3700 ACM

INSTALLATION AND OPERATION MANUAL

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IMPORTANT NOTE

The 3700 ACM power meter provides a ***display timeout*** feature which automatically turns off the front panel display after a programmable timeout period. When the 3700 ACM is shipped, this time-out period is preset to 180 minutes (3 hours).

Following a display timeout, the display of the 3700 ACM may be turned back on by the user at any time by simply pressing the DISPLAY ON (PHASE) button on the front panel of the meter.

WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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1. INTRODUCTION

1.1 DESCRIPTION

The model 3700 ACM is a second generation microprocessor based instrumentation package for electrical switchboards 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 3700 ACM replaces up to 12 individual transducers and meters with a single package.

PERFORMANCE FEATURES

The 3700 ACM offers major improvements in accuracy, communications capability, data logging, control capability, ease of use, and cost compared to first generation digital metering systems. The 3700 ACM will operate as a stand alone switchboard or substation instrument, and it can serve as a Smart RTU for SCADA or power monitoring systems.

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
- 4 digit amperage display
- 8 digit power function display.

The unit may be configured to operate in either Wye (Star) or Delta voltage mode. The following measurements are available:

- Voltage on each phase
- Current on each phase
- Line to line voltages
- Frequency
- Power factor
- KVA
- KW
- KVAR
- KW demand
- V_{aux} (auxiliary voltage input)
- Total MWHR
- Total MVARHR.

Maxima and minima 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.

AUXILIARY VOLTAGE INPUT

All 3700 ACM 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

All 3700 ACM models also provide an analog current output. The unit can be programmed for 0 to 20 mA or 4 to 20mA current output proportional to any measured parameter.

COMMUNICATIONS

The 3700 ACM is available with one of two *communication* options*: RS-232C or RS-485. An IBM PC /XT/AT (or compatible) host computer running PML's POWERVIEW or MSCADA software may communicate with 3700 ACM units. This PC based software allows a user to remotely monitor and control the units.

If using the RS-232C model of the product, one unit may be controlled by the PC. The distance limitation for RS-232C is 50 feet.

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

CONTROL RELAYS

The 3700 ACM *control relays* option* provides 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 port.

- Breaker trip relays controlled by user-definable conditions such as:

  - Over/under voltage
  - Phase unbalance
  - Phase reversal
  - Over/under frequency
  - Power direction reversal.

STATUS INPUTS

The 3700 ACM *status inputs* option* provides four 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 an IBM PC which is connected to the communications port and running PML's POWERVIEW or MSCADA software.

LOGS OPTION

The 3700 ACM *logs* option* provides the function of maintaining three data logs accessible via the communciations port. An IBM PC which is connected to the communications port and running PML's POWERVIEW or MSCADA software can display the contents of each of these logs.

- EVENT Log. This log records events such as power up, parameter changes, alarm conditions, relay changes, and status input changes. The 3700 ACM may be purchased either with the capability to store the 25 most recent events or the 50 most recent events.

- SNAPSHOT Log. This log contains voltage, current, and all power values which are recorded at user-defined time intervals.

- MIN/MAX Log. This log records the extreme values for voltages, currents, power, and other measured parameters.

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

NOTE

3700 ACM time-stamping and time-setting functions are only accessible through the use of an IBM-compatible computer running PML's POWERVIEW or M-SCADA software.

1.2 SYSTEM APPLICATIONS

Because of its unique measurement, storage, set point (load shedding) and display characteristics the 3700 ACM should be considered for use in:

a) Utility Installations
b) Industrial Buildings
c) Office Buildings
d) Commercial Buildings
e) Hospitals
f) Telephone Exchanges
g) Factories
h) Pulp Mills
i) Saw Mills
j) Shopping Centers
k) Large Stores
l) Hotels
m) Substation Metering
n) Co-generation Systems
o) Chemical Process Plants
p) Multi User Sites where allocation of electrical costs is desirable
q) Any other installation which uses significant amounts of electrical energy.
r) Any other locations where remote monitoring and control is needed.

* Refer to Appendix F for ordering information concerning available options.

2. INSTALLATION

2.1 LOCATION

The 3700 ACM should be mounted in a dry, dirt free environment away from heat sources and very high electric fields. Temperatures should not exceed 50°C (112°F) or fall below 0°C (32°F).

2.2 MOUNTING

Appendix A provides the mounting dimensions for the 3700 ACM and 3700 ACM-T (displayless version). The 3700 ACM may be panel mounted for easy access and viewing. The 3700 ACM provides four mounting studs to facilitate this. A 3.5 inch depth is required behind the front panel. The 3700 ACM-T can be mounted against any flat surface, and provides four mounting holes for this purpose.

2.3 POWER SUPPLY

The 3700 ACM is powered by 85 to 130 Volts AC or 90 to 170 Volts DC at 0.2 amps. The 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.

2.4 WIRING

Connections to the 3700 ACM are made to two pluggable terminal strips located at the top rear of the unit. 14 gauge wire is recommended for all connections. All wiring to the 3700 ACM should be routed via intermediate terminal strips.

Phasing and polarity of the AC current and voltage inputs and their relationship is critical to the correct operation of the unit. Figures 2.6.1 to 2.7.3 provide wiring diagrams to ensure correct installation.

2.5 PT AND CT TRANSFORMER SELECTION

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

PT Selection

Whether or not potential transformers (PT's) are required depends on the nature of the system being monitored, the voltage levels to be monitored, and the model of the 3700 ACM. The 120VAC (full scale) input model* may be used for direct connection to 120/208 systems, or for use with PT's that have a 120 Volt secondary. The 277 VAC (full scale) input model* may be used for direct connection to 277/480 Volt systems. If system voltages are over 277/480, PT's 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 3700 ACM. The PT's are selected as follows:

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

b) Delta: PT primary rating = system L-L voltage. PT secondary rating = 120 Volts.

PT quality directly affects system accuracy. The PT's 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 F for 3700 ACM model numbering and options information.

CT Selection

The 3700 ACM uses current transformers (CT's) to sense the current in each phase of the power feed. The selection of the CT's 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 3700 ACM 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 3700 ACM, the CT's, and the PT's (if used). Instrument accuracy Class 1 or better is recommended.

2.6 CONNECTION FOR THREE PHASE WYE (STAR) 4 WIRE SYSTEMS

Figures 2.6.1 and 2.6.2 provide wiring diagrams for WYE system configuration. The VOLTS MODE of the 3700 ACM should be set to 0, as described in Section 3.3, for 4 wire systems.

The 3700 ACM 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. The wiring diagram for this configuration is shown in Figure 2.6.1.

For system voltages over 277/480 Volts, PT's must be used. When PT's are used both the primary and secondary must be wired in a Wye (Star) configuration as shown in Figure 2.6.2. Voltage sense leads should be protected by breakers or fuses at their source. If the power rating of the PT's is over 25 Watts the secondaries should be fused. Wiring must be exactly as shown for correct operation.

*Refer to Appendix F for 3700 ACM model numbering and options information.

2.7 CONNECTION FOR THREE PHASE 3 WIRE SYSTEMS

When the Star point of a 3 wire system is grounded, the 3700 ACM may be connected directly without the use of PT's (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 2.7.1. The VOLTS MODE should be set to 0.

When configured for ungrounded (floating) Delta operation, the 3700 ACM requires PT's and senses the L-L voltages between each of the phases. VOLTS MODE of the 3700 ACM should be set to 1. In the open Delta configuration, the 3700 ACM may be connected in either of two ways. Figure 2.7.2 shows connection using 3 CT's and Figure 2.7.3 shows connection using 2 CT's.

2.8 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 V_1 and V_2 inputs of the 3700 ACM, and the outputs of the two corresponding current transformers to the I_1 input pair and I_2 input pair. This is illustrated in Figure 2.8.1. Note that the V_3 input and I_3 input pair are unused and should all be grounded. For single phase systems, the VOLTS MODE of the 3700 ACM should be set to 2.

2.9 GROUND REFERENCE CONNECTION

The ground reference connection, G, to the 3700 ACM serves as the zero voltage reference for voltage readings. This lead must be connected to earth ground. The ground reference connection should be totally separate from the chassis ground connection.

In systems which use PT's the G connection must be connected to ground and the PT common leads as shown in the illustrations. The G connection is important to overall accuracy. It should be made using a dedicated 14 gauge wire to a point where there will be no voltage error due to distribution voltage drops.

2.10 CHASSIS GROUND CONNECTION

Connect a 14 gauge (or larger) wire from the 3700 ACM chassis ground lug to the switchgear ground.

[CAUTION]

The 3700 ACM chassis 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. This wire must be separate from the 'G' terminal conductor. Failure to do so will void the warranty.

A good, low impedance chassis ground is essential for the 3700 ACM surge and transient protection circuitry to function effectively. Do not rely on metal door hinges as a ground path.

2.11 COMMUNICATIONS CONNECTIONS

Figures 2.11.1 and 2.11.2 illustrate the wiring connection requirements for the RS-232C and RS-485 communication options, respectively.

2.12 CONTROL RELAY CONNECTIONS

Figure 2.12.1 illustrates the wiring connection requirements for the control relays. Section 3.8 describes the operation of the relays.

2.13 STATUS INPUT CONNECTIONS

Figure 2.13.1 illustrates a number of possible wiring connection methods and applications for the status inputs. Section 3.9 describes the operation of the status inputs.

2.14 V_{aux} AUXILIARY VOLTAGE INPUT CONNECTIONS

Figure 2.14.1 illustrates a number of possible wiring connection methods and applications for the V_{aux} input. Section 3.6 describes the operation of this input.

2.15 I_{out} AUXILIARY CURRENT OUTPUT CONNECTIONS

Figure 2.15.1 illustrates a number of possible wiring connection methods and applications for the I_{out} output. Section 3.6 describes the operation of this output.

2.16 MAINTENANCE

The 3700 ACM contains a battery backed non-volatile memory. The rated life of the battery is seventy 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.

Other than this, the 3700 ACM does not require any regular maintenance.

2.17 CALIBRATION

The calibration interval for the 3700 ACM depends on the user's accuracy requirements. The rated accuracy drift is 0.1% per year.

The calibration procedure consists of plugging a portable *Calibration Set* into the two terminal strip sockets of the 3700 ACM, and performing a simple calibration routine.

Contact PML for calibration procedure details and equipment requirements.

2.18 FIELD SERVICE CONSIDERATIONS

In the unlikely event that the 3700 ACM 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 3700 ACM current inputs can be disconnected without open circuiting the CT's. The shorting block should be wired so that protective relaying is not affected.

2. All wiring should be routed to allow easy removal of the 3700 ACM terminal strip connectors, the 3700 ACM rear cover, and the 3700 ACM itself.

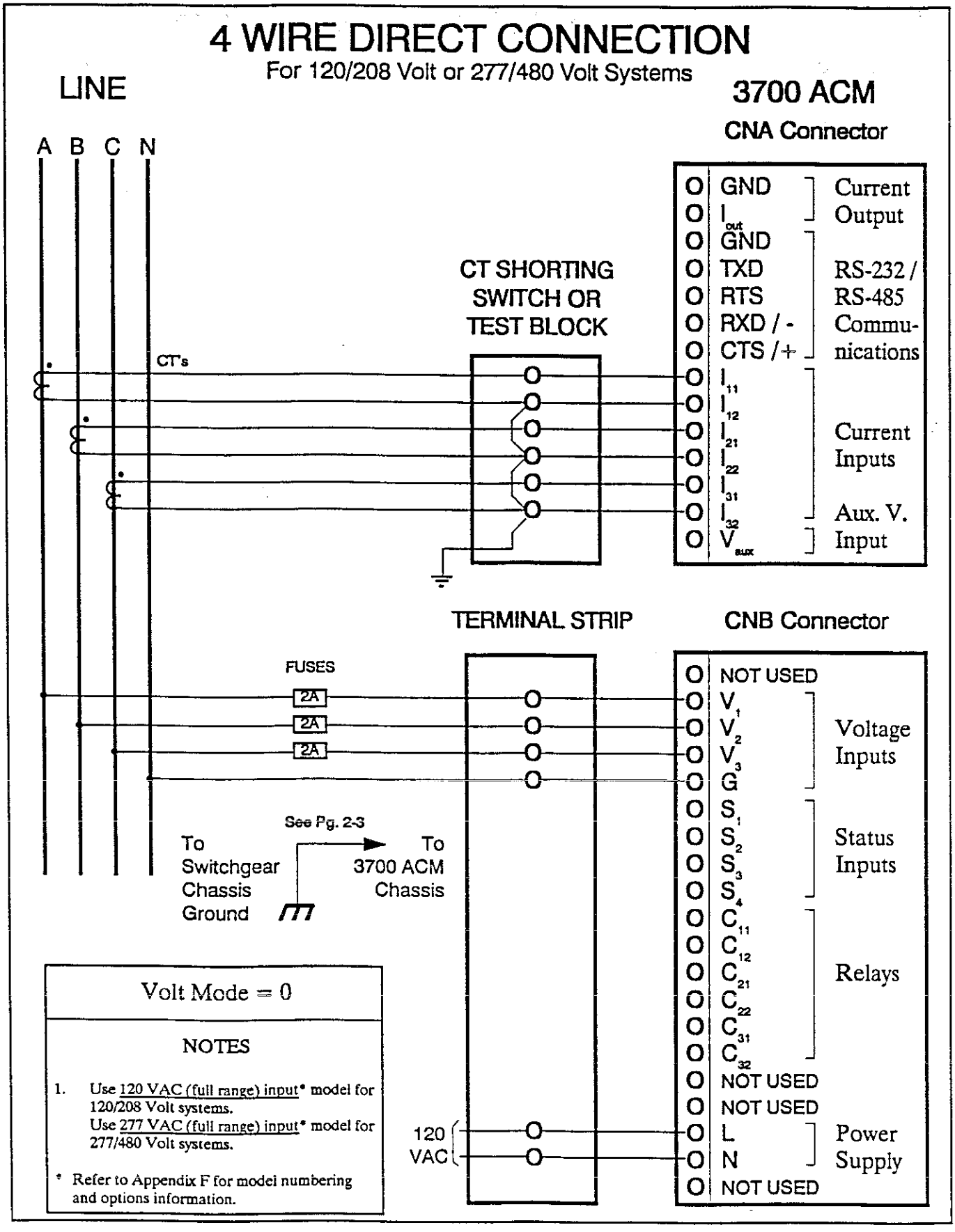

4 WIRE DIRECT CONNECTION
For 120/208 Volt or 277/480 Volt Systems
LINE
A B C N
3700 ACM
CNA Connector
CT's
CT SHORTING SWITCH OR TEST BLOCK
GND
I out
GND
TXD
RTS
RXD / -
CTS /+
Current Output
RS-232 / RS-485 Commu-nications
I11
I12
I21
I22
I31
I32
V aux
Current Inputs
Aux. V. Input
TERMINAL STRIP
CNB Connector
FUSES
2A
2A
2A
NOT USED
V1
V2
V3
G
Voltage Inputs
S1
S2
S3
S4
Status Inputs
C11
C12
C21
C22
C31
C32
Relays
NOT USED
NOT USED
120 VAC
L
N
Power Supply
NOT USED
See Pg. 2-3
To Switchgear Chassis Ground
To 3700 ACM Chassis
Volt Mode = 0
NOTES
1. Use 120 VAC (full range) input* model for 120/208 Volt systems.
Use 277 VAC (full range) input* model for 277/480 Volt systems.
* Refer to Appendix F for model numbering and options information.

Figure 2.6.1

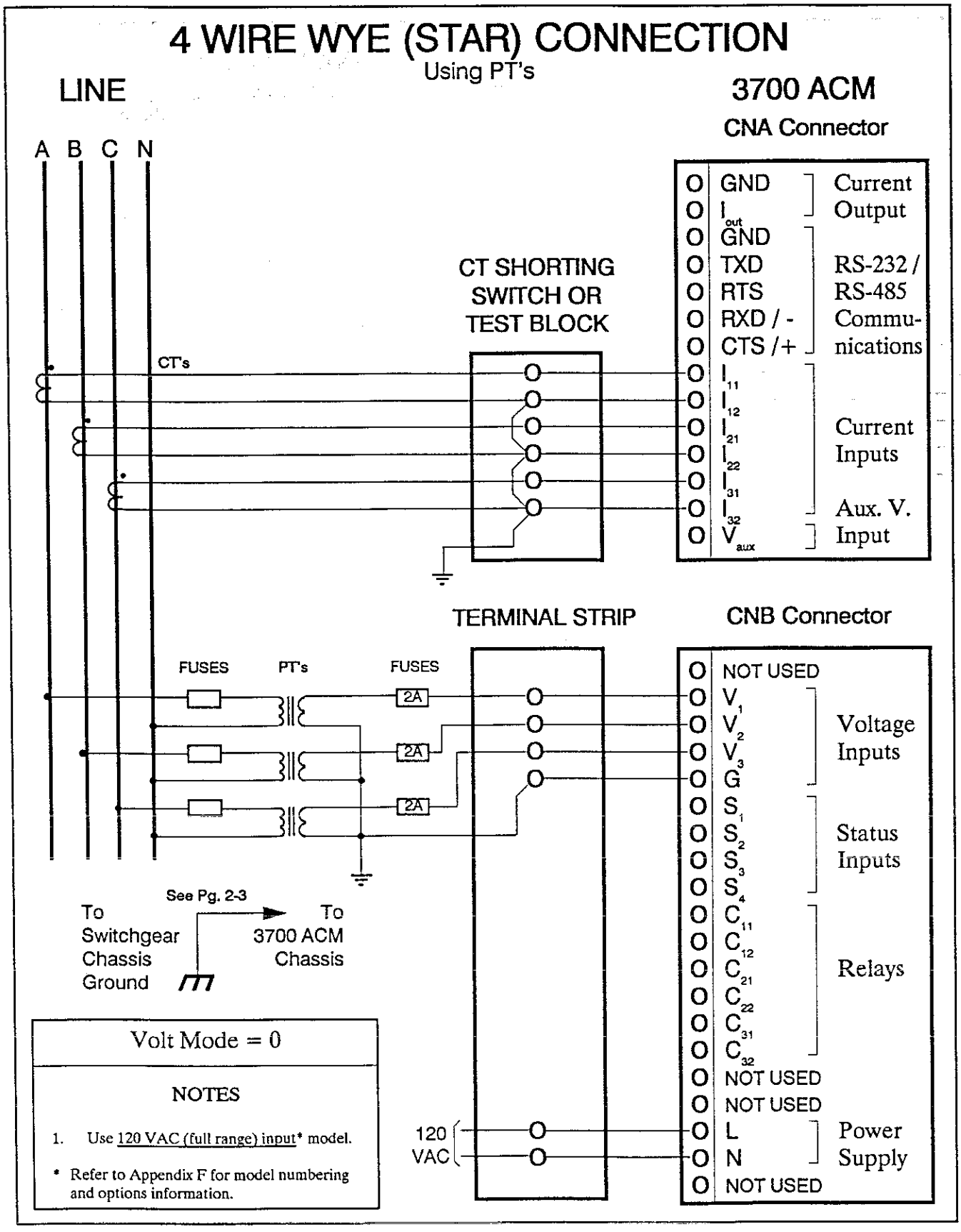

4 WIRE WYE (STAR) CONNECTION
Using PT's
LINE
A B C N
3700 ACM
CNA Connector
GND
I_{out}
GND
TXD
RTS
RXD / -
CTS /+
Current Output
RS-232 / RS-485 Communications
CT SHORTING SWITCH OR TEST BLOCK
CT's
I_{11}
I_{12}
I_{21}
I_{22}
I_{31}
I_{32}
V_{aux}
Current Inputs
Aux. V. Input
TERMINAL STRIP
CNB Connector
FUSES
PT's
FUSES
2A
2A
2A
NOT USED
V_1
V_2
V_3
G
Voltage Inputs
S_1
S_2
S_3
S_4
Status Inputs
C_{11}
C_{12}
C_{21}
C_{22}
C_{31}
C_{32}
Relays
NOT USED
NOT USED
120 VAC
L
N
Power Supply
NOT USED
See Pg. 2-3
To Switchgear Chassis Ground
To 3700 ACM Chassis
Volt Mode = 0
NOTES
1. Use 120 VAC (full range) input* model.
* Refer to Appendix F for model numbering and options information.

Figure 2.6.2

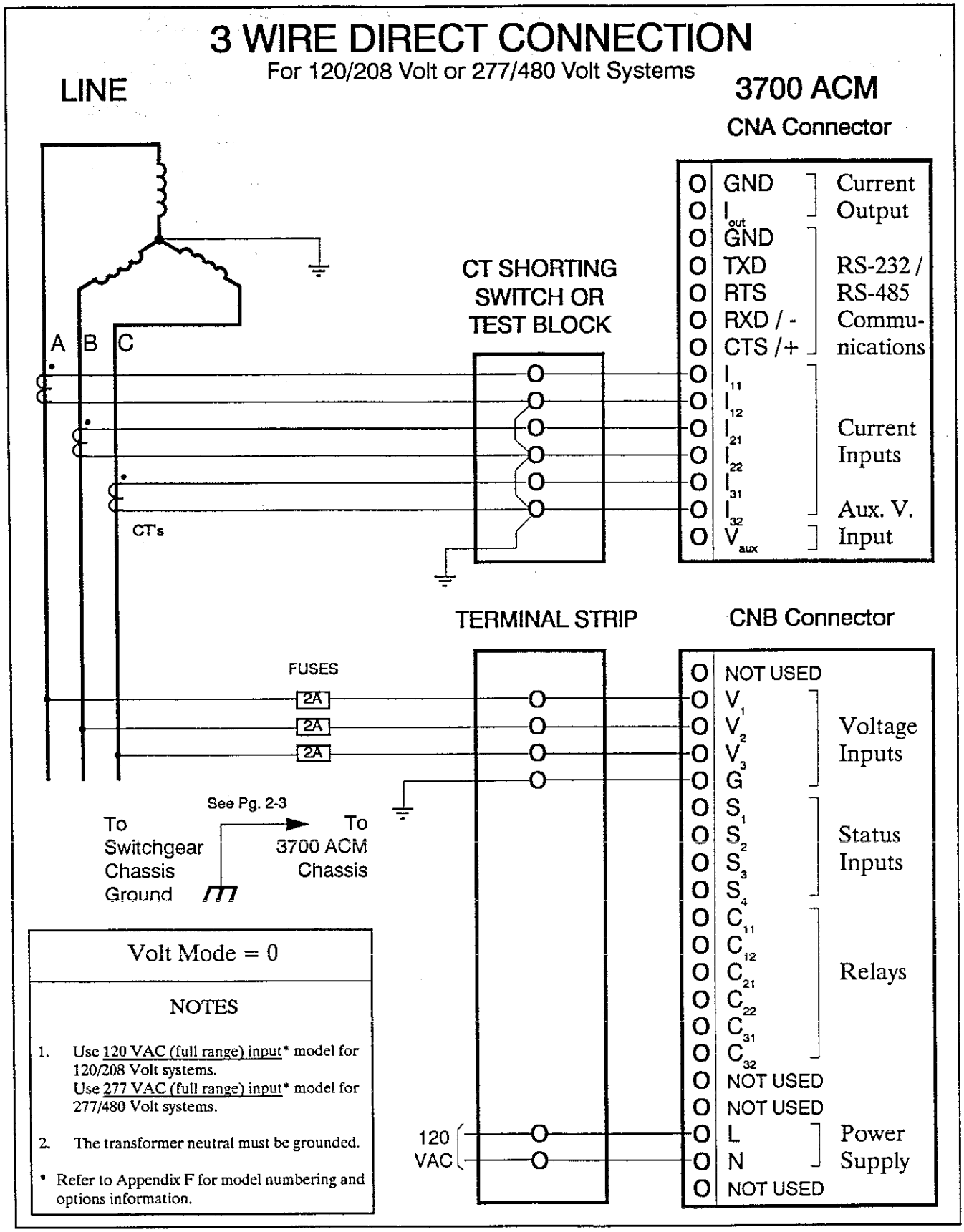

3 WIRE DIRECT CONNECTION
For 120/208 Volt or 277/480 Volt Systems
LINE
3700 ACM
CNA Connector
A
B
C
CT's
CT SHORTING SWITCH OR TEST BLOCK
GND
Iout
GND
TXD
RTS
RXD / -
CTS /+
Current Output
RS-232 / RS-485 Communications
I11
I12
I21
I22
I31
I32
Vaux
Current Inputs
Aux. V. Input
TERMINAL STRIP
CNB Connector
FUSES
2A
2A
2A
NOT USED
V1
V2
V3
G
Voltage Inputs
S1
S2
S3
S4
Status Inputs
C11
C12
C21
C22
C31
C32
Relays
NOT USED
NOT USED
120 VAC
L
N
Power Supply
NOT USED
See Pg. 2-3
To Switchgear Chassis Ground
To 3700 ACM Chassis
Volt Mode = 0
NOTES
1. Use 120 VAC (full range) input* model for 120/208 Volt systems.
Use 277 VAC (full range) input* model for 277/480 Volt systems.
2. The transformer neutral must be grounded.
* Refer to Appendix F for model numbering and options information.

Figure 2.7.1

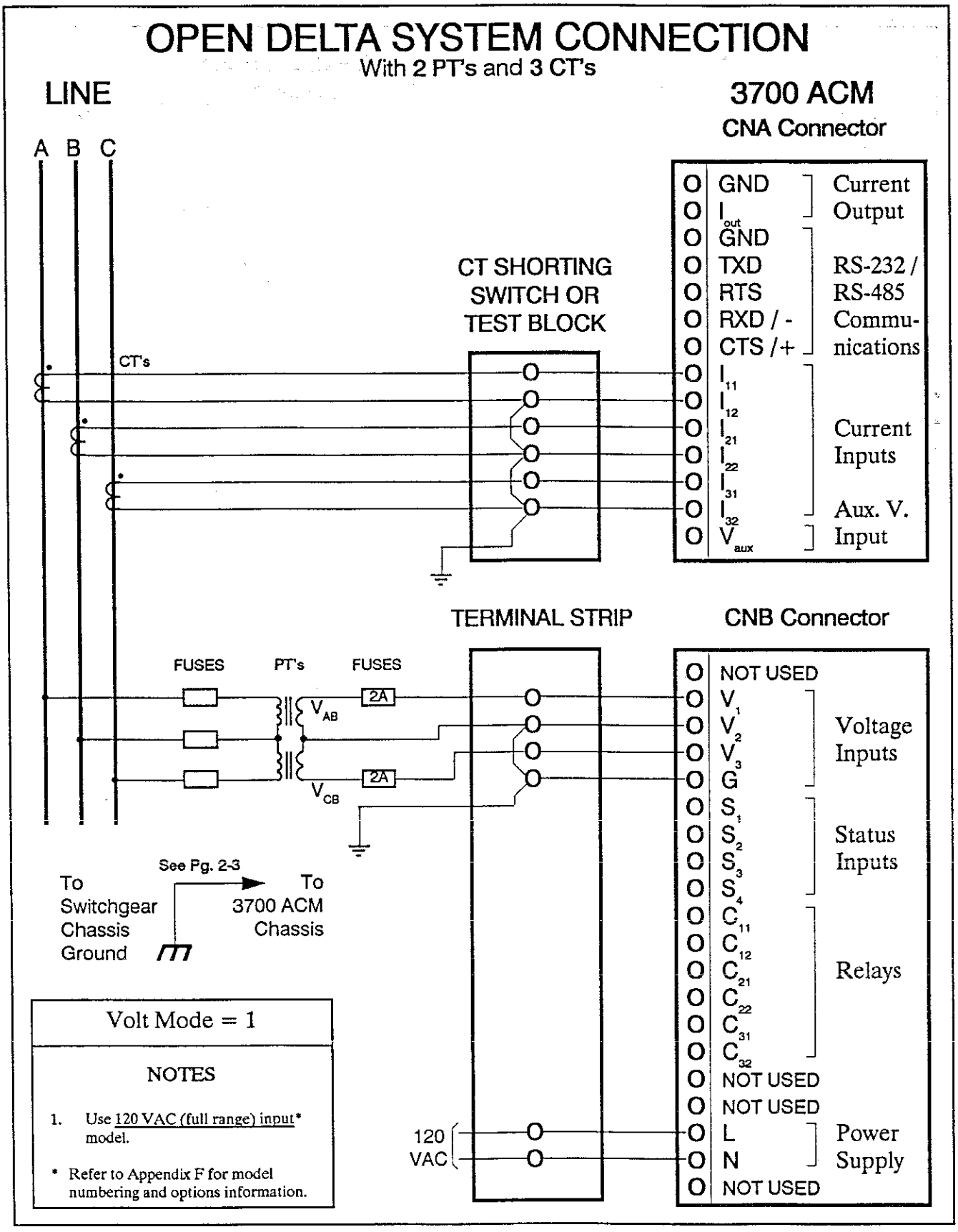

OPEN DELTA SYSTEM CONNECTION
With 2 PT's and 3 CT's
LINE
A B C
3700 ACM
CNA Connector
CT SHORTING SWITCH OR TEST BLOCK
CT's
O GND
O I_{out}
Current Output
O GND
O TXD
O RTS
O RXD / -
O CTS /+
RS-232 / RS-485 Commu-nications
O I_{11}
O I_{12}
O I_{21}
O I_{22}
O I_{31}
O I_{32}
Current Inputs
Aux. V. Input
O V_{aux}
TERMINAL STRIP
CNB Connector
FUSES
PT's
FUSES
2A
V_{AB}
V_{CB}
2A
O NOT USED
O V_1
O V_2
O V_3
O G
Voltage Inputs
O S_1
O S_2
O S_3
O S_4
Status Inputs
O C_{11}
O C_{12}
O C_{21}
O C_{22}
O C_{31}
O C_{32}
Relays
O NOT USED
O NOT USED
120 VAC
O L
O N
Power Supply
O NOT USED
See Pg. 2-3
To Switchgear Chassis Ground
To 3700 ACM Chassis
Volt Mode = 1
NOTES
1. Use 120 VAC (full range) input* model.
* Refer to Appendix F for model numbering and options information.

Figure 2.7.2

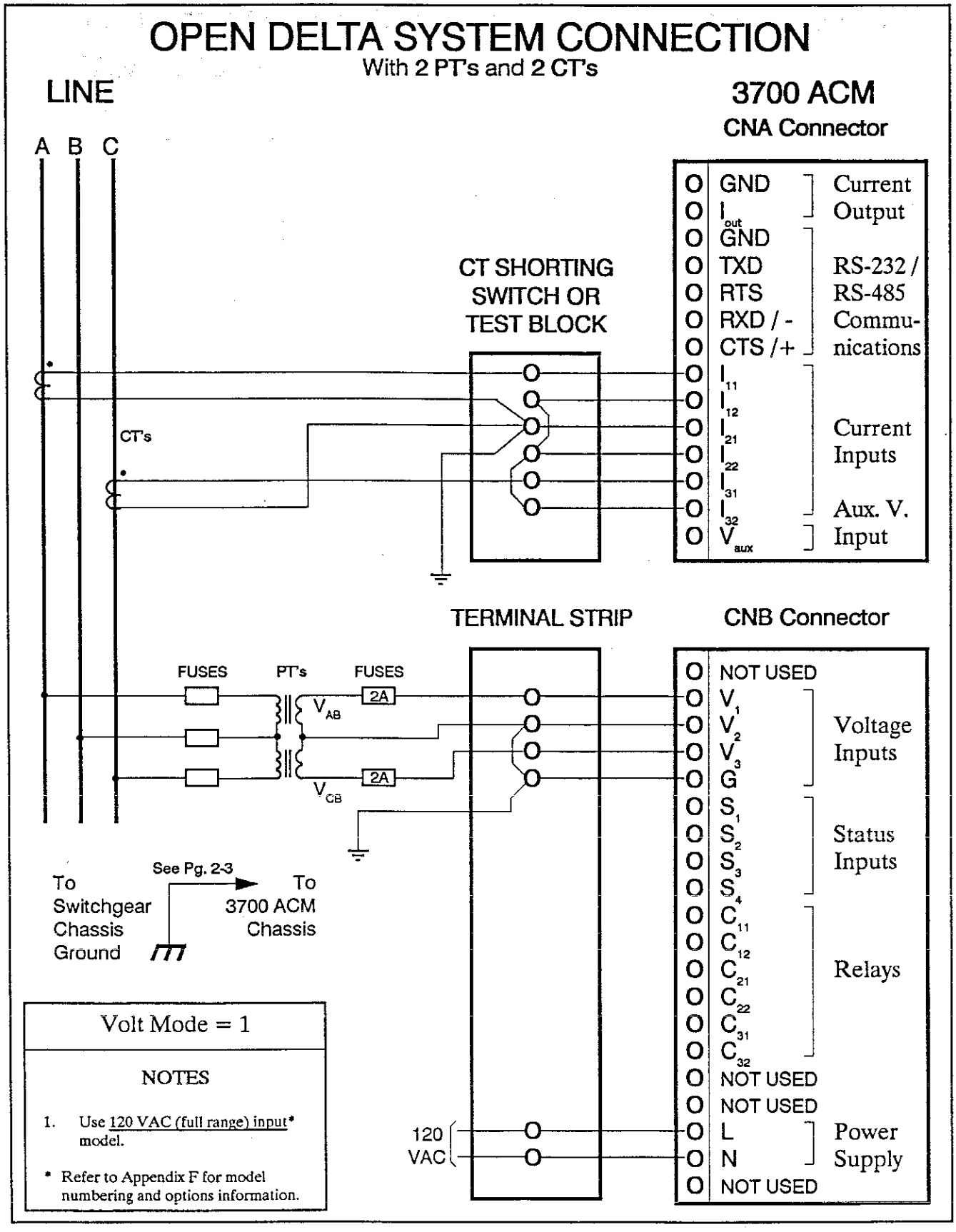

OPEN DELTA SYSTEM CONNECTION
With 2 PT's and 2 CT's
LINE
A B C
3700 ACM
CNA Connector
GND
I out
GND
TXD
RTS
RXD / -
CTS /+
Current Output
RS-232 / RS-485 Communications
I11
I12
I21
I22
I31
I32
Vaux
Current Inputs
Aux. V. Input
CT SHORTING SWITCH OR TEST BLOCK
CT's
TERMINAL STRIP
CNB Connector
FUSES
PT's
FUSES
2A
VAB
VCB
2A
NOT USED
V1
V2
V3
G
Voltage Inputs
S1
S2
S3
S4
Status Inputs
C11
C12
C21
C22
C31
C32
Relays
NOT USED
NOT USED
120 VAC
L
N
Power Supply
NOT USED
See Pg. 2-3
To Switchgear Chassis Ground
To 3700 ACM Chassis
Volt Mode = 1
NOTES
1. Use 120 VAC (full range) input* model.
* Refer to Appendix F for model numbering and options information.

Figure 2.7.3

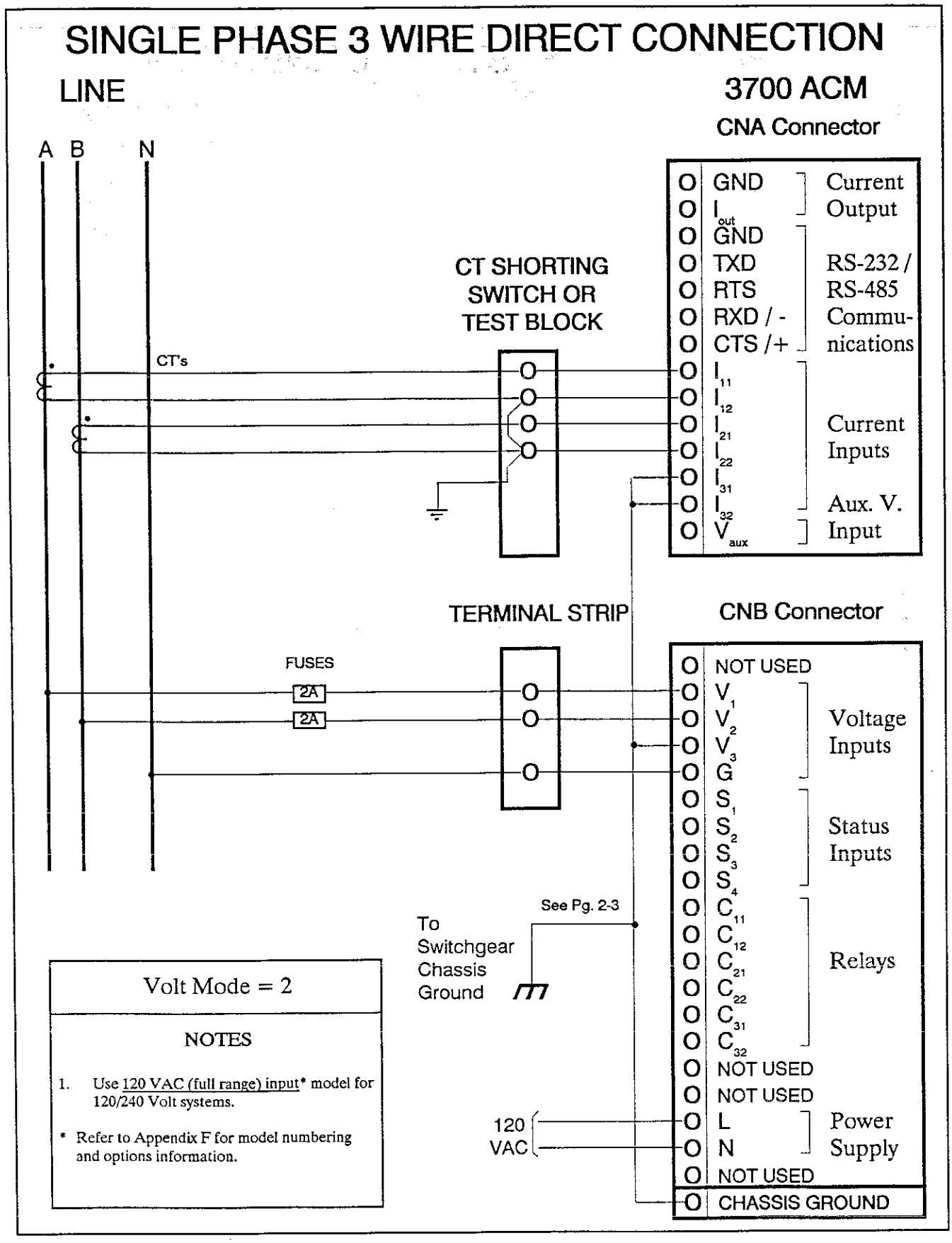
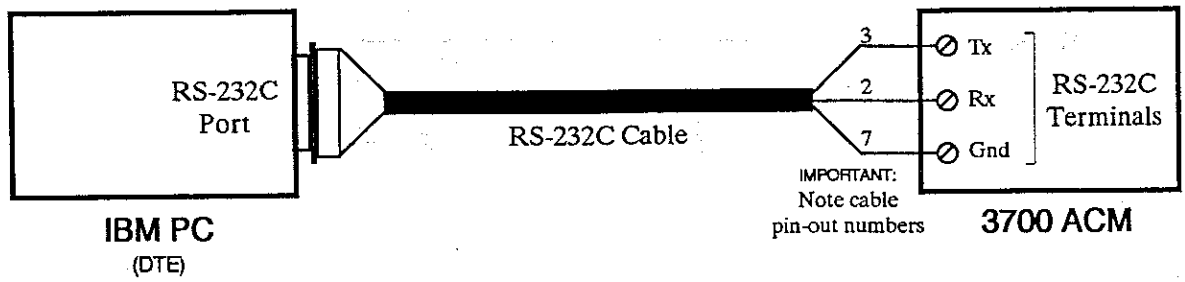

SINGLE PHASE 3 WIRE DIRECT CONNECTION
LINE
A B N
3700 ACM
CNA Connector
GND
I_{out}
GND
TXD
RTS
RXD / -
CTS /+
Current Output
RS-232 / RS-485 Communications
I_{11}
I_{12}
I_{21}
I_{22}
I_{31}
I_{32}
V_{aux}
Current Inputs
Aux. V. Input
CT SHORTING SWITCH OR TEST BLOCK
CT's
TERMINAL STRIP
FUSES
2A
2A
CNB Connector
NOT USED
V_1
V_2
V_3
G
Voltage Inputs
S_1
S_2
S_3
S_4
Status Inputs
C_{11}
C_{12}
C_{21}
C_{22}
C_{31}
C_{32}
Relays
NOT USED
NOT USED
L
N
NOT USED
Power Supply
CHASSIS GROUND
120 VAC
See Pg. 2-3
To Switchgear Chassis Ground
Volt Mode = 2
NOTES
1. Use 120 VAC (full range) input* model for 120/240 Volt systems.
* Refer to Appendix F for model numbering and options information.

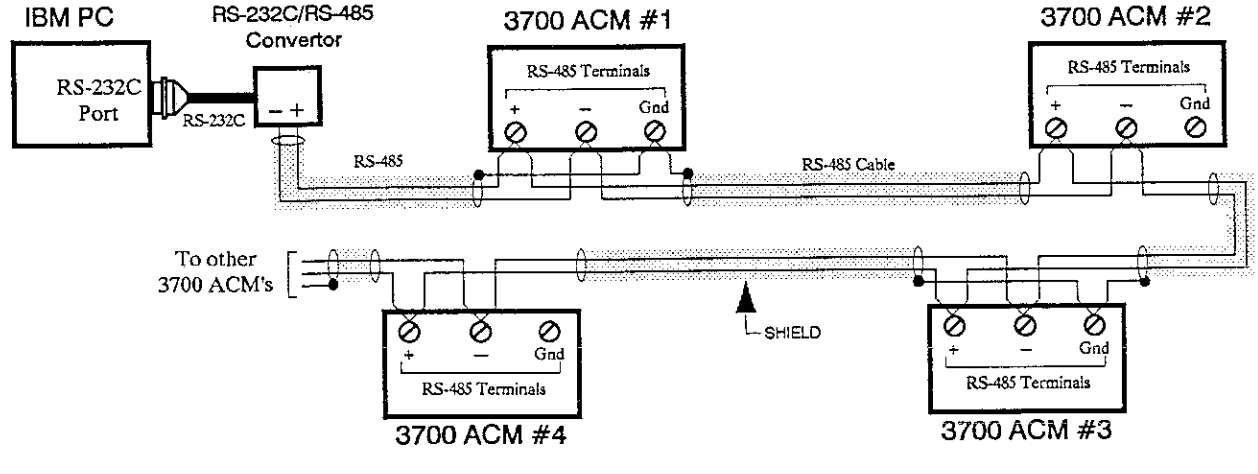
Figure 2.8.1



NOTES

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.
2. If connected directly to an IBM PC RS-232C port, the Tx and Rx leads may need to be reversed at the 3700 ACM, depending on whether the PC RS-232C port is configured as DCE or DTE.

Figure 2.11.1 RS-232C Communications Connections



NOTES

1. RS-485 Cable: 22 gauge shielded twisted pair. Total length: 4000 ft. maximum.
2. The shield must be grounded at one end only.
3. Up to 32 devices are allowed on the RS-485 bus.

Figure 2.11.2 RS-485 Communications Connections

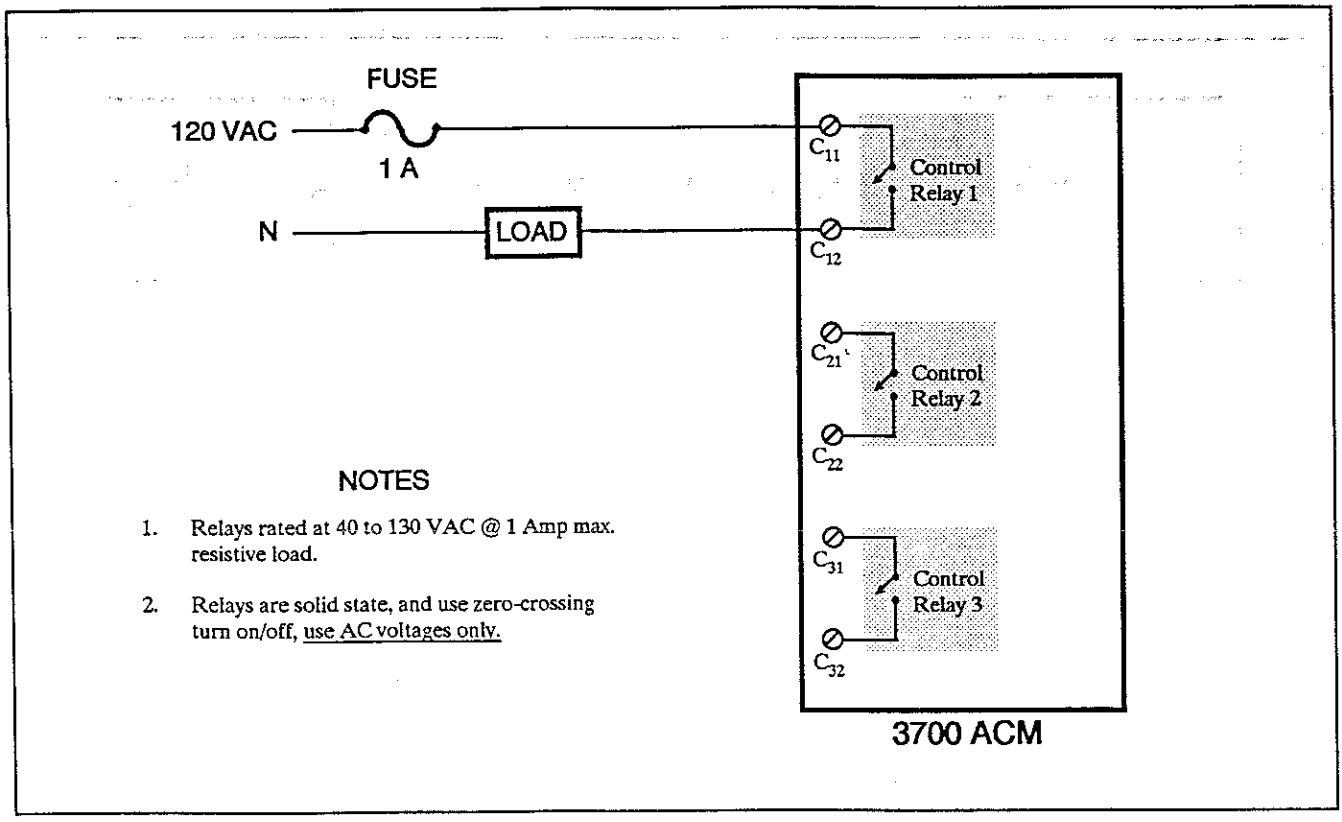


Figure 2.12.1 Control Relay Connections

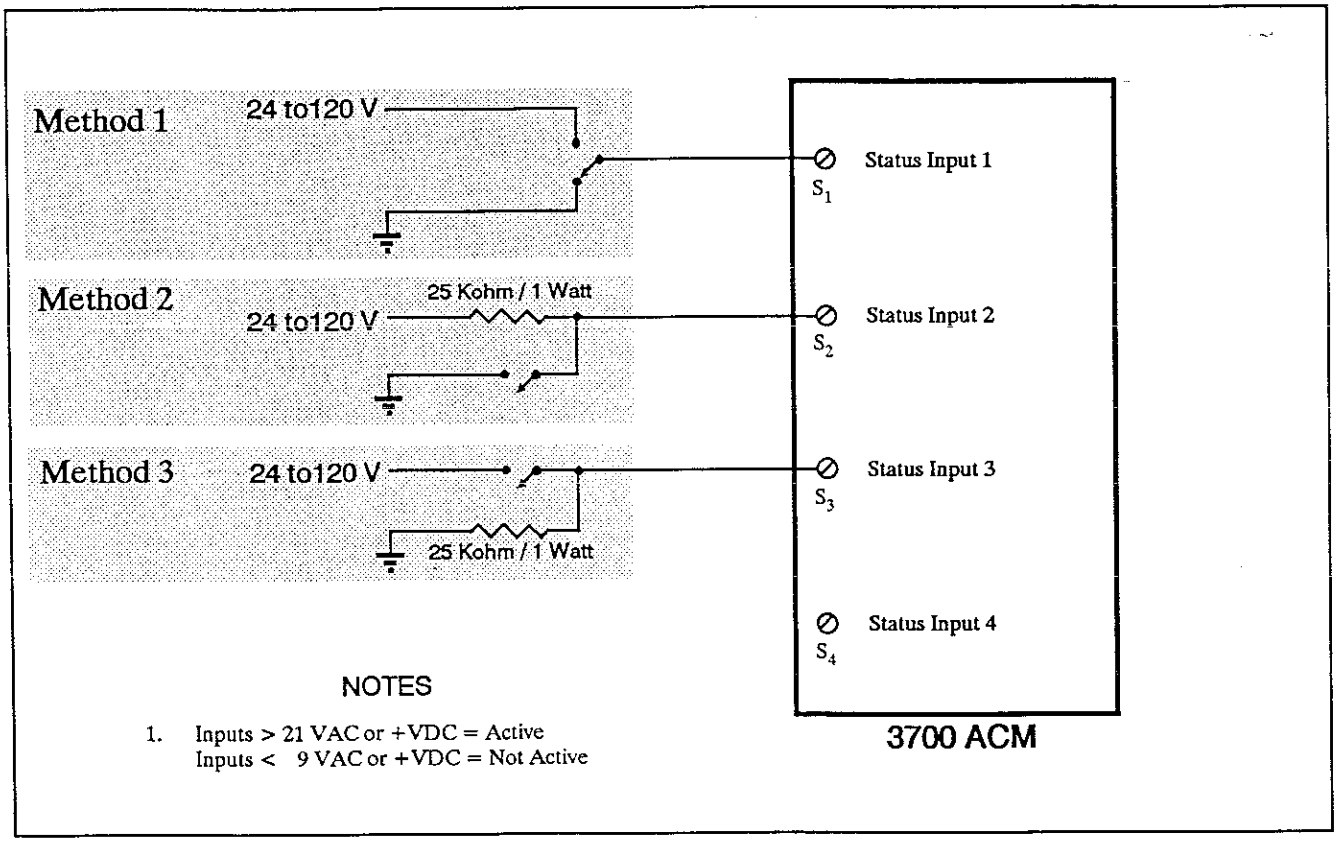


Figure 2.13.1 Status Input Connections

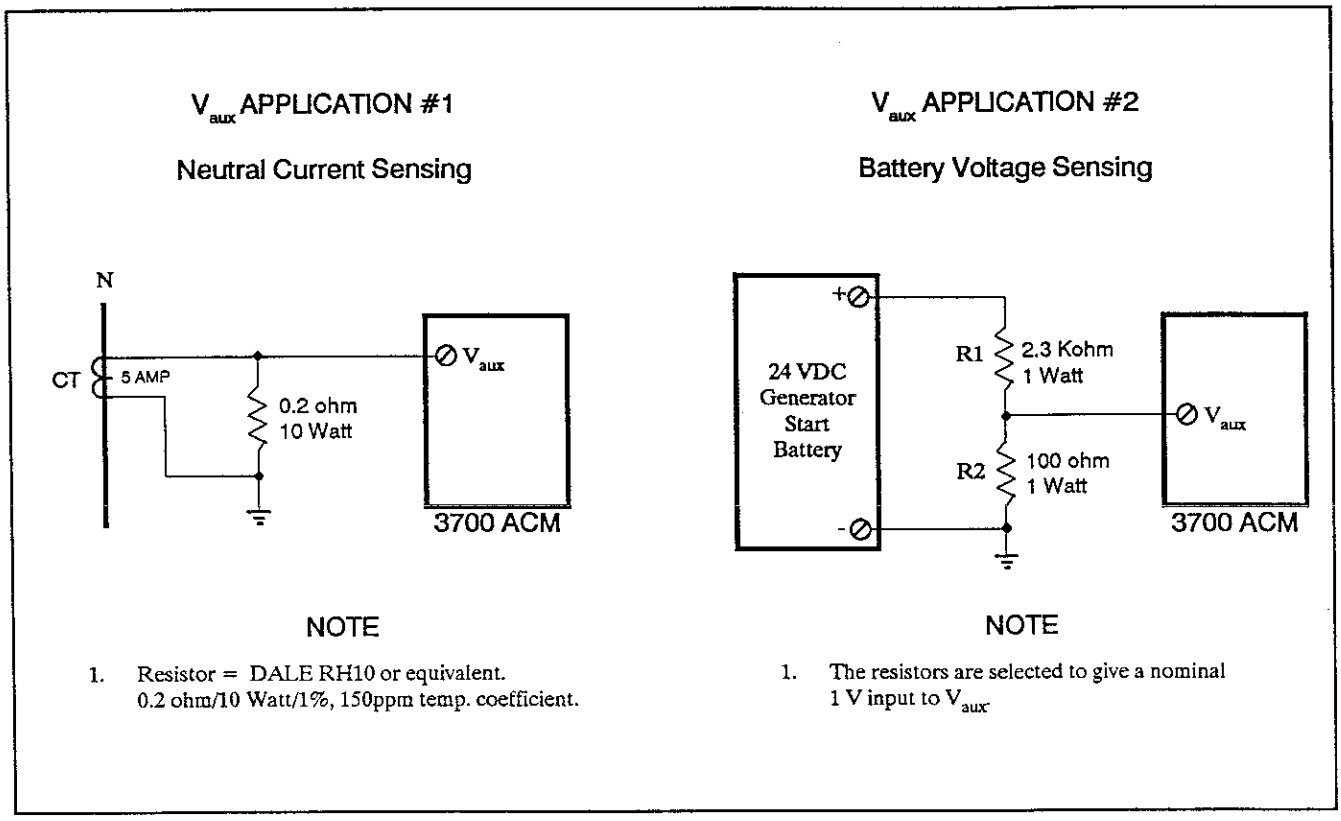


Figure 2.14.1 V_{aux} Auxiliary Voltage Input Connections

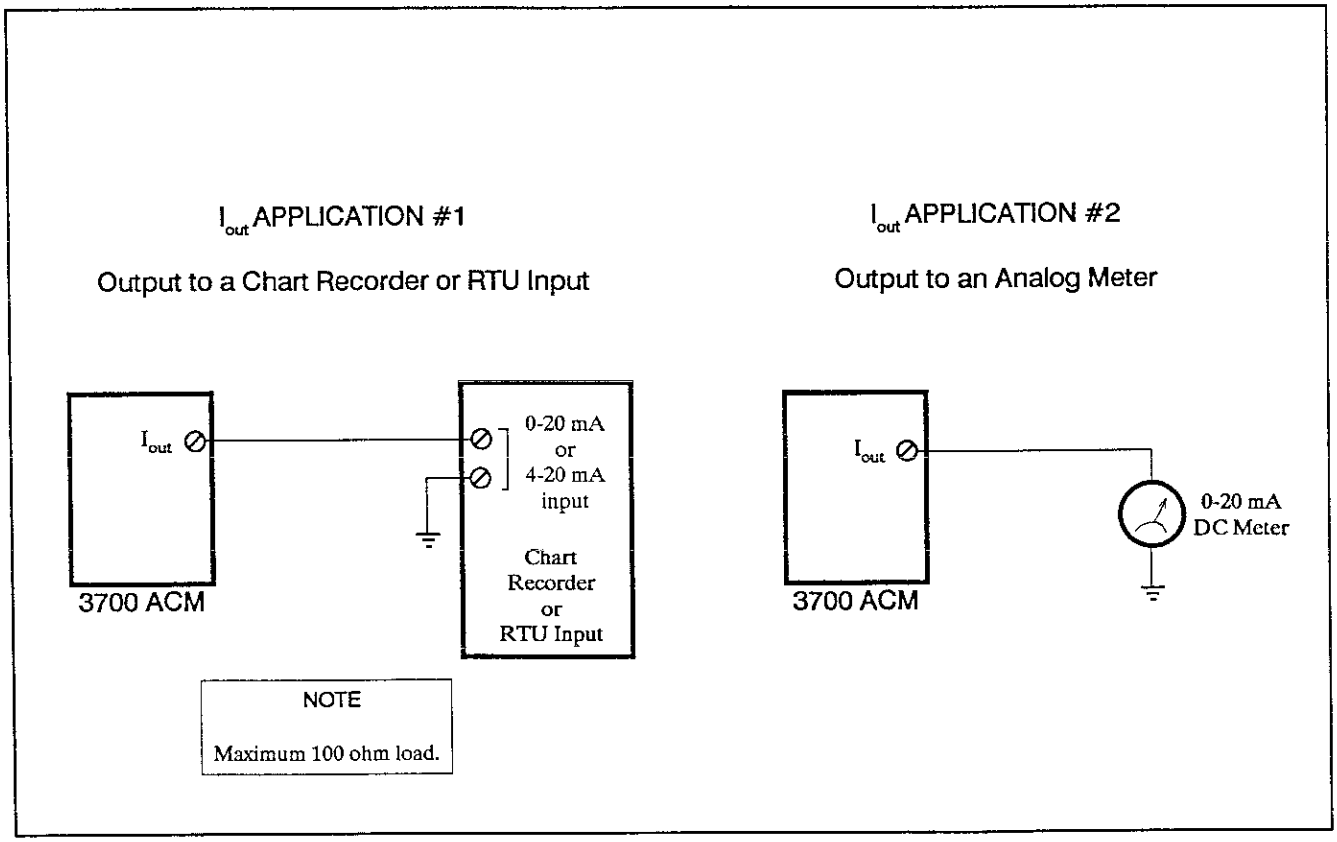


Figure 2.15.1 I_{out} Auxiliary Current Output Connections

3. GENERAL OPERATION

NOTE

The 3700 ACM-T (displayless version*) provides no front panel keypad. All information and measured data is extracted via its communications port. The 3700 ACM-T must also be programmed via its communications port. Refer to Appendix D for information on initiating communications and programming of the 3700 ACM-T.

All Operating Parameters and/or operations described in this section which deal specifically with the front panel buttons or display should be disregarded for the 3700 ACM-T. All other parameters apply to all 3700 ACM models.

3.1 POWER UP

After all installation wiring is complete and has been double checked, the unit may be powered up. The display version* of the 3700 ACM 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 3700 ACM this information is known as *field programming*.

*Refer to Appendix F for 3700 ACM model numbering and options information.

3.2 FRONT PANEL OPERATION

The 3700 ACM 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:

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

In Wye mode (VOLTS 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 (VOLTS 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 (VOLTS 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*.

b) **MIN and MAX 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 3.3.1b).

c) **FUNCTION button** selects which power function is displayed. The 3700 ACM 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}, KW hours, and KVAR hours.

3.3 FIELD PROGRAMMING

ENTERING PROGRAMMING MODE

Pressing the MIN and MAX buttons at the same time causes the 3700 ACM to enter the programming mode. When programming mode is first entered, 'POWER MEASUREMENT' will be

FIELD PROGRAMMABLE OPERATING PARAMETERS

PARAMETER	DESCRIPTION	RANGE
PASSWORD	Must be entered to change the setup parameters or clear any function.	4 digit number
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
	Note: In the parameter names below, ** indicates the currently selected setpoint number.	
SP** TYPE	Selects the type of parameter the selected setpoint is to monitor (ex. Over KW, Volts Unbalanced, etc.). Pushing the INCREMENT button displays the choices.	19 options See Figure 4.4.1
SP** HI LIMIT	Sets High Limit for the selected setpoint.	0 to 999,999
SP** LO LIMIT	Sets Low Limit for the selected setpoint.	0 to 999,999
SP** TD OPERATE	Time Delay to operate for the selected setpoint.	0 to 32,000 seconds
SP** TD RELEASE	Time delay to release for the selected setpoint.	0 to 32,000 seconds
SP** RELAY NUMBER	Selects which one of three on-board relays the selected setpoint controls. Selecting a value of 0 will cause the event to be logged without any relay operation. 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.	0 = log / no relay 1 to 3 = relay number
VOLTS SCALE	Sets full-scale AC input voltage. See Section 3.4.	0 to 999,999 Volts
AMPS SCALE	Sets full-scale AC input current (CT primary current rating). See Section 3.4.	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	

System Configuration	VOLTS SCALE
120/208 V direct connect	120
277/480 V direct connect	277
Systems which use PT's	PT primary rating

Figure 3.3.1a Field Programmable Operating Parameters I

FIELD PROGRAMMABLE OPERATING PARAMETERS

PARAMETER	DESCRIPTION	RANGE
UNIT ID	Sets 3700 ACM unit identification number. Note: The number 0 may not be used for an ID as it is reserved for other purposes.	1 to 9999
BAUD RATE	Baud Rate at which the 3700 ACM transmits and receives information.	300, 1200, 2400, 4800, 9600 Baud
COMMUNICATION MODE	Specifies RS-232C or RS-485 communications mode. See Section 6 for information on communications.	RS-232C, 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 sets 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.	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 Section 4 for setpoint operation.	ABC, ACB
I OUT KEY	Parameter code specifying with which measured value the current output will be proportional.	0 to 23 See Figure 3.7.1
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 3.3.1b Field Programmable Operating Parameters II

shown on the display. Once in this mode, the same action will cause the unit to return to display mode.

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 (ex. the MAX 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 3700 ACM 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 Section 3.5.

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 3700 ACM 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. Once all parameters have been set to their desired values, pressing the middle two buttons at the same time will cause the 3700 ACM to return to display mode.

Figure 3.3.1 provides a brief description of each parameter that may be programmed from the front panel. Detailed descriptions of operating parameters and their application are provided in the following Sections of this manual. Note that Setpoint Operation is described separately in Section 4, Demand is described in Section 5, and Communications are described in Section 6.

3.4 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.

3.5 SETTING THE VOLTS SCALE, AMPS SCALE, AND VOLTS MODE

The VOLTS and AMPS SCALES of the 3700 ACM must be set to correspond with the full scale levels which are being measured by the meter.

In a direct connect configuration, the VOLTS SCALE is normally set to 120 for a 120 VAC system and 277 for a 277 VAC system. If PTs are use for connection to higher voltage systems (using a 120 VAC model 3700 ACM), the VOLTS 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 VOLTS SCALE:

I OUT KEY PARAMETER VALUES

I OUT KEY	MEASURED PARAMETER	I OUT KEY	MEASURED PARAMETER
0	Voltage, Phase A (or Vab for Delta)	12	KVAR, Phase A
1	Voltage, Phase B (or Vca for Delta)	13	KVAR, Phase B
2	Voltage, Phase C (or Vbc for Delta)	14	KVAR, Phase C
3	Current, Phase A	15	Voltage, average
4	Current, Phase B	16	Current, average
5	Current, Phase C	17	KW, total
6	KW, Phase A	18	KVA, total
7	KW, Phase B	19	KVAR, total
8	KW, Phase C	20	Power Factor
9	KVA, Phase A	21	KW Demand
10	KVA, Phase B	22	AMP Demand
11	KVA, Phase C	23	Frequency
		24	V_{aux}

Figure 3.7.1 I OUT KEY Parameter Values

$$\text{VOLTS SCALE} = \frac{\text{PT Prim. Rating x 120 VAC}}{\text{PT Secnd. Rating}}$$

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, contact the PML factory.

The VOLTS MODE should be set according to the system connection configuration. Refer to Sections 2.6 to 2.8 and Figures 2.6.1 to 2.8.1 for more information.

3.6 V_{aux} AUXILIARY VOLTAGE INPUT OPERATION

The 3700 ACM 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.

3.7 I_{out} AUXILIARY CURRENT OUTPUT OPERATION

The 3700 ACM is 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 3.7.1 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.

3.8 CONTROL RELAY OPERATION

The 3700 ACM *control relays* option provides three control relays which may be used for a number of applications including activation of alarms or tripping of breakers for demand, power factor, or load control. Each relay can switch 40 to 130 VAC_{RMS} at 1 Amp maximum load current.

> **NOTE**
>
> The on/off action of the relays is dependant on the zero-crossings of the voltage being switched; therefore, only AC voltages may be used with the relays for proper operation.

The operation of each relay may be controlled directly by the user through remote commands via the communications port. This must be performed using an IBM PC running PML's POWERVIEW or MSCADA software.

The relays may also be operated from *setpoints* on selected measured parameters, controlled by user-definable conditions. Setpoint operation is described in detail in Section 4.

Section 2 provides wiring requirements for the control relays.

3.9 STATUS INPUT OPERATION

The 3700 ACM *status input* option 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 21 VAC or VDC, it will be sensed as active.

The status of these inputs can only be viewed using PML's POWERVIEW or MSCADA software running on an IBM PC connected to the 3700 ACM communications port. These programs will also log the status of each input over time.

3700 ACM units which have firmware Revision 1.2 or greater installed can also use Status Input #4 (S4) to provide KW Demand Synchronization. Refer to Section 5 for more information.

Section 2 provides wiring diagrams illustrating various connection methods for the status inputs.

4. SETPOINT OPERATION

> **NOTE**
>
> Programming of setpoints for the 3700 ACM-T (displayless version) must be performed via its communications port. Refer to Appendix D for information on initiating communications and programming of the 3700 ACM-T.

4.1 INTRODUCTION

The 3700 ACM is capable of monitoring many parameters (at the same time) and generating alarms and controlling relays based on these parameter's values. The 3700 ACM uses *setpoints* to do this. A setpoint is a group of six parameters that tell the unit:

a) which parameter to monitor (setpoint type),

b) at what value to operate a relay (limit),

c) at what value to release a relay (limit),

d) how long to wait before operating a relay (time delay to operate in seconds),

e) how long to wait before releasing a relay (time delay to release in seconds),

f) which relay to operate (relay number), if any.

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.

4.2 *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 'time 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 doesn't 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 time delay to release (refer to Figure 4.2.1). This change in status is also logged (along with the time and parameter value).

4.3 *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 'time delay operate' parameter (refer to Figure 4.3.1). The under setpoint becomes inactive when the parameter goes over the high limit for a number of seconds greater to the 'time delay release' parameter. Except for these differences the under and over setpoints are treated identically.

4.4 APPLICATIONS

The 3700ACM currently supports 17 different setpoints simultaneously. These are numbered from 1 to 17. All the setpoints are accessible from the front panel. Figure 4.4.1 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. KVAR Pulse Output Relay (relay 2)

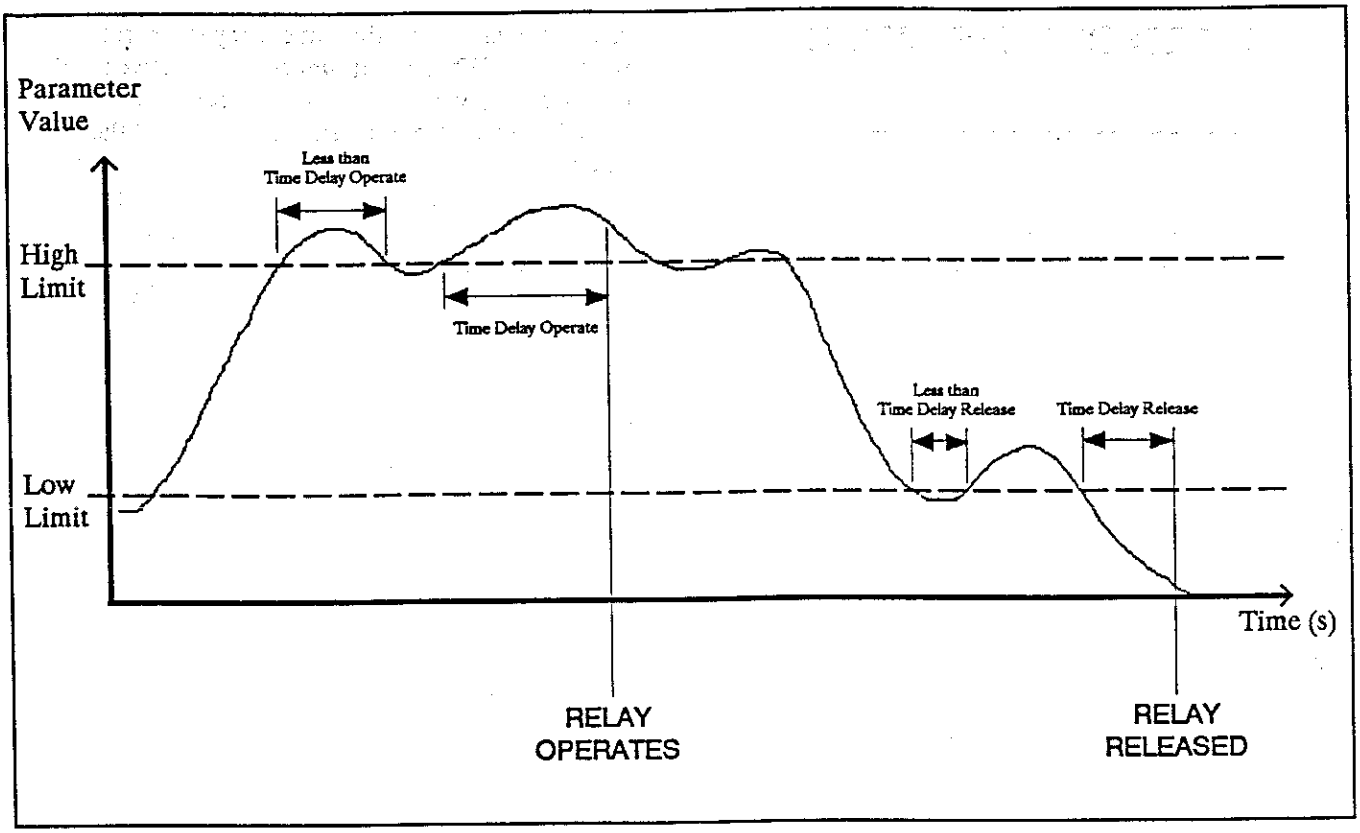


Figure 4.2.1 Over Setpoint Operation

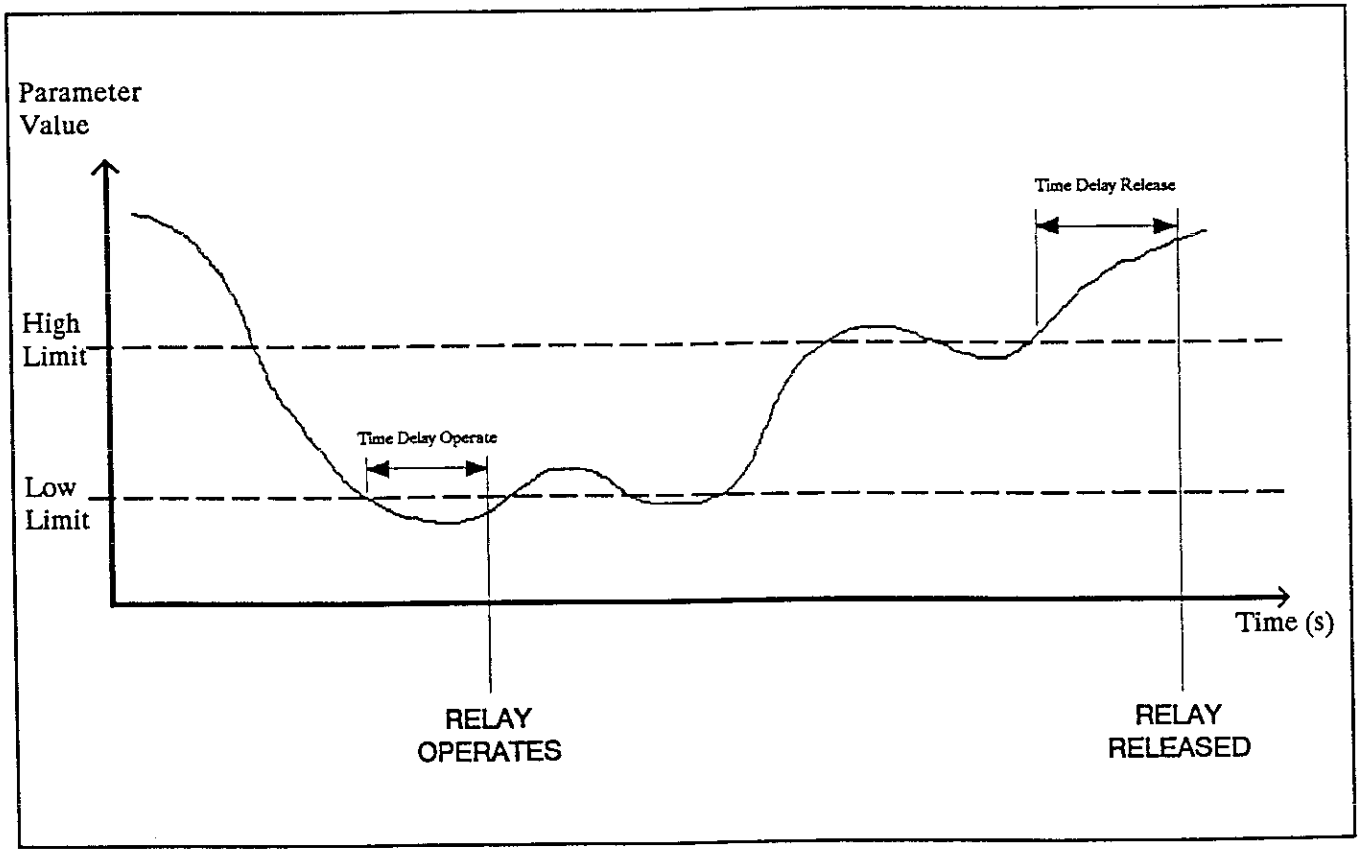


Figure 4.3.1 Under Setpoint Operation

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.
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.

Figure 4.4.1 Setpoint Types

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 KVARHour and KWHour pulsing, so care must be taken that relays are not used in a conflicting fashion.

CAUTION

The response time of the relays is 1 to 2 seconds and up to 5 seconds after initial meter power up. The 3700 ACM should not be used for protection functions which require faster operation.

4.5 PROGRAMMING SETPOINTS

Setpoints may be programmed by entering the 3700 ACM program mode, entering the correct password, then entering a non-zero number for the SETPOINT NUMBER parameter. The user may then step through and enter new values for all parameters associated with the selected setpoint.

CAUTION

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 3700 ACM will then assess the status of each setpoint and perform any required operations.

SETPOINT PARAMETER FORM

SETPOINT	FUNCTION	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	Not Used					
9	Not Used					
10	Over KWD	1200	10	900	10	3 Demand control
11						
12						
13						
14						
15						

Figure 4.5.1 Setpoint Parameter Form Example

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 3700 ACM. A copy of this information should be kept with the meter. Appendix B provides a blank Setpoint Parameter Form for this purpose. The following is an example of using a Setpoint Parameter Form to plan setpoint usage.

EXAMPLE

Relay 1 is used as a trip 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 Setpoint Form for this configuration appears in Figure 3.5.3. The form contains all information required to program the 3700 ACM to perform the operations described above.

4.6 FORCED RELAY OPERATE/RELEASE

The relays can be forced operated or forced released by commands sent via the communications port using an IBM PC running PML's POWERVIEW or MSCADA software. Forced operate/release commands override all programmed setpoint control functions.

4.7 POWER OUTAGES

When the power feed to the 3700 ACM is interrupted, even momentarily, the output relays will release. When power is restored, the 3700 ACM 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.

5. DEMAND

5.1 INDUSTRY DEMAND MEASUREMENT METHODS

Power utilities generally bill commercial customers based on both their energy consumption (in KWHR) 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 sub periods. 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.

5.2 3700 ACM INTERNALLY-TIMED DEMAND MEASUREMENT

The 3700 ACM 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 5.1.1.

5.3 3700 ACM DEMAND SYNCHRONIZATION

3700 ACM units which have firmware Revision 1.2 (or greater) installed provide the following additional feature. When the DEMAND PERIOD parameter is set to zero, the *Demand Sync Mode* is selected and the 3700 ACM 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	3700 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 1 With the fixed interval method, the 3700 ACM reading and the utility reading will not 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 3700 ACM demand readings will then always be as high or slightly higher than the utility readings.

Figure 5.1.1 Demand Calculation Chart

6. COMMUNICATIONS

6.1 DESCRIPTION

The 3700 ACM is available in models equipped with a communication port, allowing data transfer between the 3700 ACM unit and a host computer. The host could be an IBM-PC/XT or PC/AT (or compatible) running PML's POWERVIEW software, or an IBM-PC/AT or 386 running PML's M-SCADA software. This PC based software allows a user to remotely monitor and control either a single 3700 ACM unit, or a number of 3700 ACM units connected together through a common communications network.

Before communication with the host computer is possible, the user must program the communication parameters of the 3700 ACM. This may be performed via the front panel of the unit. The UNIT I.D. for each 3700 ACM must be set to a unique value (see description of RS-485 communication below). The BAUD RATE of the 3700 ACM must be set to correspond with the baud rate selected for the computer. The COMM. MODE (communication mode) of the 3700 ACM must be set to the type of communication port the unit has been configured with. 3700 ACM communication modes are described below.

RS-232C COMMUNICATION

The 3700 ACM communication port can be optionally configured as RS-485 or RS-232C. RS-232C communication is used for direct connection between the host computer and a single 3700 ACM (distance less than 50 feet), or for connection to a single unit using modems via the telephone network. Refer to Section 2 for connection diagrams.

RS-485 COMMUNICATION

RS-485 communication can be used to concurrently connect up to thirty-two 3700 ACM units to one host computer, each given a unique UNIT I.D. In this way, each 3700 ACM unit may be monitored and controlled from one location by a single computer.

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

[CAUTION]

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

POWERVIEW AND MSCADA

A host computer running PML's POWERVIEW or M-SCADA software may communicate with one or more 3700 ACM units. These programs will display all measured data normally provided through the front panel display of each 3700 ACM meter.

The user may also remotely program any set-up parameter(s) of a selected meter.

[WARNINGS]

1. The user must ensure that the COMM. MODE parameter of any selected 3700 ACM is not altered using POWERVIEW or M-SCADA. Changing the COMM. MODE of the 3700 ACM will cause that meter to cease communicating. Reinitiation of communication with that meter is then only possible through resetting the meter to the proper communication mode from its front panel.

2. When using a modem interface between the host computer and any 3700 ACM(s), the user must ensure that POWERVIEW or M-SCADA are not used to set the BAUD RATE parameter of any selected 3710 ACM outside the working range of the modem. Doing so will cause that meter to cease communicating.

... continued (see over)

WARNINGS (cont.)

Re-establishment of communication with that meter is then only possible through performing the following two steps:

a) Reset the 3700 ACM from its front panel to a BAUD RATE which is within the working range of the modem.

b) Set POWERVIEW or M-SCADA to communicate at the BAUD RATE the meter has been set to communicate at.

Beyond the functions described above, POWERVIEW and M-SCADA both provide the user with access to extended features of the 3700 ACM not available from the meter's front panel. These include:

a) EVENT Log. The contents of the 3700 ACM EVENT Log can be displayed on the computer screen. The EVENT Log contains activity information about the meter, including setpoint alarm activity, relay activity, status input activity, and activity that has changed the meter's set-up parameters.

b) SNAPSHOT Log. The contents of the 3700 ACM SNAPSHOT Log can be displayed on the computer screen. The SNAPSHOT Log contains voltage, current, and power values which are recorded at user-defined time intervals.

c) MIN/MAX Log. The contents of the 3700 ACM MIN/MAX Log can be displayed on the computer screen. The MIN/MAX Log records the extreme values for voltages, currents, and power.

d) STATUS Information. The computer can display the status of the three 3700 ACM relays, the four status inputs, and all active setpoints.

e) RELAY Control. The relays of a selected meter can be forced operated or released by the user directly from the computer.

A detailed description of 3700 ACM communication and control through the use of POWERVIEW or M-SCADA is presented in the POWERVIEW and M-SCADA Instruction Manuals.

7. TROUBLESHOOTING

7.1 DESCRIPTION

A number of problems can cause the 3700 ACM not to function properly. This section lists a number of symptoms, and explains how to correct them.

1. If the unit 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) turn the power off for 10 seconds.

2. If the voltage or current readings are incorrect:

   a) check that the voltage 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 CT's and PT's being used.

   e) make the following voltage tests:

      i) V1, V2, V3 to GND should be 120 VAC.

      ii) G to switchgear earth ground should be less than 1 VAC.

      iii) L to GND should be 120 VAC (or DC).

      iv) N to GND should be less than 2 VAC.

      v) All current inputs should be less than 1 VAC with respect to GND.

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 that the baud rate of the PC host is the same as that of the 3700 ACM.

   b) if modems are not being used, a null modem or null modem cable must be used between the 3700 ACM and the PC host.

   c) power the 3700 ACM and the PC host down, and then try again.

   d) the number of data bits should be 8, with one stop bit and no parity.

8. WARRANTY AND REGISTRATION

8.1 WARRANTY

Power Measurement Ltd. warrants its products to be free from manufacturing defects for one year from the date of shipment from the factory. The manufacturer will repair or replace defective equipment F.O.B. point of manufacture for up to one year provided the equipment has been installed, wired, programmed, and operated in accordance with the manufacturer's instruction manual included with each unit, and the applicable sections of the Electrical Code.

The warranty does not include liability for any effects caused by 3700 ACM failure.

[IMPORTANT]

The owner must contact Power Measurement Ltd. to aquire a Return Merchandise Authorization (RMA) number prior to shipment of any unit back to the manufacturer for repair or replacement. The RMA number issued must be clearly marked on the outside of the shipping carton.

Units received without prior authorization will not be accepted under any circumstances.

A functional description of unit defect or failure and electrical/environmental conditions at the time of failure should be included with the unit. Inclusion of this information will significantly reduce repair time (and cost, if warranty has expired).

8.2 REGISTRATION

Please complete and mail the enclosed Warranty Registration Form immediately. This will allow us to add you to our mailing list, to keep you up to date on the latest 3700 ACM, POWERVIEW, and MSCADA software releases, and new feature offerings.

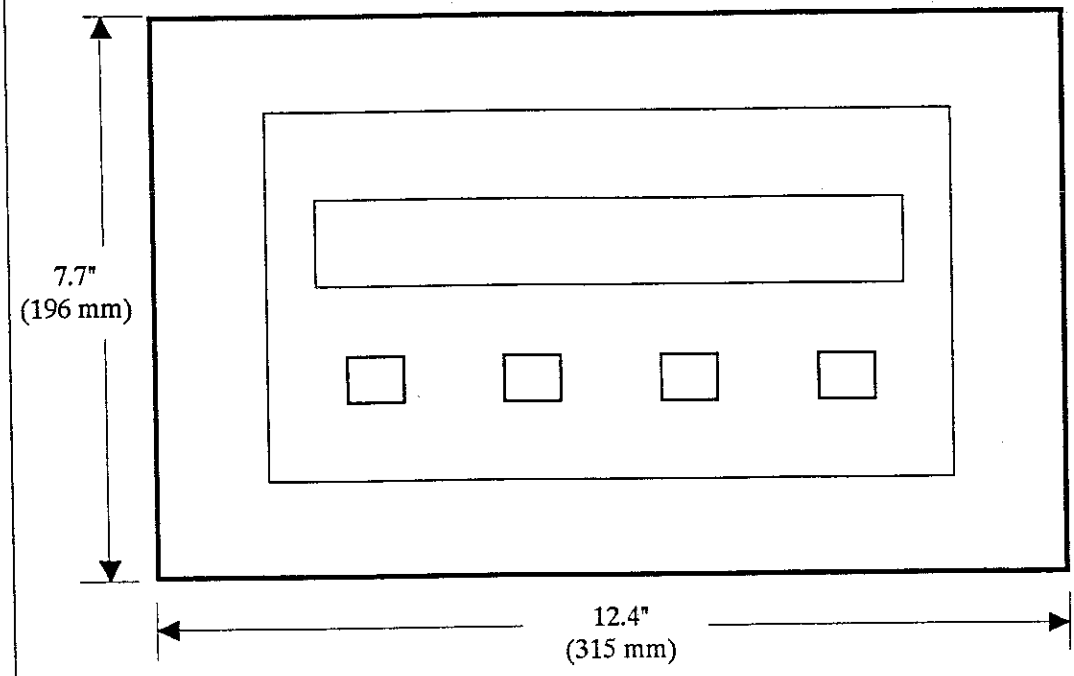
Your comments and suggestions for product improvement and feature additions are welcome.

APPENDIX A

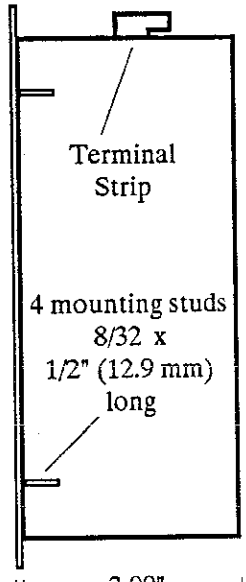
3700 ACM MECHANICAL DIMENSIONS

See Page A-2 for 3700 ACM-T dimensions

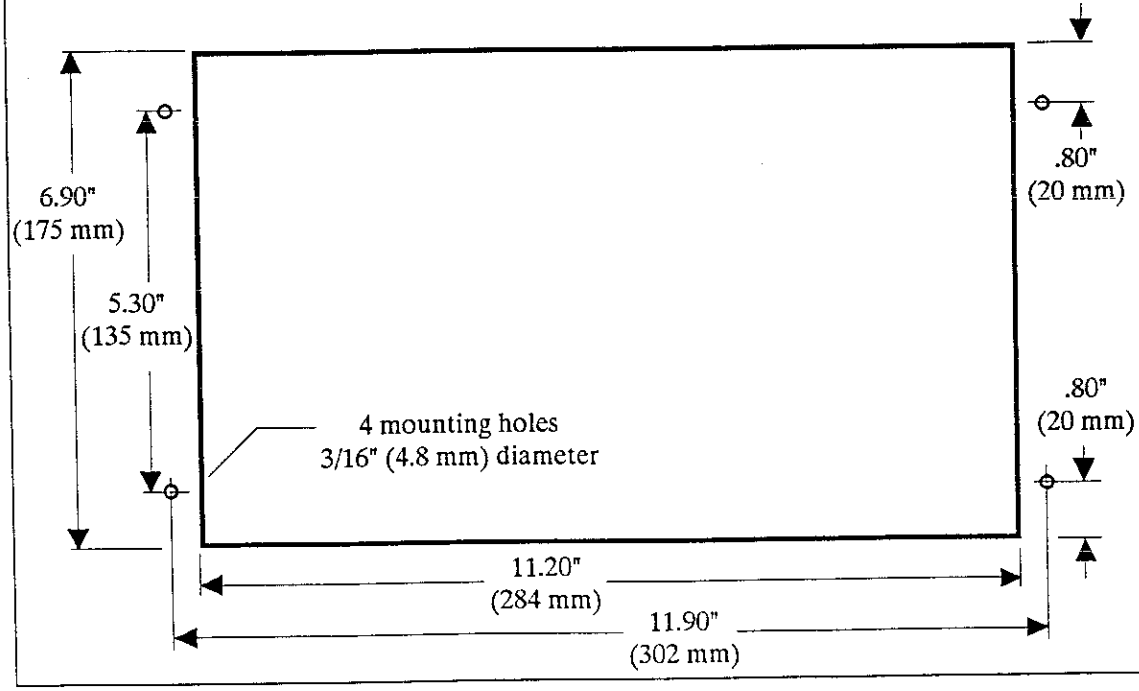
FRONT PANEL



RIGHT SIDE



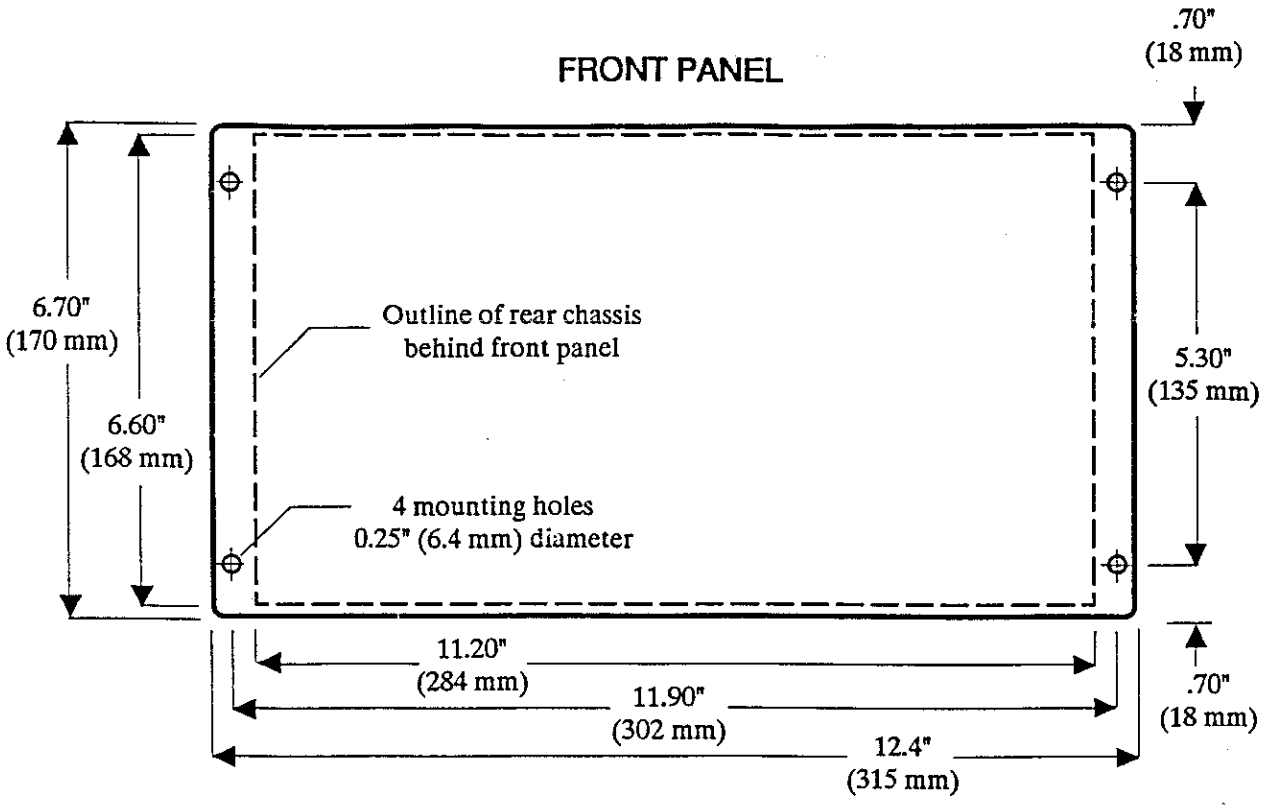
PANEL CUTOUT

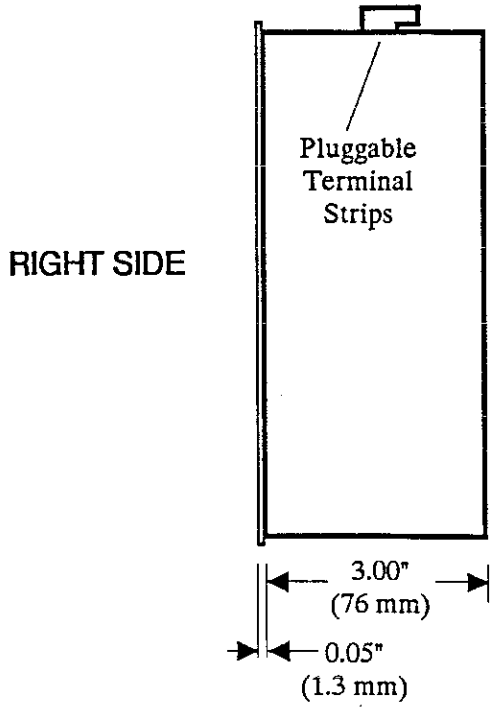


APPENDIX A

3700 ACM-T MECHANICAL DIMENSIONS

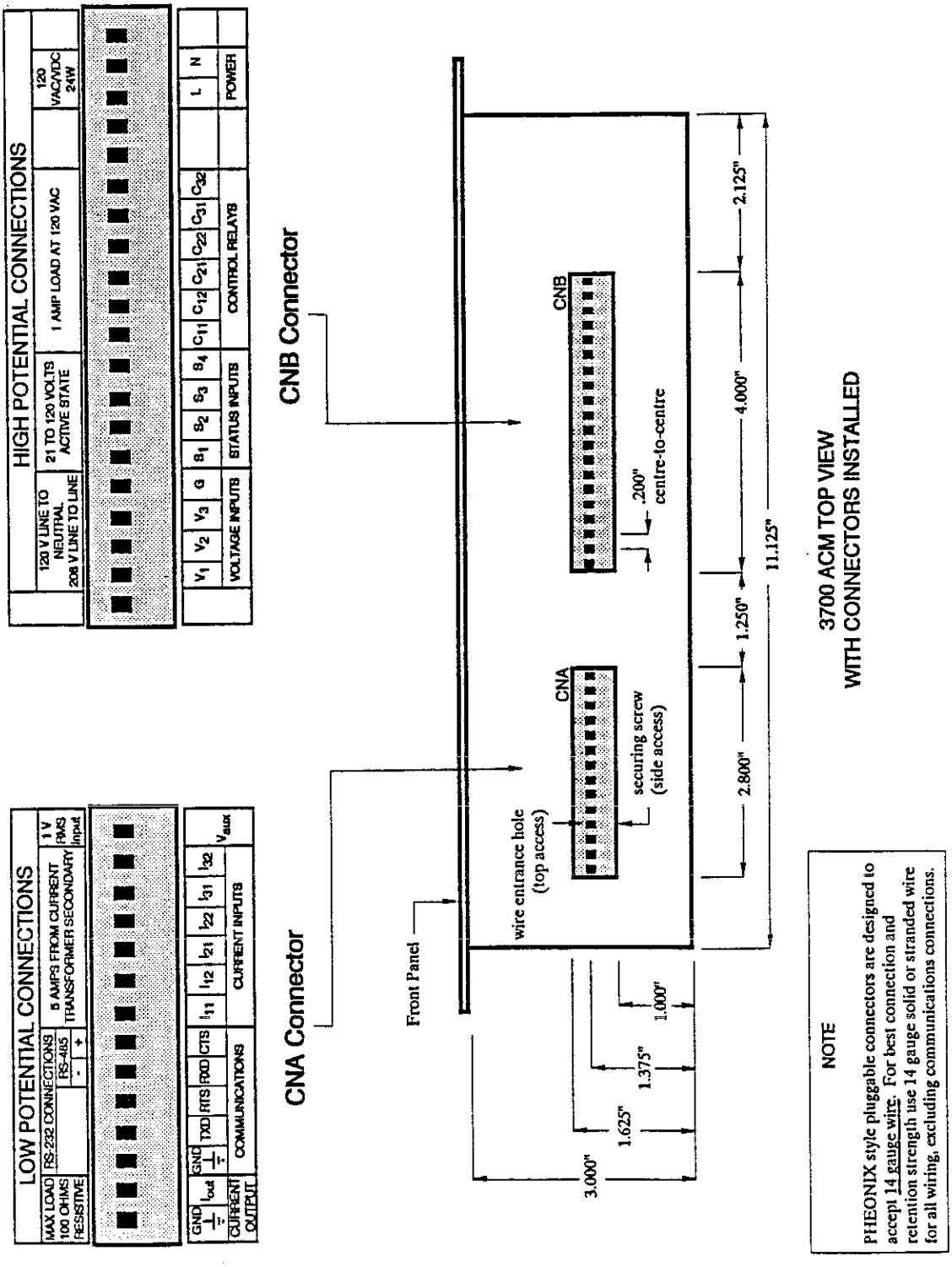
See Page A-1 for 3700 ACM dimensions





APPENDIX A

3700 ACM TERMINAL BLOCK DIMENSIONS



APPENDIX B

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						

APPENDIX C

3700 ACM SOFTWARE VERSIONS

This following table lists each software version release for the 3700 ACM and the new features or performance enhancements added with each release.

The version number is identified by a sticker on the rear cover of the 3700 ACM. If your 3700 ACM 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.

Either contact will need to know the serial number of the 3700 ACM and the software version number indicated on the rear cover label. Most upgrades to the 3700 ACM will require a simple replacement of the EPROM (integrated circuit "chip") inside the unit which contains the operating software. Complete instructions for this procedure are provided with the replacement EPROM.

VERSION	RELEASE DATE	DESCRIPTION
V1.0	October 1988	Initial release.
V1.1	December 1988	Adds communication support for POWERVIEW 1.1
V1.2	July 1989	1. Adds Single Phase Three Wire voltage mode (VOLTS MODE = 2). Note: POWERVIEW Version 2.0 or greater must be used to properly display Single Phase voltage mode data from the 3700 ACM. 2. Adds KW Demand Synchronization feature using Status Input #4.

APPENDIX D

3700 ACM-T OPERATION

INTRODUCTION

The -T version of the 3700 ACM provides all the functions of the 3700 ACM, except that it has no front panel display or keypad. All front panel display and keypad functions described in this manual should be disregarded for the 3700 ACM-T.

COMMUNICATIONS

All information and measured data is extracted from the 3700 ACM-T via its communications port.

All 3700 ACM-T setup parameters are also accessed via the meter's communications port. This port is configured at the factory to operate via either the RS-232C or RS-485 standard.

NOTE

Be certain not to connect RS-232C configured devices to RS-485 configured devices as this will cause damage to the meters or other devices.

The data collected by the 3700 ACM-T meter can be displayed on an IBM-PC/XT/AT or compatible computer running PML's POWERVIEW or M-SCADA software. These PC based software packages allow the user to remotely configure, monitor or control one or more power meters.

The 3700 ACM-T is shipped with its UNIT I.D. and BAUD RATE factory set as follows:

a) UNIT I.D. The UNIT I.D. of the 3700 ACM-T 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 02147 will be preset to UNIT I.D. of 2147.

b) BAUD RATE. The BAUD RATE of the 3700 ACM-T is set at the factory to 9600 baud.

PROGRAMMING

Once communication has been established using the factory defaults, 3700 ACM operating parameters may be changed through use of the utilities provided by the communications program. At this time the user may set the unit number to any other desired value, as well as resetting the baud rate.

APPENDIX E

TECHNICAL SPECIFICATIONS

PARAMETER	ACCURACY	RESOLUTION	RANGE
Volts	0.25 %	0.1 %	0 - 1,000,000 (1)
Amps	0.25 %	0.1 %	0 - 9,999
KVA	0.5 %	0.1 %	0 - 1,000,000 (2)
KW	0.5 %	0.1 %	0 - 1,000,000 (2)
KVAR	0.5 %	0.1 %	0 - 1,000,000 (2)
PF	1.0 %	1.0 %	1.0 to +/- 0.6
FREQUENCY	0.2 Hz	0.1 Hz	40 to 70 Hz
KW DEMAND	0.5 %	0.1 %	0 - 1,000,000
AMPS DEMAND	0.25 %	0.1 %	0 - 9,999
KWHR	0.5 %	1 KWHR	0 - 1,000,000,000
KVARHR	0.5 %	1 KVARHR	0 - 1,000,000,000
V_{aux} (1 VAC scale)	0.25 %	0.1 %	0 - 1,000,000

NOTES

(1) Reads in KV for voltages over 10,000
(2) Reads in MVA, MW, MVAR for readings over 10,000

INPUT RATINGS

Voltage Inputs: (V1, V2, V3)	120 VAC nominal full scale input version Overload withstand: 300 VAC continuous, 1000 VAC for 1 minute, 2500 VAC for 50 mSec Input impedance: 1 Megohm 277 VAC nominal full scale input version (see Option -2 below) Overload withstand: 300 VAC continuous, 1000 VAC for 1 minute, 2500 VAC for 50 mSec Input impedance: 1 Megohm
Aux. Voltage Input: (V_{aux})	1.0 VAC/VDC nominal full scale input (1.25 VAC /VDC max.) Overload withstand: 50 V continuous, 120 V for 1 second, 1000 V for 1 mSec Input impedance: 120 VAC version - 10.0 Kohm 277 VAC version (-2) - 4.64 Kohm
Current Inputs: (I11, I12, I21, I22, I31, I32)	5.000 Amps AC nominal full scale input Overload withstand: 7 Amps continuous, 50 Amps for 1 second Input impedance: 0.05 ohm, Burden: 1.25 VA
Status Inputs: (S1, S2, S3, S4)	>21 VAC/VDC = active, <9 VAC/VDC = inactive Input impedance: 1 Megohm Overload withstand: 300 V continuous, 1000 V for 1 minute, 2500 V for 50 mSec
Control Relays: (C1, C2, C3)	Solid state optically coupled outputs 40 to 130 VAC / 1 Amp maximum load current / 250 V_{PEAK} maximum transient voltage Note: Input must be AC voltage for correct operation
Power Supply:	85 to 130 VAC/ 0.2 Amps/ 50 to 70 Hz or 90 to 170 VDC / 0.2 Amps
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 C37.90A surge withstand test.

LR 57329-4

E95810

APPENDIX F

ORDERING INFORMATION

CURRENT MODEL NUMBERING (Effective April 1989)

Model	RS-232C Comm. Port	Relays	Status Inputs	Logs	Aux. Output	Aux. Input	120 V Inputs	Display	Trade Price
3700ACM	X	X	X	X	X	X	X	X	$2250
3700ACM-T	X	X	X	X	X	X	X	O	$1950
3700ACM-D	O	O	O	O	X	X	X	X	$1400

X = Included O = Not Included

OPTIONS:			
	-L	RS-485 (LAN) instead of RS-232C	No charge
	-C	Internal RS-232C to RS-485 Convertor	$235
	-2	277 Volt inputs instead of 120 Volt	No charge
	-E	Expanded Memory	$250
	-R	19 inch Rack Mount	$102

NOTE
Desired options must be specified when ordering.

ORDERING EXAMPLE:

3700ACM-T-L-2-E
Model — Options

MODEL NUMBERING PRIOR TO APRIL 1989

3700ACM-X-X-X-X

- A: RS-485 communications port, B: RS-232C communications port, 0: No communications port.
- 0: Standard Memory - 10 snapshots, 25 events. 1: Expanded Memory - 100 snapshots, 50 events
- A: Standard 120 Volt input, B: 277 Volt input for 277/480 systems
- 0: Basic Meter: includes display and front panel controls, but no communications port, no control relays, no status inputs, no logs, 1: Full Feature Unit: includes display, front panel controls, communications port, control relays, 4 status inputs, and logs, 2: Super Transducer: no display or front panel controls, but includes communications port, control relays, 4 status inputs, and logs.

MODEL NUMBERING CROSS REFERENCE (Examples)

MODEL NUMBER PRIOR TO APRIL 1989	NEW MODEL NUMBER
3700ACM-1-A-O-B	3700ACM
3700ACM-2-A-0-B	3700ACM-T
3700ACM-0-A-0-0	3700ACM-D
3700ACM-1-A-0-A	3700ACM-L
3700ACM-1-B-0-B	3700ACM-2
3700ACM-1-A-1-B	3700ACM-E
3700ACM-2-B-1-A	3700ACM-T-2-E-L