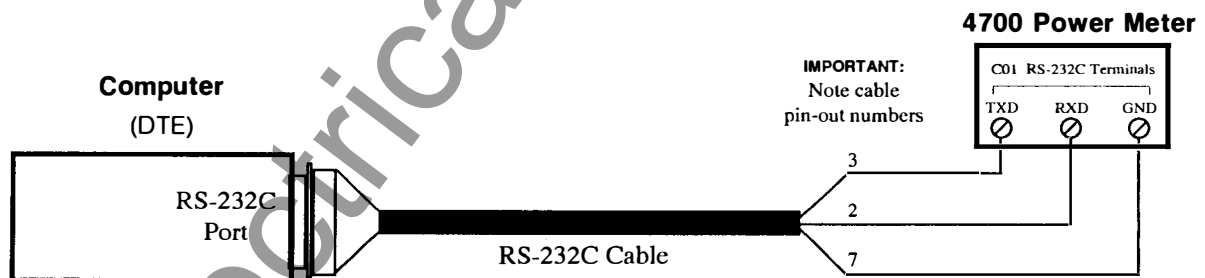
	 CAUTION
	<p>The 4700 power meter ground must be connected to the switchgear earth ground using a dedicated 14 gauge (or larger) wire in order for the noise and surge protection circuitry to function correctly. Failure to do so will void the warranty.</p>

Communications Connections

The unit may be ordered with a communications card already installed. If no card is installed, a plain rectangular plate will be found on the right side of the case back cover. Field retrofitting of cards is possible, and is described below.

Communications Using the C01 Communications Card

The C01 card allows the 4700 power meter to communicate using either the RS-232C or RS-485 communications standards. Connections are made to the terminal strip on the communications card. **Figures 7** and **8** illustrate the wiring connection requirements for RS-232C and RS-485 communications using this card. The C04 card supports RS-485 only, as shown in **Figure 8**.



NOTES	
<p>1. RS-232C Cable: 25 pin DB25 or 9 pin DB9, plug (male) or socket (female) depending on mating connector at computer serial port, 50 feet maximum length.</p> <p>2. If connected directly to an IBM-compatible PC RS-232C port, the Tx and Rx leads may need to be reversed at the</p>	<p>4700 power meter, depending on whether the PC RS-232C port is configured as DCE or DTE.</p> <p>You need to ensure Tx from the 4700 goes to Rx on the PC, and vice versa.</p>

Figure 7. RS-232C Communication Connections

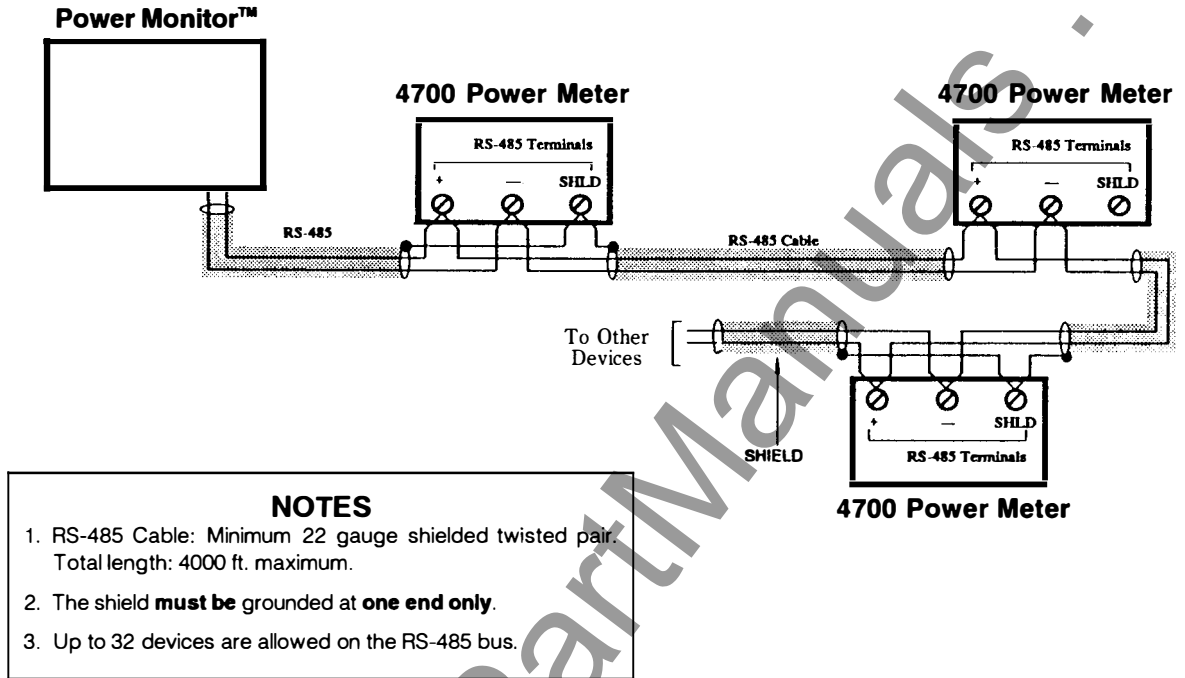


Figure 8. RS-485 Communication Connections

IMPORTANT

When the C01 card is shipped from the factory, it is set to operate in RS-232C mode. If RS-485 mode is required, a jumper on the card must be moved. See the following section and **Figure 9** for details.

Field Retrofit and Configuration of the C01 and C04 Communication Cards

This section explains the procedure for installing a C01 or C04 communication card or changing the communications mode.

The C01 card has a jumper block to allow the user to select RS-232C or RS-485 mode. The card's currently selected communications mode may be viewed from the optional front display, if the unit is operating, (see Section "General Operation" on Field Programming), or by removing the card and examining the position of the jumper block. See **Figure 9**.

Removing an Existing Communications Card

	<p>CAUTION</p> <p>An anti-static wrist grounding strap <u>must</u> be worn at all times while performing any modifications to the 4700 power meter or communication card. <u>Failing to do so may permanently damage the static-sensitive components inside the meter.</u></p>
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1. Turn off the power to the 4700 power meter.
2. Remove the four machine screws holding the rectangular C01 or C04 card mounting plate to the 4700 power meter case back cover.
3. Carefully pull the plate away from the 4700 power meter chassis to remove the card.

Configuring the C01 Card

The C01 circuit card has a jumper labelled J1. This jumper has two positions labelled "A" and "B". If the jumper is in position "A", the card will be set to RS-485 mode. If the jumper is in position "B", the card will be set to RS-232 mode (see **Figure 9**). Move the jumper to the correct position.

Reinstalling (or Field Retrofitting) the C01 or C04 Card

1. Make sure that the power to the 4700 power meter is off.
2. If field retrofitting a 4700 power meter, first remove the communications port cover plate on the rear cover of the meter.
3. Install the new C01 or C04 card as follows:

a) Insert the communications card into the communications port, ensuring that the circuit card is oriented such that it will mate properly with the edge connector on the main board inside 4700 power meter.

b) Align the holes in the mounting plate of the card with the mounting holes in the meter's rear cover while lowering the card towards its seating. The installer will be able to feel when the card has found the correct alignment with the edge connector.

c) Once the board is resting in proper alignment on the edge connector, carefully press down to plug the card into the edge connector.

d) Install the four mounting screws into the mounting plate to secure the card.

The card is now ready for use. Make all necessary communications connections as described above.

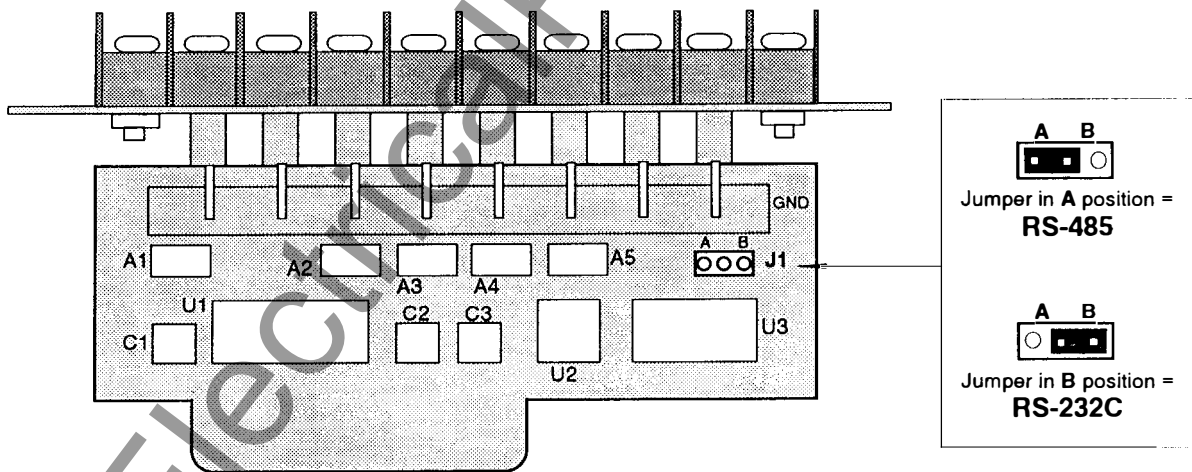


Figure 9. C01 Communication Card Jumper Configuration

Control Relay Connections

Figure 10 illustrates the wiring connection requirements for the control relays. Section "General Operation" describes the operation of the relays.

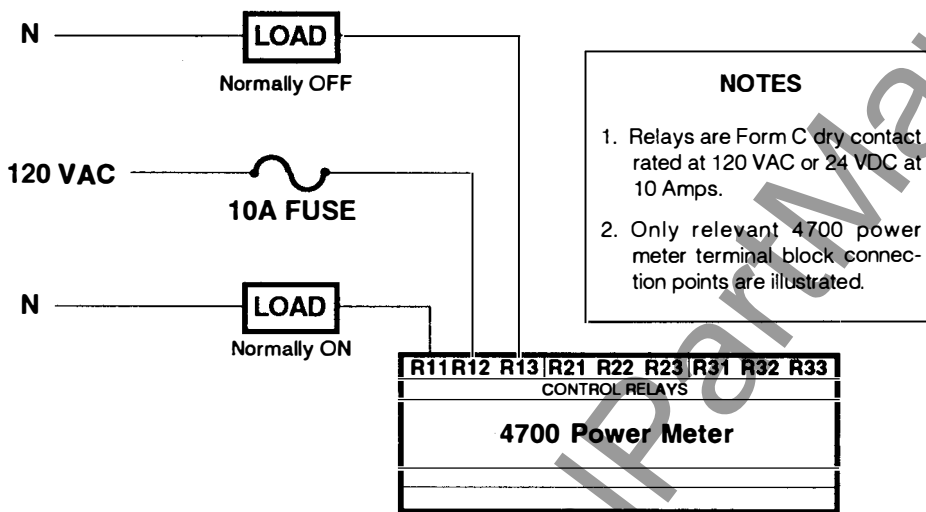


Figure 10. Control Relay Connections

Status Input Connections

Figure 11 illustrates a number of possible wiring connection methods and applications for the status inputs. Section "General Operation" describes the operation of the status inputs.

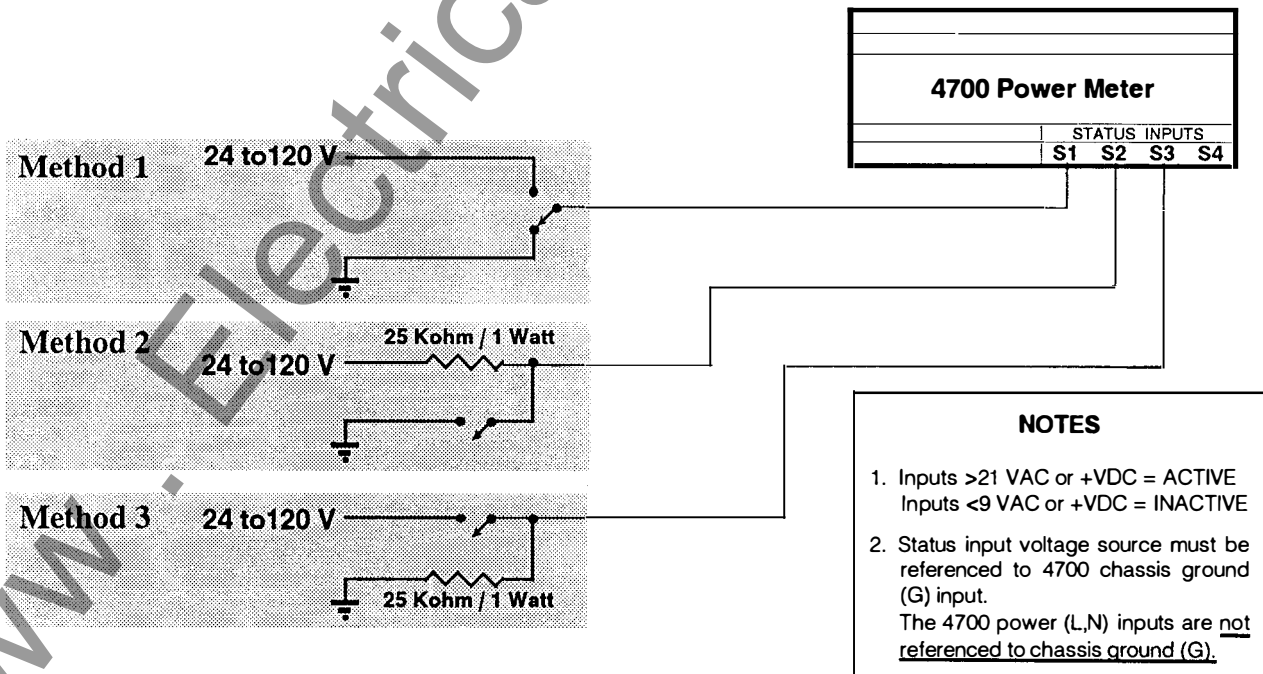
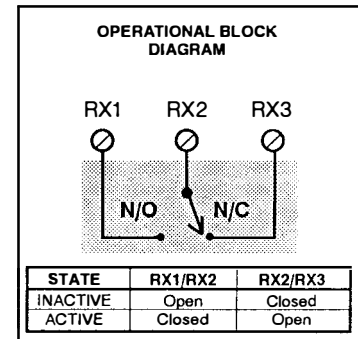


Figure 11. Status Input Connections

V_{aux} Auxiliary Voltage Input Connections

Figure 12 illustrates a number of possible wiring connection methods and applications for the V_{aux} input. The "General Operation" section describes the operation of this input.

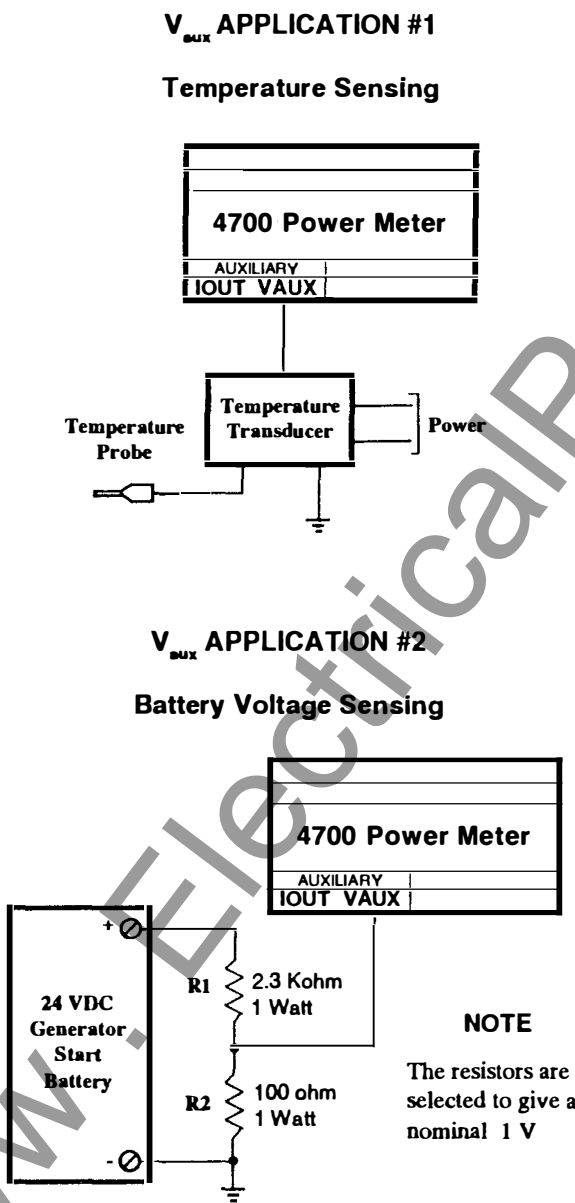


Figure 12. Auxiliary Voltage Input Connections

I_{out} Auxiliary Current Output Connections

Figure 13 illustrates a number of possible wiring connection methods and applications for the I_{out} output. Section "General Operation" describes the operation of this output.

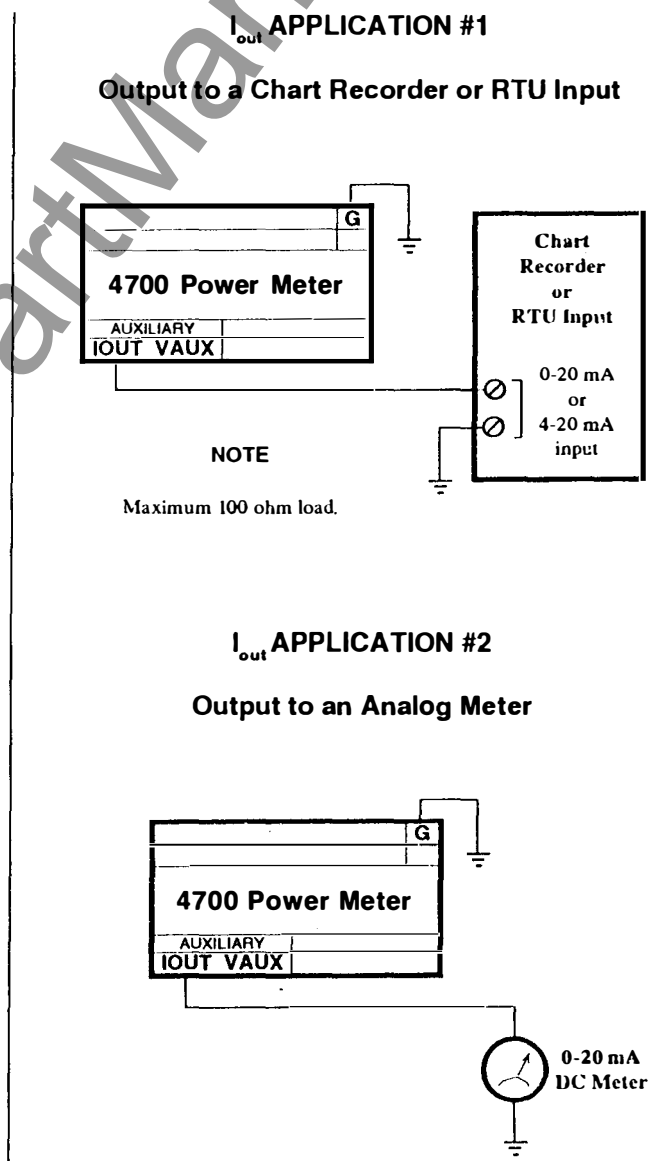


Figure 13. Auxiliary Current Output Connections

Fourth Current Input Connections

The 4700 power meter can be equipped with a fourth current input, which has identical ratings and specifications to the three phase current inputs. This input is typically used to measure the current flow in the neutral conductor. **Figure 14** shows I_4 in this configuration. The "General Operation" section describes the operation of this input.

Maintenance

The 4700 power meter contains a battery backed non-volatile memory. The rated life of the battery is 70 years at 50°C, 28 years at 60°C, and 11 years at 70°C.

If the unit operates at less than 50°C for 60% of the time, less than 60°C for 90% of the time, and less than 70°C for 100% of the time, the expected battery life is 35 years. If the meter is operating in an environment where the temperatures regularly exceed 60°C, the battery should be replaced every ten years.

NOTE

When the battery is replaced, historic data will be lost. Setup parameters and calibration of the unit will not be affected.

NOTES

1. I_4 CT must have the same current rating as the line CTs.
2. Only relevant 4700 power meter terminal block connection points are illustrated.

Other than non-volatile memory battery replacement, the 4700 power meter does not require any regular maintenance.

Calibration

The calibration interval for the 4700 power meter depends on the user's accuracy requirements. The rated accuracy drift is 0.1% per year.

The calibration procedure consists of connection of a portable Calibration Set to the two terminal strips of the 4700 power meter, and performing a simple calibration routine using a portable computer.

Field Service Considerations

In the event that the 4700 power meter unit should fail, it will generally be serviced by exchanging the unit for a replacement unit. The initial installation should be done in a way which makes this as convenient as possible:

1. A CT shorting block should be provided so that the 4700 power meter current inputs can be disconnected without open circuiting the CT's. The shorting block should be wired so that any CT connection to protective relaying is not affected.
2. All wiring should be routed to allow easy removal of the connections to the 4700 power meter terminal strips, the 4700 power meter rear cover, and the 4700 power meter itself.

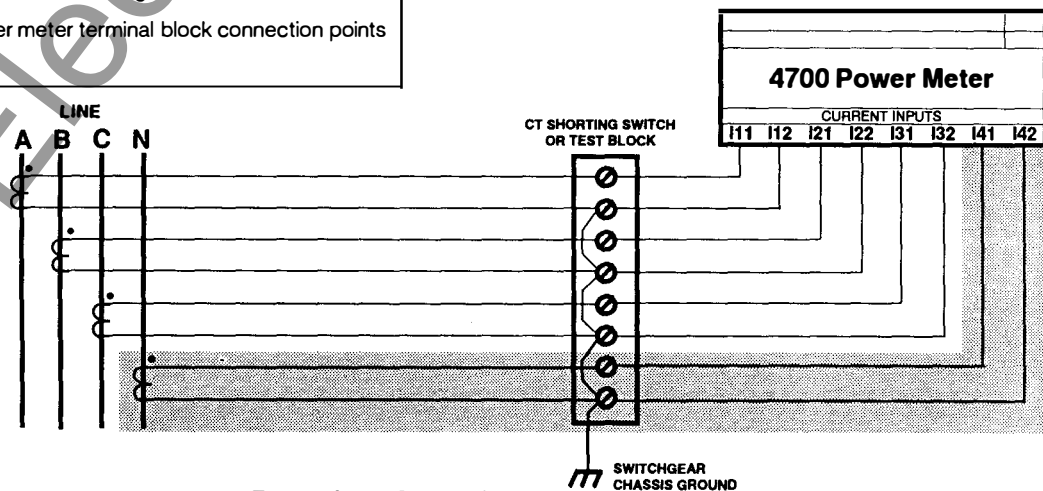


Figure 14. I_4 Connections

NOTE

The non-display versions of the 4700 power meter provide no front panel display or keypad. All measured data is read via the communications port. All field programming of operating parameters must also be performed via the communications port. Refer to Appendix F for instructions regarding the non-display versions. For the non-display versions, please disregard all references made to front panel display or keypad operations.

Power Up

After all installation wiring is complete and has been double checked, the unit may be powered up. The 4700 power meter will display Volts, Amps, and kW. The values initially appearing will probably not be correct since the unit has not yet been told a number of necessary pieces of information about the installation. The process of giving the 4700 power meter this information is known as field programming. This is described below.

Front Panel Operation

The 4700 power meter's front panel has been set up to be as simple to operate as possible. It has two modes of operation: display mode and programming mode. In display mode, the unit shows three fields: VOLTS, AMPS and POWER FUNCTION. There are four labeled buttons used to control the information presented on the display:

Phase: The phase button selects the phase (A, B, C, or Average) for which the volt and amp values are displayed. The "" symbol indicates the average volts and amps values.

In Wye mode (VOLT MODE =0), the PHASE button will increment through all line to neutral values, the line to neutral average, and all line to line values. Note that the line to line values are displayed with a comma after the phase indicator (ex. A,).

In Delta mode (VOLT MODE =1), the PHASE button will increment through all line to line values for all the phases as well as the average (of the three phases).

In Single Phase mode (VOLT MODE = 2), the PHASE button will increment through a sequence of A, B, L. A indicates the A phase voltage and current. B indicates the B phase voltage and current. L indicates the line to line voltage along with the average of the two line currents.

Function: The function button selects which power function is displayed. The 4700 power meter displays volts, amps and KW when it is first powered up. Pressing the function button once changes the KW field to KVA. Pressing it again changes it to KVAR and so on. The complete sequence is: KW, KVA, KVAR, power factor, frequency, KW demand, Amp demand, V_{aux} , I_4 , KW hours, and KVAR hours. kWhr and kVARhr use the entire display to show up to 10 digits of data.

Minimum and Maximum: These buttons display the minimum and maximum values, respectively, of volts, amps and power functions. Min/Max values are displayed for 3 seconds before returning to the real time display. Values displayed are Min/Max values logged since the last CLEAR MIN/MAX function was performed (refer to **Figure 15**).

FunctionLabel

Kilowatts	KW (MW)
Kilovoltamperes	KVA (MVA)
Kilovoltamperes (Reactive)	KQ
Power Factor	PF
Frequency	HZ
Kilowatt Demand	KWD (MWD)
Amp Demand	AMD
V_{aux}	VX
Fourth Current Input	I_4
Kilowatt Hours	KWHRS
Kilovoltampere (Reactive) Hours	KVARHRS

Field Programming

Entering Programming Mode

Pressing the function and minimum buttons at the same time causes the 4700 power meter to enter the programming mode. When programming mode is first entered, PROGRAMMING MODE will be shown on the display. Once in this mode, the same action will cause the unit to return to display mode. Avoid pressing the function button first, because it would alter the selected parameter.

Programming Button Functions

In programming mode, the three right hand buttons of the front panel take on new programming functions. The label below each button indicates its alternate function (eg. the Maximum button now functions as PARAMETER SELECT).

The parameter select button selects which parameter is displayed. The CURSOR and INCREMENT buttons change the value of the displayed parameter. Specifically, pressing the CURSOR key moves the cursor left one digit (it will wrap around the number) and the INCREMENT key increments the digit under the cursor.

Certain parameters have yes or no values, such as CLEAR MIN/MAX?. In this case pressing the INCREMENT key will cause the yes or no value to toggle.

Other parameters, such as BAUD RATE, have a number of possible values, and pressing INCREMENT will cause the display to scroll through them.

Entering the Password

The first parameter of the programming mode is the PASSWORD. When the 4700 Power Meter is shipped, the PASSWORD will be 0. This PASSWORD must be entered if any parameter values are to be changed. If the password is not entered, the programming may still be viewed, but it will be impossible to change any values. The password may be changed, as explained in this section under "Setting the Password." There is a backup password that can be issued by Siemens in the event the password is forgotten.

Skipping Over the Setpoint Parameters

To skip the setpoint parameters (explained in Section 4) enter a setpoint number of 00 (which is the default). If another number is entered, the 4700 power meter will keep going through the setpoint parameters. This makes it easy to examine and/or change multiple setpoints. If the setpoint number is 0, and the PARAMETER SELECT button is pressed, the setpoint items will be passed over.

Parameter Wrap-Around

The parameter list wraps around. If a parameter is missed, the PARAMETER SELECT button may be pressed repeatedly until the parameter is on the screen again.

Returning to Display Mode

Once all parameters have been set to their desired values, pressing and holding "minimum", then pressing "function" at the same time will cause the 4700 to return to display mode.

Operating Parameter Descriptions

Figures 15 and 16 provide a brief description of each parameter that may be programmed from the front panel

display. Detailed descriptions of operating parameters and their application are provided in the following Sections of this manual. Note that Setpoint Operation, Demand and Communications are described in subsequent sections.

Setting the Password

To change the password, the programming mode should be entered, and the PARAMETER SELECT button should be pressed. The present value of the password must be entered (which means that the password must be known for it to be changed). To change the password the PARAMETER SELECT button should be pressed repeatedly until the password parameter is displayed again. This time the new password should be entered. Once this has been done, returning to display mode will cause the password to be changed.

Setting the Volt Scale, Amp Scale, and Volt Mode

The VOLT and AMP SCALES of the 4700 power meter must be set to correspond with the full scale levels which are being measured by the meter. The scale is the value the meter will display when the input is at full scale.

Volts Scale

In a direct connect configuration, the VOLT SCALE is normally set to 120 for a 120 VAC system, 277 for a 277 VAC system, or 350 for a 350 VAC system. If PTs are used for connection to higher voltage systems (using a 120 VAC model), the VOLT SCALE should be set to the primary rating of the PT. Note that this only applies if the PTs have secondaries rated at 120 VAC. If the secondaries of the PTs are not 120 VAC, the following formula should be used to determine the required VOLT SCALE:

$$\text{VOLT SCALE} = \frac{\text{PT Primary Rating} \times 120 \text{ VAC}}{\text{PT Secondary Rating}}$$

Amps Scale

The AMPS SCALE should be set to the Primary Rating of the CTs being used. Similarly, this only applies if the CTs used are rated for a 5 Amp full scale output. If the CT is not rated for a 5 Amp full scale output, the following formula should be used to determine the required AMP SCALE:

$$\text{AMP SCALE} = \frac{\text{CT Primary Rating} \times 5 \text{ A}}{\text{CT Secondary Rating}}$$

Field Programmable Operating Parameters												
Parameter	Description	Range										
PASSWORD	Must be entered to change the setup parameters or clear any function	0-9999										
SETPOINT NUM	Selects a setpoint to be programmed. Note: If left at 0, no setpoint is selected and pressing Parameter Select will skip directly to VOLTS SCALE.	0 = no setpoint selected 1 to 17 = setpoint number										
SP _n TYPE	Select a code corresponding to the type of parameter the selected setpoint is to monitor (ex. Over KW, Volts Unbalanced, etc.). Pushing the INCREMENT button displays the choices. <hr/> <p style="text-align: center;">Note: In the parameter names below, _n indicates the currently selected setpoint number.</p> <hr/>	See Figure 20										
SP _n HI LIMIT	Sets High Limit for the selected setpoint.	0 to 999,999										
SP _n LO LIMIT	Sets Low Limit for the selected setpoint.	0 to 999,999										
SP _n TD OPERATE	Time Delay to operate for the selected setpoint.	0 to 32,000 seconds										
SP _n TD RELEASE	Time delay to release for the selected setpoint.	0 to 32,000 seconds										
SP _n RELAY NUMBER	Selects which one of three on-board relays the selected setpoint controls. Selecting a value of 0 will use no relay. Note: After setting this parameter, pressing Parameter Select will return to the SETPOINT NUM display set to 0. The user may then select another setpoint to program or advance to VOLTS SCALE (below) by pressing Parameter Select again. For more information, see "Setpoint Operation."	0 = no relay 1 to 3 = relay number										
VOLT SCALE	Sets full-scale AC input voltage. See "General Operation". <hr/> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">System Configuration</th> <th style="width: 50%;">Volts Scale</th> </tr> </thead> <tbody> <tr> <td>120/208 V direct connect</td> <td>120</td> </tr> <tr> <td>277/480 V direct connect</td> <td>277</td> </tr> <tr> <td>350/600 v direct connect</td> <td>350</td> </tr> <tr> <td>Systems which use PT's</td> <td>PT primary rating</td> </tr> </tbody> </table> <hr/>	System Configuration	Volts Scale	120/208 V direct connect	120	277/480 V direct connect	277	350/600 v direct connect	350	Systems which use PT's	PT primary rating	0 to 999,999 Volts
System Configuration	Volts Scale											
120/208 V direct connect	120											
277/480 V direct connect	277											
350/600 v direct connect	350											
Systems which use PT's	PT primary rating											
AMP SCALE	Sets full-scale AC input current (CT primary current rating). See "General Operation".	0 to 9,999 Amps										
VAUX SCALE	Sets full-scale auxiliary voltage input reading.	0 to 999,999 Volts										
VOLTS MODE	Sets Volts Mode. 0=WYE, 1=DELTA, 2=SINGLE PHASE, 3=DEMO											

Figure 15. Field Programmable Operating Parameters I

Field Programmable Operating Parameters		
Parameter	Description	Range
UNIT ID	Sets Seabus communication address for 4700 power meter. Note: The number 0 may not be used for an ID as it is reserved for other purposes.	1 to 254
BAUD RATE	Baud Rate at which the 4700 power meter transmits and receives information.	300, 1200, 2400, 4800, 9600 Baud
COMMUNICATION MODE	Specifies the communications format used by the 4700 power meter. <u>This parameter is controlled by the physical jumper block located on the optional plug-in Communications Card. See "Demand" section of this manual.</u>	Reads: RS 232 or RS 485
DISPLAY TIMEOUT	Number of minutes after last button push until the display turns itself off. This extends the life and brightness of the display. A timeout interval of 180 minutes is recommended.	0 = display stays on 1 to 999 = timeout minutes
CLEAR MAX/MIN	Pressing increment button clears the max/min array.	No, Yes
CLEAR KW/KVARHRS	Pressing increment button resets the KW hours and KVAR hour readings to 0.	No, Yes
DEMAND PERIOD	Selects "Sync" mode, or length of each demand period to be used in calculating demand values.	0 = Demand Sync Mode 1 to 99 = minutes
NUM DMD PERIODS	Number of demand periods to be averaged to calculate demand values. For more information see "Demand".	1 to 15
KWHR PULSE	Number of KW hours between KW hour pulses on Relay 3	0 = feature disabled 1 to 65,535 = KW hours/pulse
KVARHR PULSE	Number of KVAR hours between KVAR hour pulses on Relay 2.	0 = feature disabled 1 to 65,535 = KVAR hours/pulse
PHASE ROTATION	Specifies the normal phase sequence. This is used for PF polarity detection in delta mode, and for the phase reversal detection setpoint. See "Setpoint Operation."	ABC, ACB
I OUT KEY	Parameter code specifying with which measured value the current output will be proportional.	0 to 25 See Figure 17
I OUT SCALE	Scale of current output.	0 to 999,999
I OUT RANGE	Indicates 0 to 20 mA or 4 to 20 mA proportional current output.	0 = 0 to 20 mA 1 = 4 to 20 mA

Figure 16. Field Programmable Operating Parameters II

NOTE

The fourth CT rating must be the same as the phase CTs. See "Fourth Current Input Operation" in this section.

Volts Mode

The VOLTS MODE should be set according to the system connection configuration. Refer to the "Installation" section and **Figures 1 to 6** for more information.

V_{aux} Auxiliary Voltage Input Operation

The 4700 power meter has an auxiliary voltage input which allows an external voltage (1 VAC nominal, 1.25 VAC max.) to be measured and displayed. The V_{aux} Scale parameter defines what the meter will display with a 1.000 VAC_{RMS} full scale input applied.

Note that this 1 volt input is not a 120 volt input like V1, V2 and V3.

I_{out} Auxiliary Current Output Operation

The 4700 power meter can be equipped with an analog current output that may be programmed to deliver a current proportional to any measured parameter. The maximum load on the current output is 100 ohms resistive.

This output is controlled from the programming mode. Three parameters must be set:

a) I OUT KEY. This is a number specifying to which measured parameter the current output will be proportional. **Figure 17** shows the values for I OUT KEY corresponding to each measured parameter.

b) I OUT SCALE. This selects the value of the parameter corresponding to full scale current output.

c) I OUT RANGE. This indicates whether the output mode is 0 to 20 mA or 4 to 20 mA.

i) I OUT RANGE = 0 indicates 0 to 20mA.

ii) I OUT RANGE = 1 indicates 4 to 20mA.

<u>I Out Key</u>	<u>Measured Parameter</u>
0	Voltage, Phase A (or Vab for Delta)
1	Voltage, Phase B (or Vca for Delta)
2	Voltage, Phase C (or Vbc for Delta)
3	Current, Phase A
4	Current, Phase B
5	Current, Phase C
6	KW, Phase A
7	KW, Phase B
8	KW, Phase C
9	KVA, Phase A
10	KVA, Phase B
11	KVA, Phase C
12	KVAR, Phase A
13	KVAR, Phase B
14	KVAR, Phase C
15	Voltage, Average
16	Current, Average
17	KW, Total
18	KVA, Total
19	KVAR, Total
20	Power Factor
21	KW Demand
22	AMP Demand
23	Frequency
24	V _{aux}
25	I ₄

Figure 17. I Out Key Parameter Values

Control Relay Operation

The 4700 power meter optionally provides three control relays (R1 to R3) which may be used for a number of applications including activation of alarms or load control. Each relay can switch a.c. loads of up to 120 VAC and d.c. loads of up to 24 VDC at 10 Amps. The operation of each relay may be control-

led directly by the user through remote commands via the communications port.

The relays may also be operated from setpoints on selected measured parameters, controlled by user-definable conditions. Setpoint operation is described in detail in the next section "Setpoint Operation."

A third use for the relays is for KWHR (Relay 3) and KVARHR (Relay 2) pulsed output (see **Figure 16**)

The "Installation" section provides wiring requirements for the control relays.

Status Input Operation

The 4700 power meter optionally provides four status inputs (S1 to S4) which can each be used to sense the state of an external contact. If the input voltage is below 9 VAC or VDC, the input will be sensed as inactive. If it is over 20 VAC or VDC, it will be sensed as active.

The status of these inputs can only be viewed using a Power Monitor display and monitoring unit (or other computer) connected to the 4700 power meter's communications port.

4700 power meter units can be programmed to use Status Input #4 (S4) to provide KW Demand Synchronization. Refer to "Demand" section for more information.

The 4700 power meter maintains a counter for the Status Input #1 (S1). The maximum frequency the counter will accurately follow is 0.3 Hz. This counter may be zeroed at any time via the Power Monitor panel or other computer connected to the optional communications port.

The "Installation" section provides wiring diagrams illustrating various connection methods for the status inputs.

Fourth Current Input Operation

The 4700 power meter has an optional fourth current input, designated I₄. This input uses connections I41 and I42 on the terminal strip. The ratings of this input are identical to the three phase current inputs (5 Amperes nominally). The AMPS SCALE parameter of the 4700 power meter specifies the scaling for all four current inputs. This requires that the CT primary rating of the I₄ current input be the same as the CT primary ratings for the three phase current inputs.

Typically, this input is used to measure current in the neutral conductor. In installations with non-linear loads, odd harmonics can fail to cancel, producing significant currents in the neutral conductor. **Figure 14** shows the wiring connections for neutral conductor current measurement.

The I₄ reading may be displayed from the front panel, or viewed remotely. To view I₄ from the front panel, the FUNCTION button is pressed repeatedly until I₄ is displayed.

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NOTE

The non-display versions of the 4700 power meter provide no front panel display or keypad. Setpoint parameters must be programmed via the communications port. Refer to Appendix F.

Introduction

The 4700 power meter is capable of monitoring many parameters at the same time and generating alarms and controlling relays based on these parameters values. The 4700 power meter uses setpoints to do this. A setpoint is a group of six parameters that tell the unit:

- 1) Which parameter to monitor (setpoint type), Over or under.
- 2) High Limit.
- 3) Low Limit.
- 4) Activate Delay.
- 5) Deactivate Delay.
- 6) Which relay to operate, if any, if too high or too low.

Setpoints can function either as over setpoints or under setpoints. An over setpoint becomes active if the given parameter becomes too large (Eg. over current). An under setpoint becomes active if the parameter becomes too low (Eg. under voltage or under frequency). Over and under setpoints are very similar. A description of each is provided below.

Over Setpoint

An over setpoint will become active when the parameter that is being monitored goes over the high limit (and stays over the limit) for a number of seconds greater than the activate delay to operate parameter. When a setpoint becomes active it will operate the given relay (unless the relay number is zero, in which case it does not change any of the relays). When a setpoint becomes active, its change of status is stored in the event log with the time and the value of the parameter at that instant. An over setpoint becomes inactive when the given parameter falls below the low limit for longer than the deactivate delay (refer to **Figure 18**). This change in status is also logged (along with the time of return within limit and the most out-of-limit value).

Under Setpoint



An under setpoint differs only in that the meanings of high limit and low limit are reversed. The setpoint becomes active when the parameter falls below the low limit for a number of seconds greater than the activate delay parameter (refer to **Figure 19**). The under setpoint becomes inactive when the parameter goes over the high limit for a number of seconds greater than the deactivate delay parameter. Except for these differences the under and over setpoints are treated identically.

Applications

The 4700 power meter currently supports 17 different setpoints simultaneously. These are numbered from 1 to 17. All the setpoints are accessible from the front panel, when provided. **Figure 20** describes the parameters that the setpoints may monitor. Each relay may be used for any one of the following:

1. Trip Relay - to shunt trip a breaker.
2. Alarm Relay - to activate an alarm buzzer or light.
3. Control Relay - to control an external piece of equipment.
4. Remote Control Relay - to control an external piece of equipment via the communications port.
5. kWhr Pulse Output Relay (relay 3)
6. kVARhr Pulse Output Relay (relay 2)

Any relay (one of three) may be assigned to any of the setpoints. Multiple setpoints may be assigned to one relay. A relay will be activated if any of the setpoints controlling it become active. Relays 2 and 3 may also be used for kVARhr and kWhr pulsing, so care must be taken that relays are not used in a conflicting fashion.

	 CAUTION
	<p>The response time of the relays is 1 to 2 seconds up to 5 seconds after initial meter power up and it is disabled when the 4700 is in programming mode. The 4700 power meter should not be used for protective functions which require faster operation. Use separate reliable AC or DC control power where shortest possible reaction times are needed.</p>

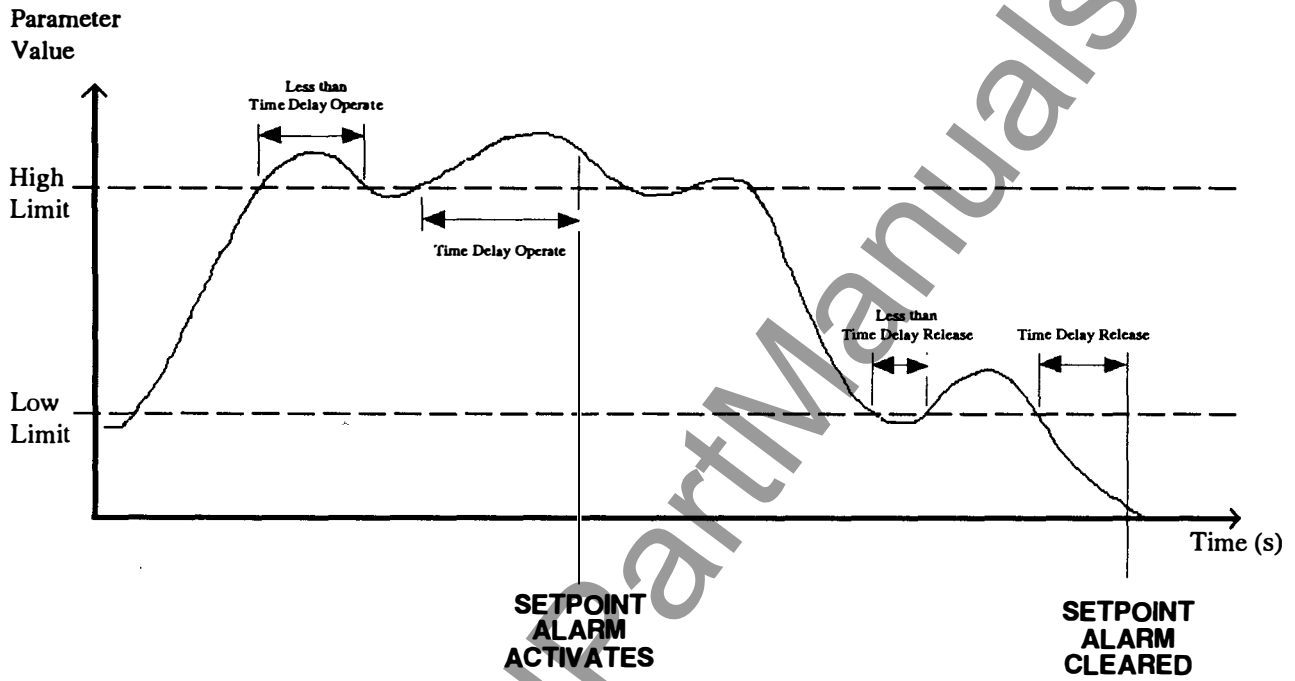


Figure 18. Over Setpoint Operation

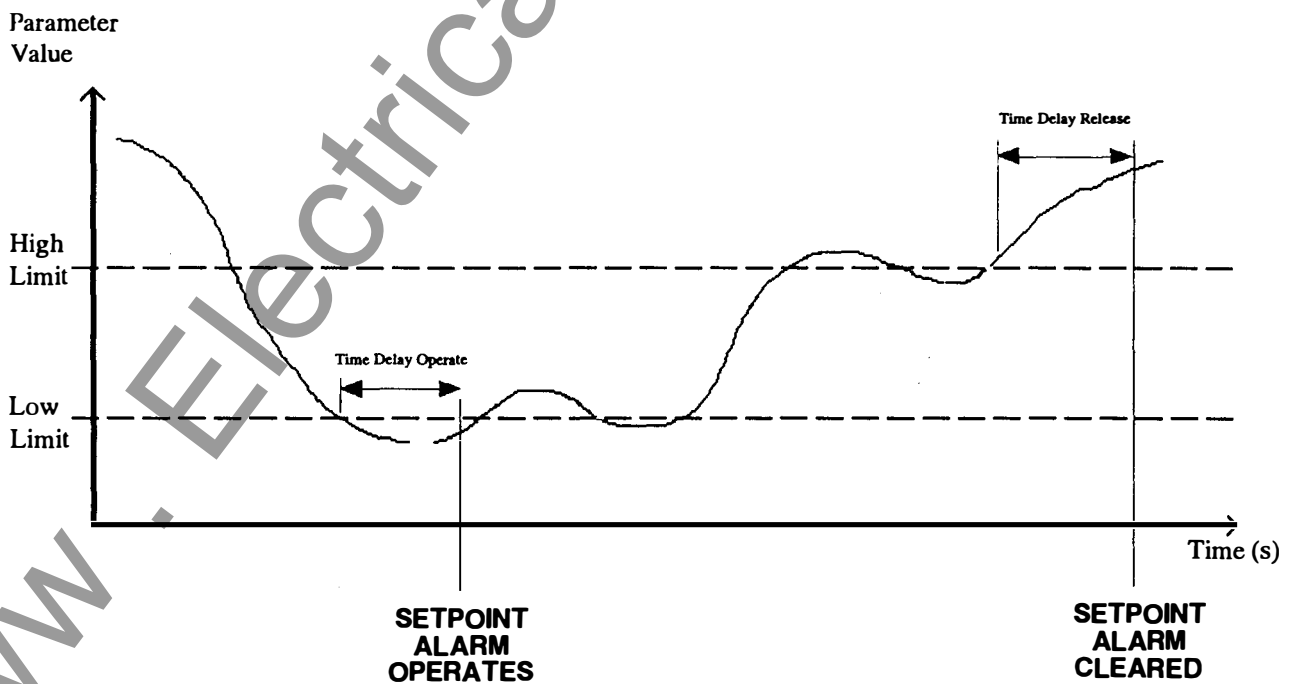




Figure 19. Under Setpoint Operation

Setpoint Types	
Type	Description
NOT USED	A setpoint which is not being used.
OVER VOLT	Over voltage (highest phase voltage).
UNDER VOLT	Under voltage (lowest phase voltage).
VOLTAGE UNBAL	% difference of most deviant phase voltage from the average.
OVER CURRENT	Over current (highest phase current).
CURRENT UNBAL	% difference of most deviant phase current from the average.
OVER KVA	Over KVA.
OVER KW	Over KW.
OVER KWREV	Over negative KW (feeding power into utility grid).
OVER KVAR	Over KVAR.
OVER KWD	Over KW demand.
OVER AMPD	Over amp demand.
OVER FREQUENCY	Over frequency. (Enter: Frequency x 10 [ie. 60 Hz = 600])
UNDER FREQUENCY	Under frequency. (Enter: Frequency x 10 [ie. 60 Hz = 600])
OVER VAUX	Over auxiliary voltage.
UNDER VAUX	Under auxiliary voltage.
PHASE REVERSAL	Phase reversal. Operates if the phase rotation does not match the programmed normal rotation.
UNDER PF LAG	Under power factor lagging.
UNDER PF LEAD	Under power factor leading.
OVER I ₄	Over I ₄ current.

Figure 20. Setpoint Types

Programming Setpoints

Setpoints may be programmed by entering the 4700 power meter program mode, entering the correct password, then entering a number from 1 to 17 for the SETPOINT NUMBER parameter. The user may then step through and enter new values for all parameters associated with the selected setpoint.

	 CAUTION
	<p>After the correct password has been entered in programming mode, no setpoint-controlled relay operation will occur until after the user has exited the programming mode. The 4700 power meter will then assess the status of each setpoint and perform any required operations.</p>

It is recommended that setpoint utilization be planned using a Setpoint Parameter Form. This form contains the setpoint information that the user programs into the 4700 power meter. A copy of this information should be kept with the meter. Appendix B provides a blank Setpoint Parameter Form for this purpose. **Figure 21** is an example of using a Setpoint Parameter Form to plan setpoint usage.

<h3>EXAMPLE</h3>
<p>Relay 1 is used as an alarm relay, with over voltage, under voltage, voltage unbalance, and phase reversal trips enabled. The relay is connected to the breaker shunt trip input. Relay 2 is used as an alarm relay to warn of loads which are over 70% of the breaker rating. Its output is connected to a buzzer. Relay 3 is used as a KW demand control relay. The form contains all of the information required to program the 4700 power meter to perform the operations described above.</p>

Forced Relay Operate/Release

The relays can be forced operated or forced released by commands sent via the communications port. Forced operate/release commands override all programmed setpoint control functions.

Power Outages

When the power feed to the 4700 power meter is interrupted, even momentarily, the output relays will release. When power

is restored, the 4700 power meter will allow a 3 second settling time, then the setpoint conditions will be re-evaluated, and, if appropriate, the relays will operate after the programmed time delays.

If any relay has been forced operated or forced released via the communications port, it will be released and then resume normal setpoint operation after a power outage.

Setpoint Parameter Form						
Setpoint Number	Setpoint Type	High Limit	TD Operate	Low Limit	TD Release	Relay/Function
1	Over Volts	332	5	290	1	1 Trip
2	Under Volts	270	5	220	1	1 Trip
3	Volts unbal.	30%	5	10%	1	1 Trip
4	Phase Reversal	—	1	—	1	1 Trip
5	Not Used					
6	Not Used					
7	Over Amps	2100	10	2000	1	2 Alarm
8	Over Volts	300	10	290	1	2 Alarm
9	Under PF Lag	90	10	85	10	2 Alarm
10	Under PF Lead	90	10	85	10	2 Alarm
11	Over KWD	1200	10	900	10	3 Demand control
12						
13						
14						
15						
16						
17						

Figure 21. Setpoint Parameter Form

Industry Demand Measurement Methods

Power utilities generally bill commercial customers based on both their energy consumption (in kWh) and their peak usage levels, called peak demand in kW. Demand is a measure of average power consumption over a fixed time period, typically 30 minutes. Peak demand is the highest demand level recorded over the billing period.

Demand measurement methods and intervals vary from power utility to power utility. Some common methods include: thermal averaging, the fixed interval technique, and the sliding window technique. For thermal averaging, the demand indicator responds to heating of a thermal element in the Watt hour meter. The demand period is determined by the thermal time constant of the element, typically 15 to 30 minutes. The fixed interval technique measures average usage electronically over each period. The highest recorded value is the peak demand. The sliding window technique (or rolling interval method) divides the demand interval into sub periods and the demand is measured electronically based on the average load level over the most recent set of subperiods. This has the effect of improving the response times as compared to the fixed interval method. For example, with a 6x5 minute (30 minutes total) sliding window method, demand will be the

average power consumption over the last six 5 minute periods.

Internally-Timed Demand Measurement

The 4700 power meter uses the sliding window method to measure demand. Both the DEMAND PERIOD (1 to 99 minutes) and NUMBER OF DEMAND PERIODS to be averaged (1 to 15) are user programmable. This allows the user to match virtually any utility demand measurement method as illustrated in Figure 22.

Demand Synchronization

4700 power meter units provide the following additional feature. When the DEMAND PERIOD parameter is set to zero, the Demand Sync Mode is selected and the 4700 power meter no longer internally times the duration of each demand period used in the kW demand calculation. Instead, it looks for a pulse (INACTIVE to ACTIVE transition) on Status Input #4 (S4) to indicate the start of the subsequent demand interval. The user is still free to choose the NUMBER OF DEMAND PERIODS as with the self-timed mode of operation described above.

UTILITY METHOD	4700 PROGRAMMING	
	Demand Period (in minutes)	Number of Demand Periods (must be 15 or less)
Fixed Interval (Note 1)	Utility Period	1
Fixed Interval Emulation	Utility Period%15	15
Thermal	Utility Period%15	15
Sliding Window	Utility Sub Period	Utility # of Sub Periods

Note With the fixed interval method, the 4700 Meter maximum reading and the utility reading will not necessarily be the same unless the demand periods are time synchronized. The best way to resolve this problem is to use the sliding window method with the same total demand period as the utility as shown above. The 4700 Meter maximum demand reading will then always be as high or slightly higher than the utility readings.

Figure 22. Demand Calculation Chart.

Description

The 4700 power meter is available in models equipped with a communication card, allowing data transfer between the 4700 power meter unit and other display and monitoring devices such as the Power Monitor unit. The Power Monitor panel provides complete control of several 4700 meters and other "ACCESS™—compatible" field devices connected together through a common RS-485 network.

Before communication is possible, the user must program the communication parameters of the 4700 power meter. This may be performed via the front panel of the unit, or over the communications bus. The ADDRESS for each 4700 power meter must be set to a unique value (see description of RS-485 communication below). The BAUD RATE of the 4700 power meter must be set to correspond with the baud rate selected for the network. The COMM. MODE (communication mode) of the 4700 power meter is set by the jumper position on the C01 communications card, as explained in "General Operation, Field Programming. 4700 power meter communication modes are described below.

RS-232C Communication


The C01 communication card can be optionally configured as RS-485 or RS-232C. RS-232C communication is used for

direct connection between a computer and a single 4700 power meter (distance less than 50 feet).

RS-485 Communication

RS-485 communication mode can be used to concurrently connect up to thirty-two 4700 power meter units to one network, each given a unique ADDRESS. In this way, each 4700 power meter unit may be monitored and controlled from one location by a single Power Monitor panel or other computer.

The total distance limitation for RS-485 communication is 4000 feet using 22 gauge twisted pair shielded cable. Refer to Section 2 for connection diagrams.

	CAUTION
	It is important that the shield of each leg of RS-485 cable be grounded at one end only.

Description

A number of problems can cause the 4700 power meter not to function properly. This section lists a number of symptoms, and explains how to correct them.

1. If the display does not operate:

- a) Check that there is at least 110 volts available to the power supply (L and N connections on the terminal strip).
- b) Confirm that the G terminal is connected directly to ground.
- c) Press the "Display" button.

2. If the voltage or current readings are incorrect:

- a) Check that the volt mode is properly set for the given wiring.
- b) Check that the voltage and current scales are properly set.
- c) Make sure the G terminal is properly grounded.
- d) Check the quality of the CTs and PTs being used.
- e) Make the following voltage tests:
 - i) V1, V2, V3 to G should be 120 VAC (or rated full scale values of 277 or 350VAC)

- ii) G to switchgear earth ground should be 0 V.
- iii) L to G should be 120 VAC or DC (or optional rated control power voltage).
- iv) N to G should be less than 2 VAC.
- v) All current inputs should be less than 1 VAC with respect to G.

3. If the kW or power factor readings are incorrect but Voltage and Current readings are okay:

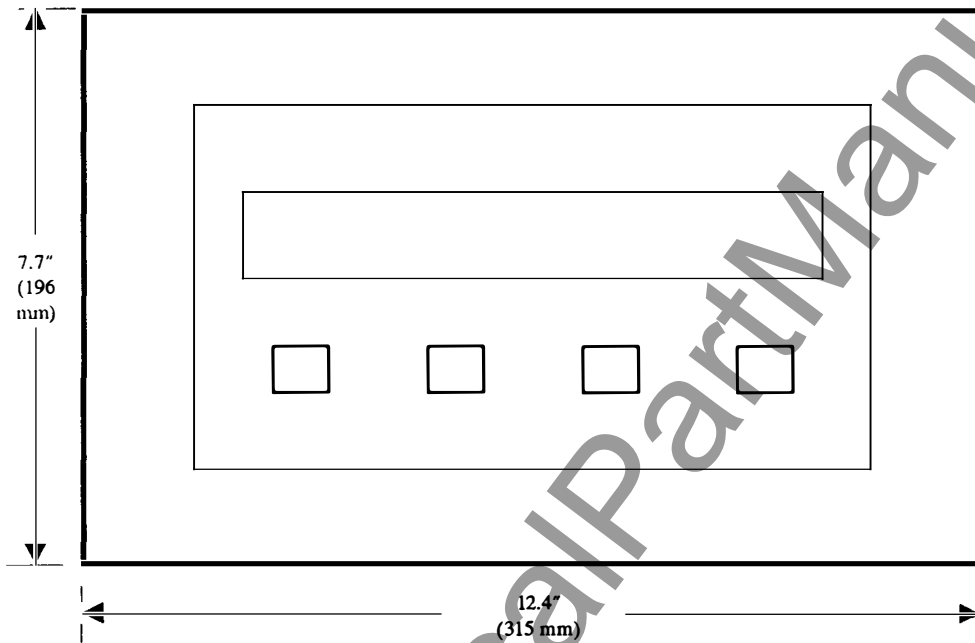
- a) Make sure that the phase relationship between voltage and current inputs is correct by comparing the wiring with the appropriate wiring diagram.

4. If RS-232 or RS-485 communication does not work:

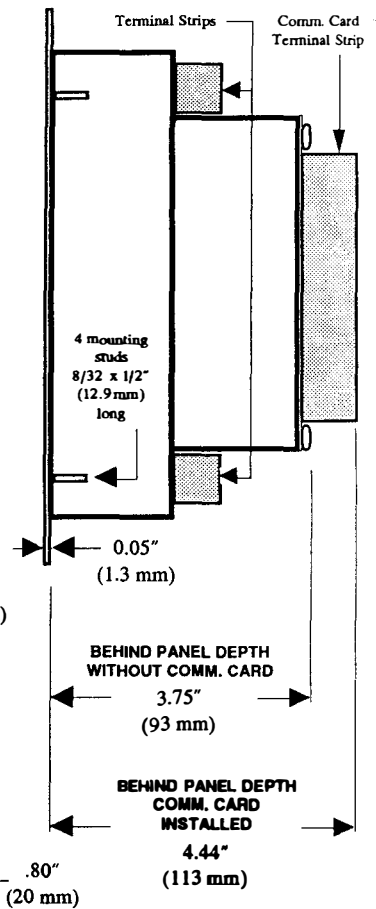
- a) Check the baud rate matches that of the Power Monitor device or other computer.
- b) The communications mode (RS-232 or RS-485) set by the jumper on the communications card is correct for the given installation (see "Installation" section on Field Retrofit and Configuration of the C03 communication card).
- c) Check the ADDRESS at the 4700 power meter matches that configured at the Power Monitor panel or other computer.

4700 Mechanical Dimensions—Mounting

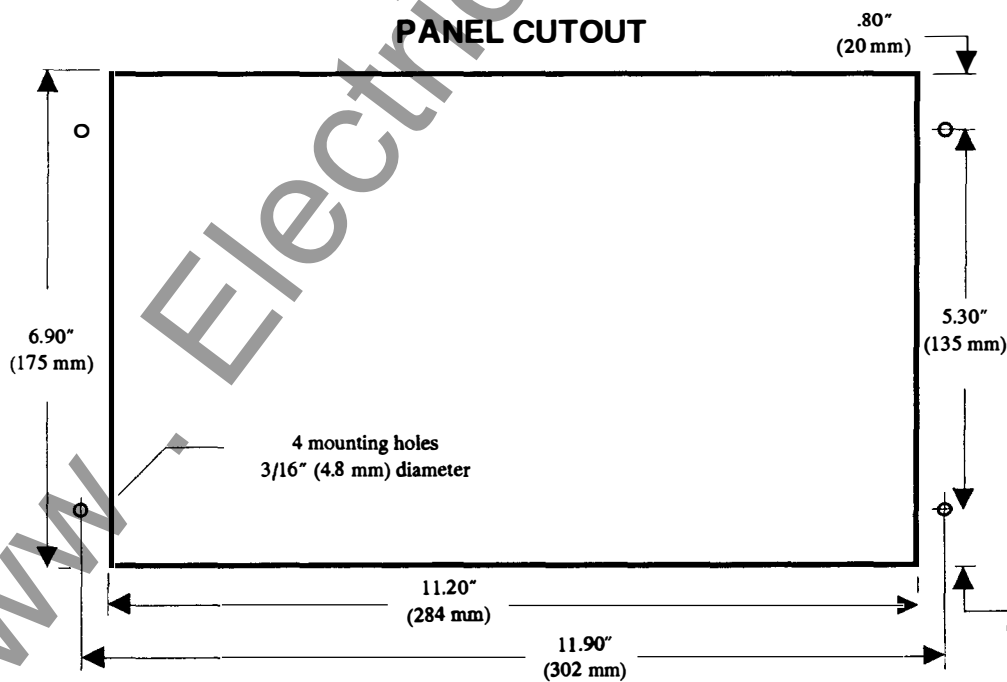
FRONT PANEL

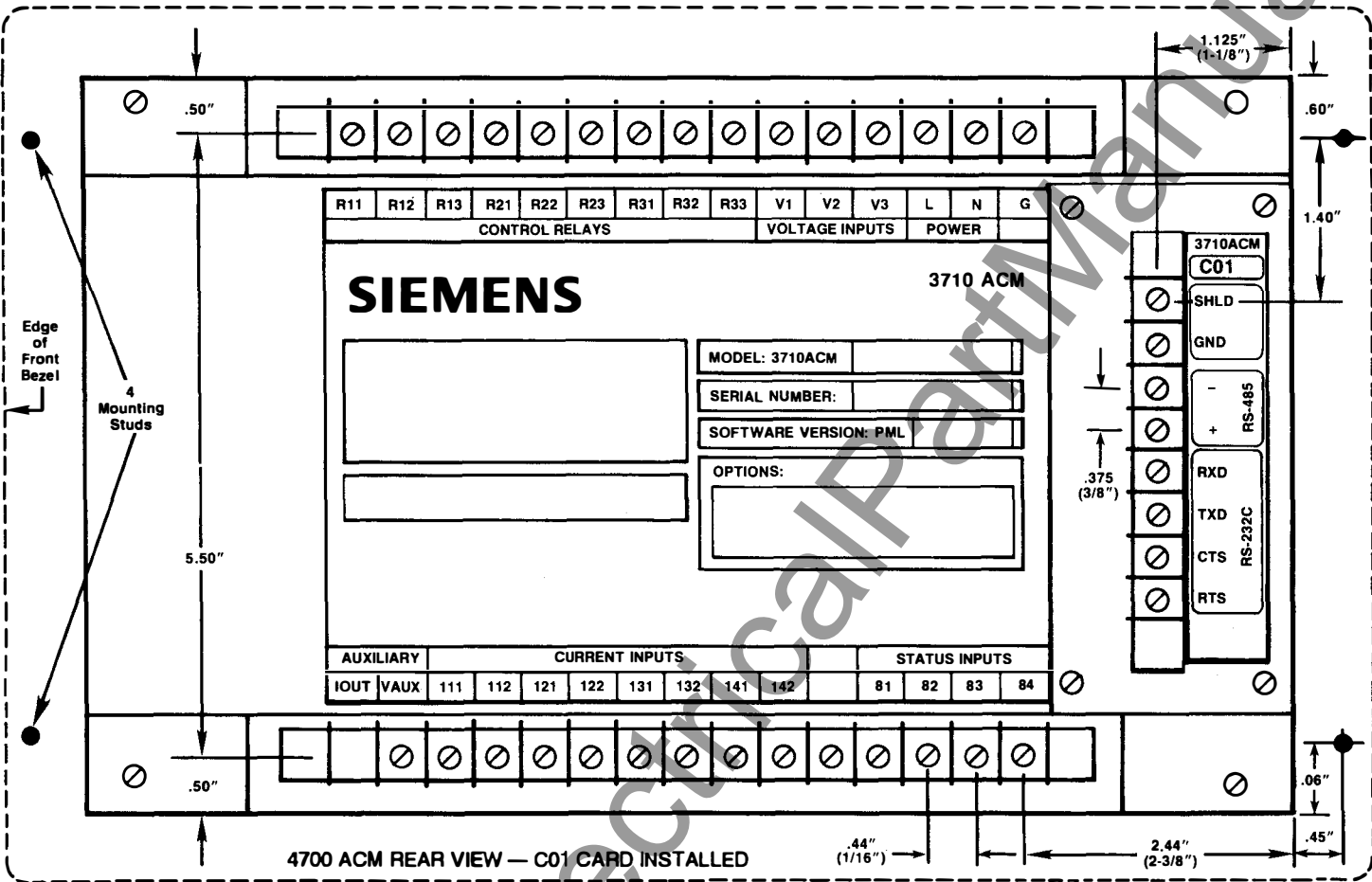


RIGHT SIDE



PANEL CUTOUT





4700 Mechanical Dimensions—Terminal Block

Setpoint Parameter Form

SETPOINT	FUNCTION	HIGH LIMIT	TD OPERATE	LOW LIMIT	TD RELEASE	RELAY/FUNCTION
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

4700 Power Meter Software Versions

The following table lists each software version release for the 4700 power meter and the new features or performance enhancements added with each release.

The version number is identified on the label on the rear cover of the 4700 power meter. If yours is currently using a software

version older than the most recent version listed in the table below, you may upgrade the software in that unit by contacting your local representative or the manufacturer. Upgrades to the 4700 power meter require a simple replacement of the EPROM (integrated circuit "chip") which contains the operating software inside the unit. This must be done by a trained electronic serviceman.

<u>VERSION</u>	<u>RELEASE DATE</u>	<u>DESCRIPTION</u>
V2.0	October 1989	Initial Release
V2.0.0.1	December 1989	Added 3600 Communication Emulation
V2.0.0.2	December 1989	Fixed Negative kVAR in 3600 Communications
V2.0.0.3	January 1990	Fixed Volt Mode 4 in 3600 Communications Fixed Overflow in Average Voltages
V2.0.0.4	March 1990	Fixed Negative kW in 3600 Communications Fixed Min/Max Flag in 3600 Communications

4700 Power Meter Technical Specifications

Parameter	Accuracy	Resolution	Range
Volts	0.2%	0.1%	0-999,999 (1)
Amps (L & N)	0.2%	0.1%	0-9,999
KVA	0.4%	0.1%	0-999,999 (2)
KW	0.4%	0.1%	0-999,999 (2)
KVAR	0.4%	0.1%	0-999,999 (2)
PF	1.0%	1.0%	1.0 to +/-0.6
FREQUENCY	0.2 Hz	0.1 Hz	40 to 70 Hz
KW DEMAND	0.4%	0.1%	0-999,999
AMPS DEMAND	0.2%	0.1%	0-9,999
KWHR	0.4%	1 KWHR	0-999,999,999
KVARHR	0.4%	1 KVARHR	0-999,999,999
V _{aux} (1 VAC scale)	0.25%	0.1%	0-999,999
Neutral Current	0.2%	0.1%	0-9,999

Notes

(1) Reads in KV for voltages over 9,999
 (2) Reads in MVA, MW, MVAR for readings over 9,999

Input Ratings	
Voltage Inputs: (V1, V2, V3)	120 VAC nominal full scale input version Overload withstand: 1500 VAC continuous, 2500 VAC for 1 Sec Input impedance: 2 Megohm 277 VAC nominal full scale input version (Option-277) Overload withstand: 1500 VAC continuous, 2500 VAC for 1 Sec Input impedance: 2 Megohm 347 VAC nominal full scale input version (Option-347) Overload withstand: 1500 VAC continuous, 2500 VAC for 1 Sec Input impedance: 2 Megohm
Aux. Voltage Input: (V _{aux})	1.0 VAC/VDC nominal full scale input (1.25 VAC/VDC max.) Overload withstand: 120 V continuous, 1000 V for 1 Sec Input impedance: 200 Kohm
Current Inputs: (I11, I12, I21, I22, I31, I32, I41, I42)	5.000 Amps AC nominal full scale input Overload withstand: 15 Amps continuous, 300 Amps for 1 Sec Input impedance: 0.05 ohm, Burden: 1.25 VA
Status Inputs: (S1, S2, S3, S4)	>20 VAC/VDC = active, <9 VAC/VDC= inactive (S1, S2, S3, S4) Input impedance: 2 Megohm Overload withstand: 1500 V continuous, 2500 V for 1 Sec
Control Relays: (R1, R2, R3)	Form C dry contact relays 120 VAC or 24 VDC @ 10 Amp maximum load current
Power Supply:	Standard North American: 85 to 132 VAC/0.2 Amps/47 to 440 Hz or 110 to 170 VDC/0.2 Amps European/Optional: 85 to 264 VAC/0.2 Amps/47 to 440 Hz or 110 to 340 VDC/0.2 Amps Other Available Options: 24 VDC and 48 VDC
Operating Temperature:	0°C to 50°C (32°F to 122°F) ambient air temperature range

Voltage, Current, Status, Relay and Power inputs all pass the ANSI C37.90A surge withstand and fast transient tests.

4700 Series Power Meter Model/Ordering Information

Table 1. 4700 Product Designations

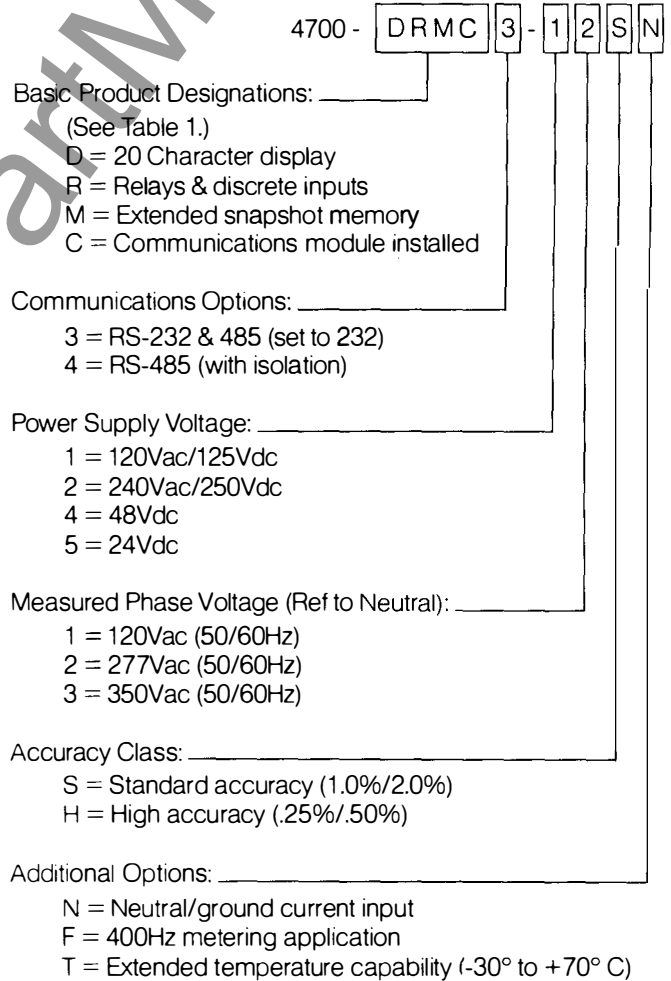
Features	Available Basic Product Designations							
	D	DR	DC	DRC	C	RC	DMC	DRMC
15 metered parameters	X	X	X	X	X	X	X	X
Min/Max log	X	X	X	X	X	X	X	X
Aux voltage (1Vac/1Vdc nominal)	X	X	X	X	X	X	X	X
20 character display	X	X	X	X			X	X
Four discrete inputs		X		X		X		X
Three programmable relay outputs		X		X		X		X
One analog output (4 to 20mA)		X		X		X		X
Extended memory (100 snapshots)							X	X
Communications module installed			X	X	X	X	X	X

Examples:

"4700-C4-11S" defines a power meter without integral display with an isolated RS-485 communications module installed, a 120Vac/125Vdc power supply, 120Vac nominal measured phase voltage inputs and standard 1%/2% accuracy.

"4700-DR-12HN" defines a power meter with integral display, status inputs and relay outputs, 120Vac/125Vdc power supply, 277Vac nominal measured phase voltage inputs, high accuracy (.25%/50%) and a fourth current input for neutral or ground currents.

4700 Power Meter Catalog Number Designations



4700 Non-Display Unit Operation Introduction

The TRANSDUCER version of the 4700 provides all the functions of the 4700, except that it has no front panel display or keypad. All front panel display and keypad functions described in the 4700 Operation Manual should be disregarded for this model.



The mounting requirements differ slightly for the non-display unit model. These are described in "Monitoring."

The user interface/communications for the non-display unit model also differ from the standard 4700. These are described below.

Communications

All information and measured data is extracted from the 4700 TRANSDUCER model via its communications port, provided by the Communications Card. All TRANSDUCER model setup parameters are also accessed via the meter's communications port.

All TRANSDUCER models are shipped from the factory with a Communications Card installed. The card is user-configurable to operate in either the RS-485 or RS-232C communications standard (see "Field Retrofit and Configuration of the C01 Communications Card"). "Communications Connections" describes all necessary communications connections.

	 CAUTION
	<p>Be certain not to connect RS-232C configured devices to RS-485 configured devices as this will cause <u>damage to the meters</u> or other devices.</p>

The data collected by the TRANSDUCER model can be displayed on a Siemens Power Monitor™ Display and Monitoring unit, which allows the user to remotely configure, monitor or control one or more power meters.

To initiate communications with the TRANSDUCER model, the factory-set UNIT I.D. and BAUD RATE must be used. The TRANSDUCER model is shipped with its UNIT I.D. and BAUD RATE set as follows:

- a) UNIT I.D. The UNIT I.D. of the TRANSDUCER model is set at the factory to be the last 4 digits of the unit's serial number, which can be found on the rear cover of the unit. For example, a unit with serial number 71317 will be preset to UNIT I.D. of 1317.
- b) BAUD RATE. The BAUD RATE of the TRANSDUCER model is set at the factory to 9600 baud.

Programming

Once communication has been established using the factory defaults, 4700 TRANSDUCER model operating parameters may be changed through use of the Power Monitor™. The user may also set the UNIT I.D. of the TRANSDUCER model to any other desired value, as well as resetting the BAUD RATE.

NOTE

Refer to "Communications" of the 4700 Operation Manual for important information on resetting the BAUD RATE.

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