



AP30

Phase Identification System For the Power Industry

User's Guide



Product Division of EDM International, Inc.



EDM International, Inc.

4001 Automation Way
Fort Collins, CO 80525 USA
Tel: (970) 204-4001
Fax: (970) 204-4007
info@edmlink.com
www.edmlink.com

Technical Support

(800) 687-4196
support@edmlink.com

PhaseTrakker™ is a trademark of EDM International, Inc. in the United States and other countries. Other product names mentioned herein may be the trademarks of their respective owners.

PhaseTrakker AP30 is made in the U.S.A. and protected by U.S. Patent # 6,642,700.

Copyright © 2010-2022 by EDM International, Inc.

All rights reserved. No part of the contents of this guide may be reproduced or transmitted in any form or by any means without the written permission of EDM International, Inc.

Version November 2022

CONTENTS

Cautions and Warnings.....	1
System Overview.....	2
Common Applications	2
What's in the Box	3
Quick Start.....	4
Installing the Reference Unit	5
<i>Placing the Reference Unit</i>	5
<i>Naming the Reference Unit (Optional)</i>	6
Setting Up the Field Unit	7
<i>Entering Network Address for Each Reference Unit</i>	7
<i>Selecting the Time Zone.....</i>	9
<i>Setting Phase Preferences (Optional)</i>	10
Setting Phase Sequence	11
Setting Phase Labels.....	12
Setting Phase Angles	13
<i>Changing Backlight Power Save Setting (Optional)</i>	14
Operating the Hotstick Unit	15
Power On.....	15
High Voltage.....	16
Low Voltage	17
Optimizing Hotstick Signal Reception	17
Operating the AP30 LowVolt Sensor (Accessory)	19
Operating the AP30 Non-Contact Sensor (Accessory)	20
Calibrating the Field Unit.....	22
<i>Deciding When to Calibrate Again.....</i>	24
Using the Field Unit	25
Power-Up.....	25
Identifying Phases.....	26
"No Match" Readings	28
Adjusting for Phase Shift.....	29
Unreferenced Readings.....	30
Viewing Records	32
Field Unit Sounds	33
Using a Secondary Reference Unit.....	34
Charging the Field Unit Battery.....	35
Atomic Field Unit	36
Phase Measurement Tips.....	37
<i>Handling "No Match" Readings</i>	37
<i>Single-Phase Transformers</i>	38

<i>Three-Phase Transformer Banks</i>	39
<i>Three-Phase Transformers, Delta-Wye</i>	40
Regional Reference Units	41
PhaseTrakker Utility	42
<i>Installing the PhaseTrakker Utility</i>	42
<i>Using the Utility with Reference Unit</i>	43
Checking Reference Unit Status	43
Verifying the Reference Unit Network Address	43
Configuring the Reference Unit	43
<i>Using the Utility with Field Unit</i>	44
Retrieving Records from the Field Unit	45
Clearing Records on the Field Unit	46
Setting the Field Unit Configuration	46
Saving Field Unit Configuration to a File	51
Loading a Saved Field Unit Configuration	52
Troubleshooting	53
<i>Reference Unit</i>	53
<i>Field Unit</i>	53
<i>PhaseTrakker Utility</i>	54
Compatibility with AP10 and AP20	55
AP30 Phasing Conventions	57
<i>ABC Sequence</i>	57
<i>ACB Sequence</i>	58
<i>Phase Angles</i>	58
Specifications	59
<i>System</i>	59
<i>Reference Unit</i>	59
<i>Field Unit</i>	59
<i>Hotstick Unit</i>	59
<i>LowVolt Sensor (Optional Accessory, Alternate Hotstick Unit)</i>	60
<i>Non-Contact Sensor (Optional Accessory, Alternate Hotstick Unit)</i>	60
Accessories and Related Products	61
<i>Accessories</i>	61
<i>Related Product</i>	62
<i>How to Order</i>	62
Warranty and Service	63
<i>Limited Warranty</i>	63
<i>Service and Support</i>	63
<i>Service Contracts</i>	63



Cautions and Warnings

NOTICE

Before operating the AP30 system, thoroughly read, understand, and follow this manual. Save this manual – do not delete or destroy.

CAUTION

The equipment covered in this manual should be used and serviced only by competent personnel familiar with and following good work and safety practices. This equipment is for use by such personnel, and the manual is not intended as a substitute for adequate training and experience in safe procedures for this type of equipment.

These instructions neither cover all the details or situations in equipment use, nor do they provide for every possible contingency to be encountered in relation to installation, operation, or maintenance. Should additional information and details be desired, or if situations arise that are not covered adequately for the user's purpose, the specifics should be referred to EDM International, Inc.

WARNING

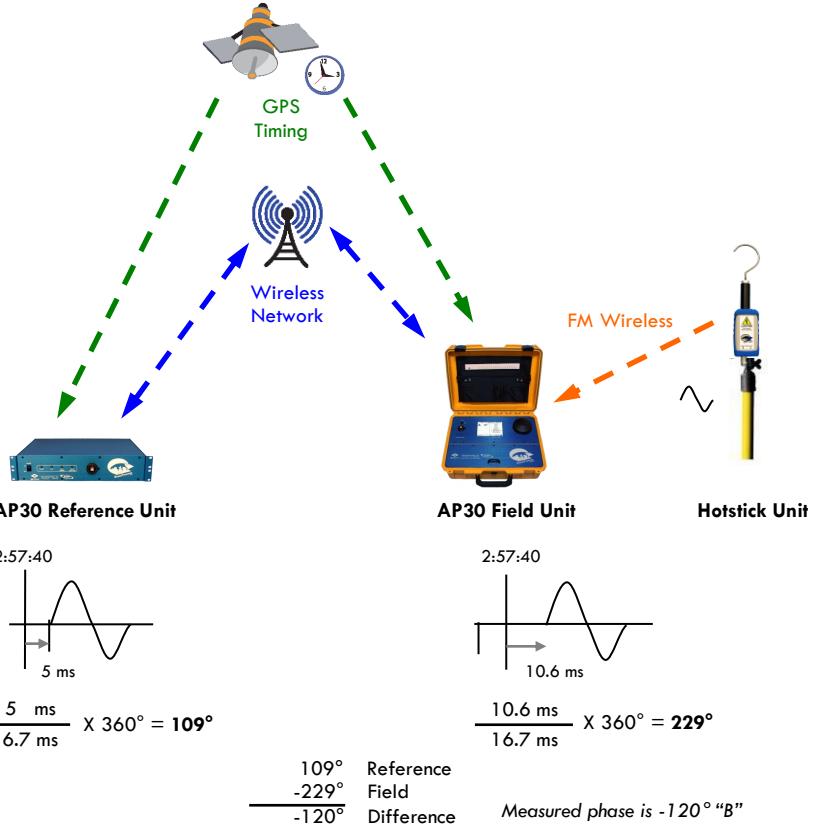
On voltages above 300 V, the AP30 Hotstick Unit must be used in conjunction with an approved insulated stick. Failure to do so could result in injury or death.

During use at voltages above 300 V, the entire Hotstick Unit should be considered energized. Do not let the Hotstick Unit or universal fitting touch any grounded contact point. For 15 kV and below, maintain minimum 3" clearance between the Hotstick Unit and ground. Above 15 kV maintain a minimum of 5" clearance. A ground contact will damage the Hotstick Unit and could cause injury.



System Overview

The PhaseTrakker™ AP30 consists of three components that communicate with each other.



Common Applications

- Phase tagging
- Data logging for system mapping
- Phasing when energizing new construction
- Phasing at switches and interconnects
- Phasing at protective relays, revenue meters, and transformers
- Optimizing load balances



What's in the Box

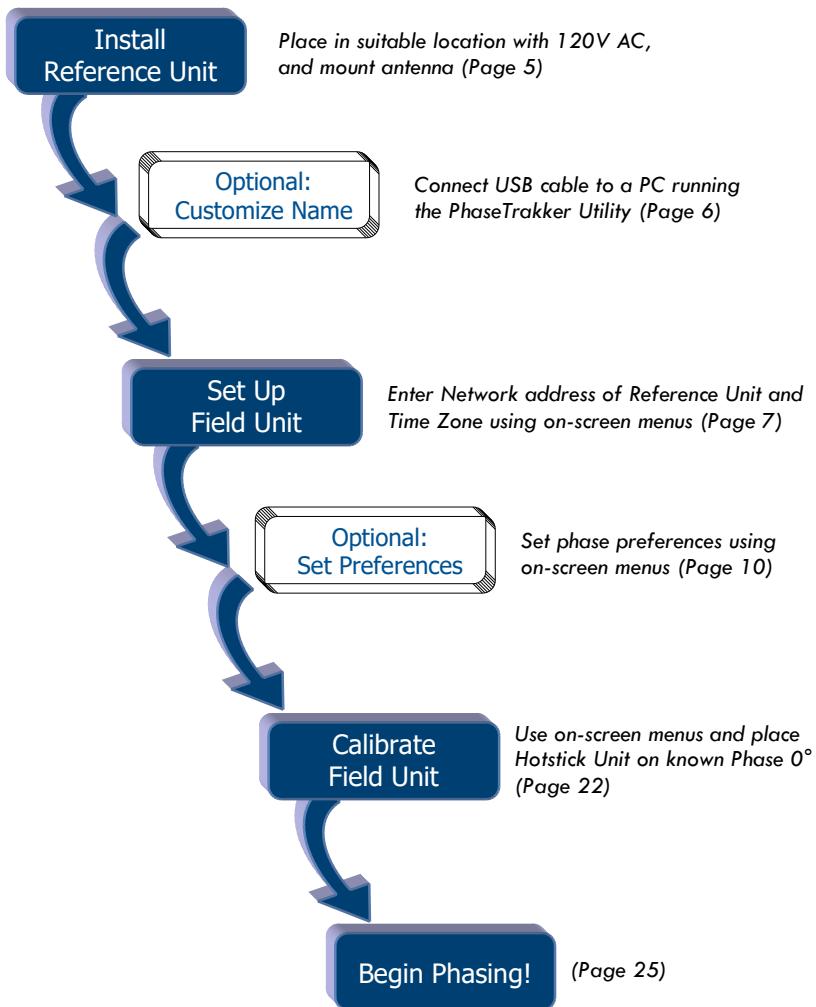
You should have received the following items with your AP30 system:

 <p>Field Unit</p>	 <p>User's Guide</p>  <p>AC Adapter</p>  <p>Auto Adapter</p>  <p>USB Cable</p>  <p>Utility Software</p>  <p>1 Year Network Service</p>
 <p>Hotstick Unit (located in Field Unit storage compartment)</p>	 <p>Hooks</p>  <p>Probe Tip</p>  <p>Test Lead</p>  <p>Spare Batteries</p>
 <p>LowVolt Sensor (optional accessory)</p>	<p>Handheld alternative to Hotstick Unit to phase voltages between 0.5 V and 300 V.</p>
 <p>Non-Contact Sensor (optional accessory)</p>	<p>Handheld alternative to Hotstick Unit when contact with energized source is not practical.</p>
 <p>Reference Unit Rack Mount or Portable Case</p>	 <p>User's Guide</p>  <p>AC Power Cord</p>  <p>USB Cable</p>  <p>GPS/Cell Antenna</p>  <p>50' Antenna Cable</p>  <p>Utility Software</p>  <p>1 Year Network Service</p>



Quick Start

When you receive your AP30 system, the wireless network devices are already provisioned and ready to use.





Installing the Reference Unit

Installing the Reference Unit is easy:
Choose a suitable location and optionally
configure it with a custom name.



Placing the Reference Unit

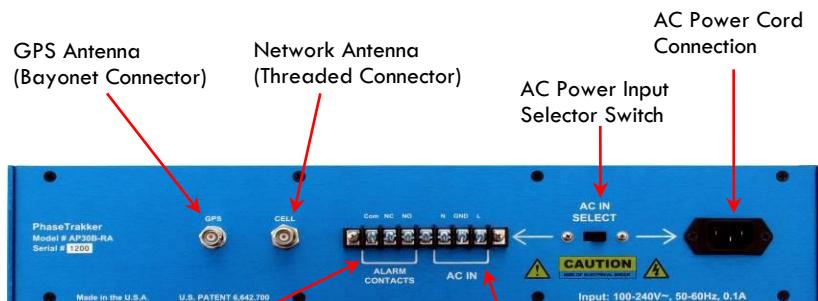
There are some important considerations in placing the AP30 Reference Unit.

- **120 V AC single-phase power source**
 - **Direct power** - must be powered from the grid with no UPS or battery backup
 - **Permanent power** - if the reference phase is changed, all field units must be recalibrated
 - **Clean power** – excessive harmonics on the reference voltage inhibit phasing operations
- **Roof mount for GPS/cellular antenna** - access to run cables and mounting place for antenna with clear view of sky
- **Cellular Service** - good network signal is required for reliable Reference Unit operation (the Network LED will blink if the signal is weak)

Some examples of suitable locations to place the Reference Unit are:

- Substation
- Work Center or Communications Center
- Office

AC power can be supplied to the rack mount Reference Unit either by using the supplied power cord or by wiring directly to terminals on the back panel (shown below) and setting the AC IN SELECT switch accordingly. The Alarm switch is triggered if the unit loses either GPS or Network signals.



Alarm (switch)
COM - Common
NC - Normally Closed
NO - Normally Open

Alternate AC Power Connection
N – Neutral
GND – Ground
L – Line

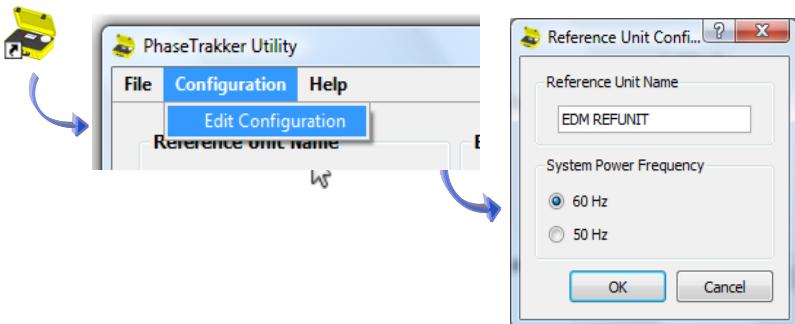


The portable Reference Unit (below) receives AC power supplied through the AC power cord only, and does not provide an Alarm switch.



Naming the Reference Unit (Optional)

By default, the Reference Unit is set with system frequency of 60 Hz and the name “RUnnnnnnnnnnn”, where nnnnnnnnnnn is the SIM number of unit’s wireless networking device. The PhaseTrakker Utility is needed only to change the Reference Unit system frequency (50 or 60 Hz) or enter a customized name (alphanumeric, up to 16 characters).





Setting Up the Field Unit

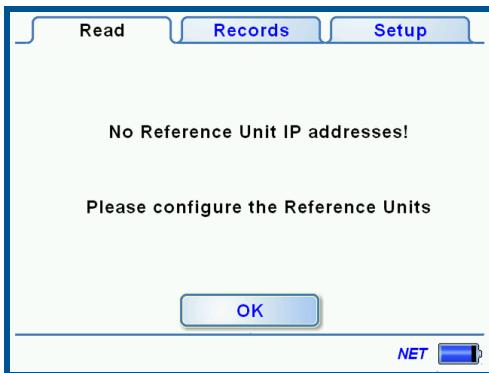
The AP30 Field Unit requires some initial set-up:

1. Enter network address of each Reference Unit
2. Select time zone
3. Set phase preferences (optional)
4. Calibrate using known Phase A (0°)

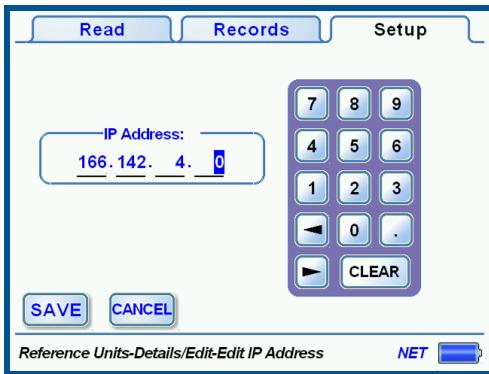


Entering Network Address for Each Reference Unit

On power-up, the Field Unit acquires a GPS fix, registers on the network and attempts to connect to the configured Reference Units. If there are no Reference Units configured, the Read tab displays the following screen:



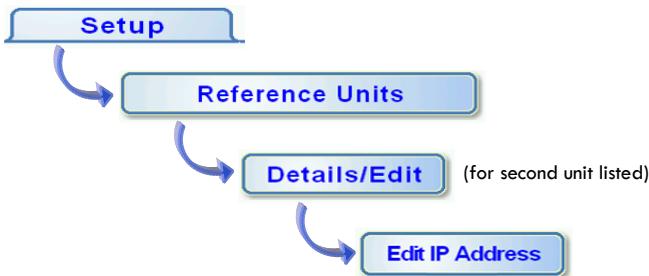
Enter the Network Address of the Primary Reference Unit.



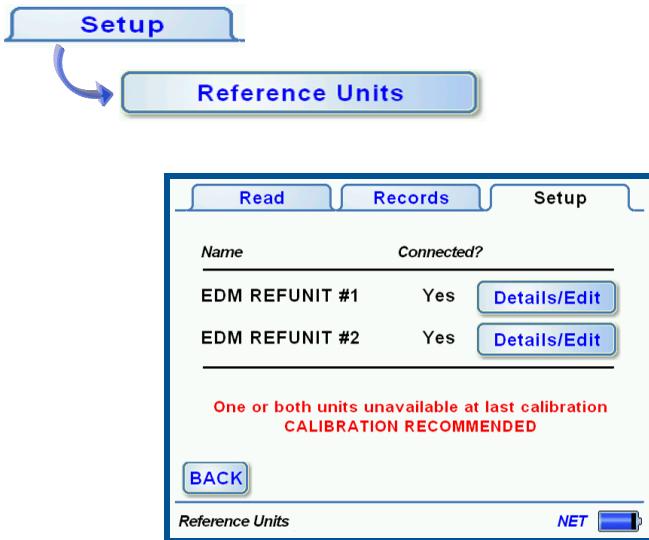
To verify the Network Address of the Reference Unit, connect a PC to the Reference Unit and start the PhaseTrakker Utility software.



If a Secondary Reference Unit (backup) is to be configured, navigate to enter the Network Address as follows:



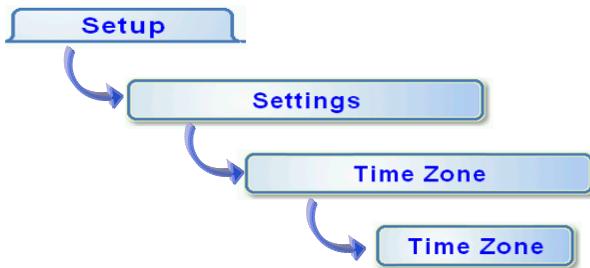
You can check the status of the configured Reference Units by navigating to the Reference Unit summary screen as shown:



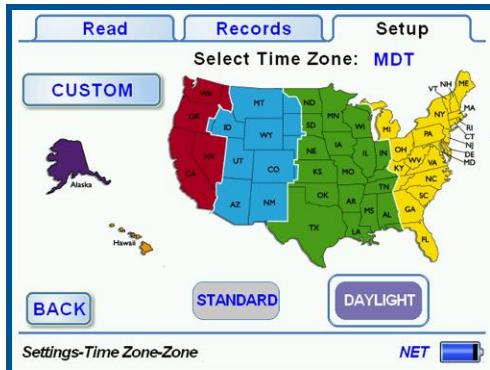


Selecting the Time Zone

The Field Unit Time Zone can be set by navigating the menu as follows:



Touch the area of the map corresponding to your time zone and select standard or daylight savings time. Touch the CUSTOM button to set a different time zone.





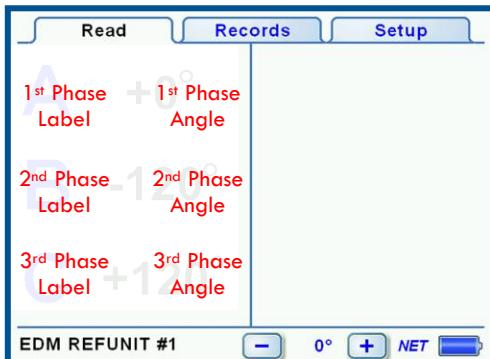
Setting Phase Preferences (Optional)

Before Phase Preferences are selected, it is helpful to understand the AP30 Field Unit display. Three-phase power consists of a set of three AC power sources whose cycles arrive in a fixed sequence at any given point in time. The Field Unit Phase Preferences menus refer to these sources as 1st Phase, 2nd Phase, and 3rd Phase, according to arrival time. A variety of conventions are in use to describe these phases with labels and angles. The AP30 Field Unit Read screen displays custom phase labels and phase angles according to the selected Phase Preferences. The Field Unit displays any characters for phase labels, in the order that reflects the time sequence. *The order these are shown on the display is always in time sequence: The top position is the 1st Phase in the sequence, the middle position is the 2nd Phase, and the bottom position is the 3rd Phase.*

Top position is always
1st Phase in time sequence
(1 beep)

Middle position is always
2nd Phase in time sequence
(2 beeps)*

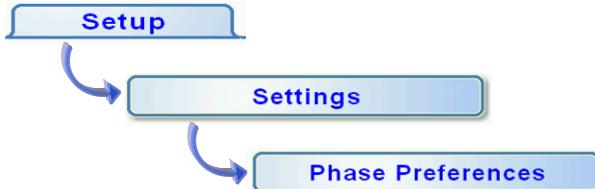
Bottom position is always
3rd Phase in time sequence
(3 beeps)*



* 2nd and 3rd Phase beeps are switched when Sequence is set to ACB for AP20 compatibility

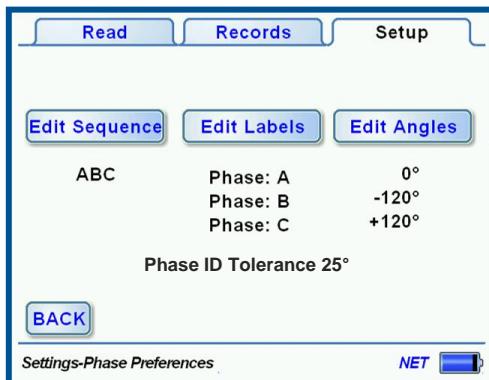
The vertical ordering in the choices displayed in the Phase Preferences menus reflects the order that will be displayed on the Read screen.

The preferences for phase identification are specified in the Setup menu. The AP30 allows phase sequence, labels and angles to be customized using the Phase Preferences menus.



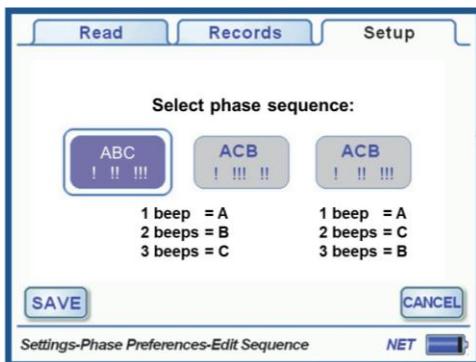


The Phase Preferences menu displays the current settings with buttons to edit changes. The Phase ID Tolerance is changed using the PhaseTrakker Utility.



Setting Phase Sequence

The Edit Sequence menu allows a convenient way to exchange the labels assigned to the 2nd and 3rd Phases. The Angles assigned to these phases remain unchanged. The default labels A B C are shown in this example, but the menu will display the actual phase labels configured.



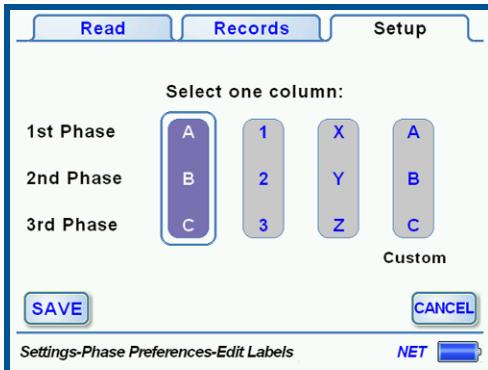
When "ACB" is selected, the AP30 Field Unit displays A in the first position, C in the middle, and B in the last position, reflecting their order in phase timing. Field Unit sounding for each choice is indicated by exclamation points ("!"). For "ABC" sequence, the Field Unit always sounds 1 beep for A, 2 beeps for B, and 3 beeps for C. For "ACB" sequence, there are two choices: 2nd and 3rd Phases can be sounded in either in label order or in timing order.

Changing the phase sequence does not affect records already stored in the Field Unit.

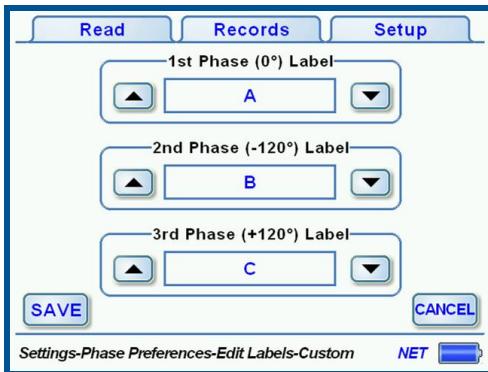


Setting Phase Labels

The Phase Settings menu also allows the user to customize the labels displayed for phases. Any single letter or numeral can be selected to label a phase. The phases are listed from top to bottom in time sequence order: 1st, 2nd, and 3rd. The vertical order in the choices displayed reflects the order that will be displayed on the Read screen.



Some of the labels commonly used are listed as button choices, and a Custom button allows other labels to be specified. The Custom label menu also displays the currently configured phase angles.



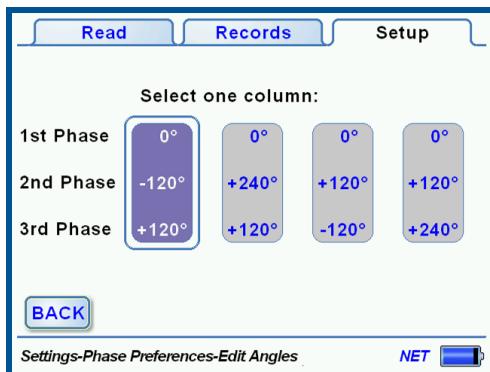
To simply exchange the labels assigned to the 2nd and 3rd Phases, the Edit Sequence menu can be used instead of using the Custom label menu.

A change of labels assigned to phases does not affect records already stored in the Field Unit.



Setting Phase Angles

The phase angles displayed can be represented by different values that can be selected by the user. The 1st Phase is always 0°, while the 2nd and 3rd Phases can be assigned different angle values according to desired preference. The phases are listed from top to bottom in time sequence order: 1st, 2nd, and 3rd. The vertical order in the choices displayed reflects the order that will be displayed on the Read screen.

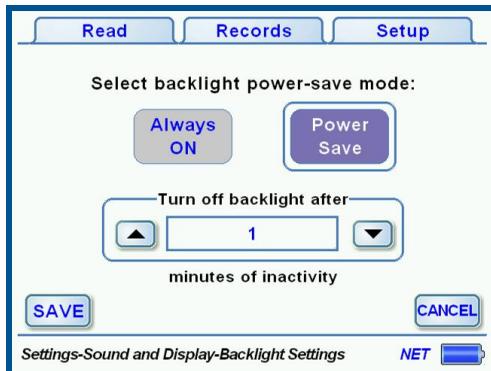
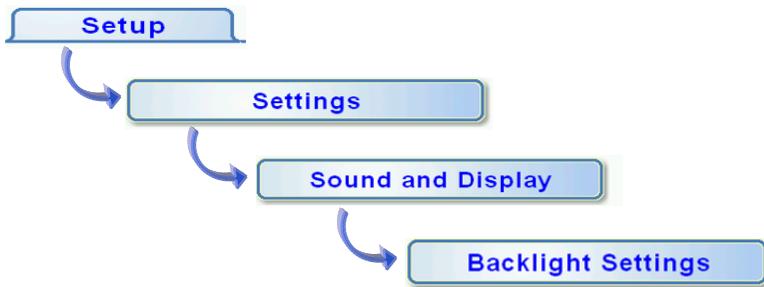


The Phase Angles choice can be changed at any time. A change to the Phase Angles preference automatically applies to all the stored records on the Field Unit.



Changing Backlight Power Save Setting (Optional)

The preferences for phase identification can be specified in the Setup menu. The AP30 allows phase sequence, labels and angles to be customized.





Operating the Hotstick Unit

Power On

Hold in the TEST/ON switch for about one second to turn on the unit. The unit remains on standby (flashing STATUS light) for one minute before automatically turning off to conserve the battery. Therefore, the Hotstick Unit must be placed on an energized source within one minute of being turned on. When energized, the STATUS light is on steady and the unit is transmitting to the Field Unit.



The Status LED signals the Hotstick Unit status:

- **Off** – Hotstick Unit is OFF and waiting for AC voltage
- **Flashing** – Hotstick Unit is ON and waiting for AC voltage
- **On steady** – Hotstick Unit is transmitting signal to the Field Unit
- **Fast blinks then off** – Low battery

Select a measurement point as far as possible from other energized lines. Proximity to E-fields from nearby energized sources can cause interference on the Hotstick Unit sensor and skew phase angle measurements.

For best transmission of the Hotstick Unit signal to the Field Unit, orient the Hotstick Unit so the face plate is aimed at the Field Unit (as indicated by the arrows on the Hotstick Unit label).

FCC Notice: FCC ID: 2A9GX-AP30HS

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The Hotstick Unit operates on a 9 V battery. To replace the battery, remove the Hotstick Unit sensor from the rubber boot and remove the battery compartment cover on the back of the unit.



High Voltage

Between 4 kV and 100 kV, activate the Auto-On feature as follows: Hold the hook or probe so it barely touches the energized source and tap it a few times. You may hear a slight buzzing between the hook and the wire. The green light should come on after a few seconds.

When used at voltages above 100 kV, the Hotstick Unit Hook or Probe should not touch the energized part. The TEST/ON switch must be used to turn the unit on. For best results, position the Hotstick Unit Hook or Probe as follows:

Phase-to-Phase Voltage

Distance from energized part

- Below 100 kV-----Touching
- 100 kV to 230 kV -----About 2 feet
- 230 kV to 345 kV -----About 4 feet
- 345 kV-----About 15 feet
- 500 kV-----About 25 feet

• A probe tip attachment is provided for use in URD cabinets and other situations where the Hook attachment is inconvenient.



For load break elbows, a third-party URD bushing well adapter or bushing probe with standard 1/4" stud can be attached to the Hotstick Unit.



Low Voltage

The Hotstick Unit sensor can be removed from the rubber boot and used at voltages between 50 V and 300 V. The LowVolt Sensor accessory is available for phasing below 50 V (see next section).



Sources between 50 V to 300 V are phased with the supplied Test Lead. The Test Lead snaps onto a stud on the back of the sensor. The Test Lead *must not be used above 300 V*. The TEST/ON switch must be used to turn the Hotstick Unit on.

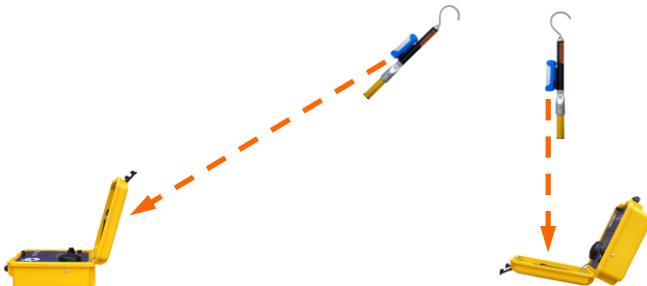


For best results when using the Hotstick Unit sensor with the test lead, hold your hand flat or place the sensor on a level surface. Using the Hotstick Unit on low voltages may not be possible when high voltage E-fields are near.

Optimizing Hotstick Signal Reception

Operation of the PhaseTrakker system relies on a 914 MHz FM wireless signal from the Hotstick Unit to the Field Unit. The quality of this performance depends on transmission and reception. Solid green lights on both the Hotstick Unit and the Field Unit indicate good communication.

- **Unit Orientation.** The Field Unit's RF antenna for the Hotstick Unit signal is in the Field Unit lid. The antenna gets the best reception from signals coming in a direction perpendicular to the lid (from the front or back). Reception is poorest for signals coming into the edges of the lid (from either side or from directly above).
 - Position the Hotstick Unit so that the faceplate (with the status light) is pointing toward the Field Unit. The FM signal is transmitted from this window.
 - Position the field unit so that the lid is perpendicular to the direction of the hotstick unit.



When the Hotstick Unit is directly above the Field Unit, try tilting the Field Unit so that the open lid is lying flat and facing up toward the Hotstick Unit. This will make the antenna in the lid perpendicular to the Hotstick Unit signal and will give the best reception.

- **Battery.** Use a fresh, industrial grade 9V battery in the Hotstick Unit for best results.
- **Clutter.**
 - **Cables, reflective labels, or metal items stored in the lid pocket organizer interfere with signal reception.** Remove such items from the lid organizer.
 - Structures and people can block the Hotstick signal. If possible, orient the units for a clean line of sight between them.
 - Adjacent metal buildings, piles of metal, etc. can cause reflections of the Hotstick Unit signal which confuse the Field Unit. Move phasing work to a more open area.
- **Phase Spacing.** Closely spaced phases can cause interfering E-fields. The Hotstick Unit will not be able to get a clear reading on the selected phase. Move Hotstick Unit to location with wider phase spacing.
- **Ground Grids.** The ground grid beneath a substation can interfere with Hotstick Unit signal reception at the Field Unit. Lift the Field Unit at least a foot above the ground to alleviate this. This can also improve the cell network signal.
- **Line Noise** (rarely been encountered). If there is significant noise on the AC voltage waveform, the Field Unit will reject the signal coming from the Hotstick Unit. Noise can be caused by remote metering system (e.g. TWACS or TURTLE). Harmonics can be generated by unusual loads on the feeder. Move phasing work to another location.



Operating the AP30 LowVolt Sensor (Accessory)

The handheld AP30 LowVolt Sensor is used in place of the AP30 Hotstick Unit for low voltage phasing, from 0.5 V to 300 V.



The supplied red and black test leads plug into corresponding ports on the unit. Because the leads connect directly to the sensor, measurement is not affected by nearby E-fields. Connect the red probe to Line and black probe to Neutral. The LowVolt hotstick sensor can be used to identify phase and phase angle at recloser control terminals as low as 0.5 V.



The AP30-LowVolt Sensor operates on a 9V battery. To replace the battery, remove the battery compartment cover on the back of the unit.



Note: The AP30 LowVolt Sensor is sold separately. For information on ordering, visit www.edmlink.com or contact EDM at info@edmlink.com or 970-204-4001.



Operating the AP30 Non-Contact Sensor (Accessory)

The handheld AP30 Non-Contact Sensor (AP30-NCS) is used in place of the AP30 Hotstick Unit when physical contact with the energized source is less convenient or not practical. The sensor is not operable in substations because of the multiple strong E-fields present. New AP30 Field Units can be ordered to include the Non-Contact Sensor, and it can also be purchased separately.



A power switch on the front is used to turn on the unit. A momentary press turns the unit on. A long press turns the unit off. The AP30-NCS turns off automatically 2 minutes after AC voltage is no longer present.

The Status LED signals the Non-Contact Sensor status:

- **Off** – Non-Contact Sensor is OFF
- **Flashing** – Non-Contact Sensor is ON, waiting to sense AC voltage
- **On steady** – Non-Contact Sensor is transmitting signal to the Field Unit
- **Fast blinks then off** – Low battery

Select a measurement point as far as possible from other energized lines. Proximity to E-fields from nearby energized sources can cause interference on the AP30-NCS and skew phase angle measurements.



Voltage

- 120 V ----- ½ inch
- 480 V ----- 3 inches
- 8 kV ----- 30 feet
- 138 kV----- 50 feet

Maximum Sensing Distance

Important Note on Calibration: For best accuracy, Field Unit Calibration should be performed using the standard AP30 Hotstick Unit, not the Non-Contact Sensor. Calibrate to Phase A on local distribution network.

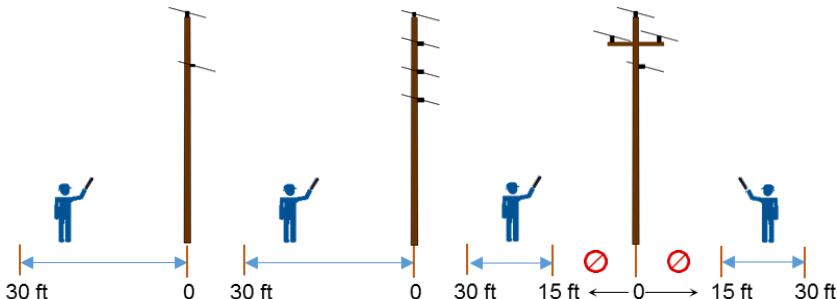


The AP30-NCS may not be able to distinguish phases on distribution underbuild or double circuit configurations.

For best transmission of the AP30-NCS signal to the Field Unit, orient the NCS so the face plate is aimed at the Field Unit (as indicated by the arrows on the front label). Turn the Field Unit so that the opened lid is perpendicular to the direction of signals from the AP30-NCS.



Take measurements at the proper distance. Stay within 30 feet for single phase and vertical configurations. Stay between 15 feet and 30 feet for horizontal configurations. For horizontal configurations, measure both sides to verify.



Adjacent phases may cause a shift in the measured phase angle. For more information on using the AP30-NCS on three-phase configurations, refer to the PhaseTrakker AP30-NCS Application Note.



The AP30-NCS can be used on single phase, self-contained meters. Make sure the NCS touches the case to ensure the most accuracy. Hold the NCS still and wait for the Field Unit to report at least three readings (storing a record). Use the Field Unit Phase Shift setting. In most cases, only Phase Shifts of 0° or 180° are needed.

The AP30-NCS operates on a 9V battery. To replace the battery, remove the battery compartment cover on the back of the unit.



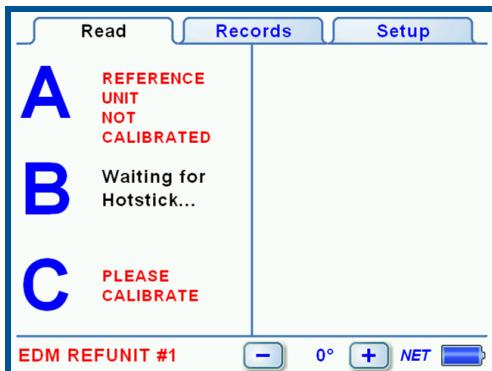
Note: The AP30 Non-Contact Sensor is sold separately.
For information on ordering, visit www.edmlink.com or contact EDM at info@edmlink.com or 970-204-4001.



Calibrating the Field Unit

Before taking phase measurements, the Field Unit must be calibrated to the configured Reference Unit(s). The Field Unit keeps a Reference Offset for each configured Reference Unit. This value is the degree offset between the angle of the reference phase and a known 0° phase measured by the Field Unit. Calibration to the configured Reference Units is performed in one step. The Field Unit must be in a location allowing it to acquire a GPS fix and receive network service.

After GPS and network registration are established, the Field Unit will connect to the configured Reference Units. If the Field Unit has not been calibrated to the Reference Unit, the following screen will be displayed:



To perform calibration, navigate to the calibration screen as follows:



Important Note on Calibration: For best measurement accuracy, Field Unit Calibration should be performed using the AP30 Hotstick Unit, not the Non-Contact Sensor (optional accessory).



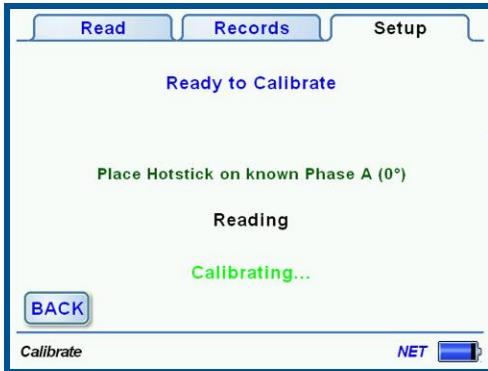
The Calibration screen prompts you to place the Hotstick Unit on a known phase A (0°). Good hotstick signal reception from a source with no interference from adjacent phases will give the most accurate calibration. When the Hotstick Unit is in position and the Field Unit displays a steady Hotstick light, press OK.

Important: If the Hotstick light on the Field Unit is unsteady (blinking or flickering), inaccurate calibration may result. Reposition the Field Unit and Hotstick Unit to obtain a steady Hotstick light.



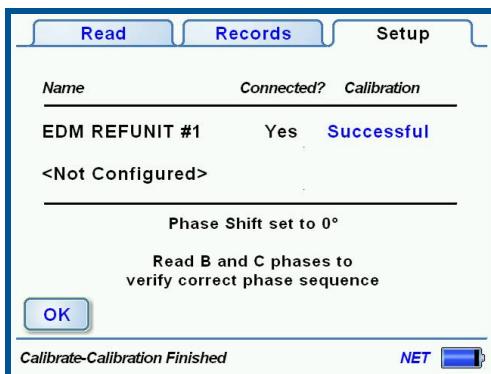
Note: Once OK is pressed, calibration will proceed on any electric fields sensed. If OK is pressed before the Hotstick Unit is in position, move the Hotstick Unit quickly into place from a direction that minimizes interference from adjacent phases.

Calibration to the configured Reference Unit(s) is automatically performed using the first stable measurement. The parameters for a stable measurement (default 3 consecutive readings within 5°) can be changed using the PhaseTrakker Utility.





When Calibration is complete, a summary screen is displayed. The Calibration operation always sets the current Phase Shift setting to 0°. The Calibration operation will fail if a Reference Unit is offline or there are network communication problems. An unsuccessful Calibration should be repeated in an area with good network communication with the Reference Unit(s) online.



If this is the first Calibration performed on the Field Unit on this system, confirm the Phase Sequence setting by reading known phases B and C. If these are reversed, use the Phase Settings menu to change the Phase Sequence setting and select the desired Phase Angle setting.

Deciding When to Calibrate Again

Calibration is easy and can be quickly performed whenever a known 0° phase is available. Calibration is recommended in the following circumstances:

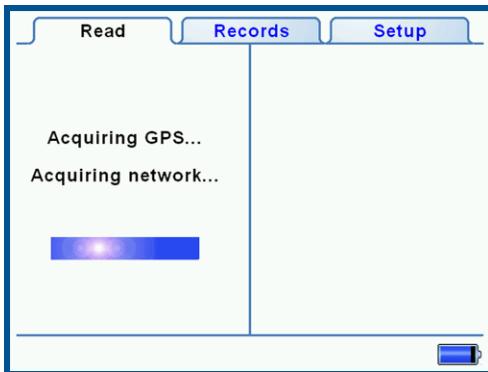
- A different Hotstick Unit is being used with the Field Unit.
- The Field Unit has moved more than 200 miles since the last time Calibration was performed.
- One of the configured Reference Units was not available at the last Calibration. Calibrate again when the Reference Unit is back online.
- A Reference Unit has been moved or is being powered by a different reference phase.
- The difference in phase timings measured at two locations a long distance apart can drift with changes in power flow on the grid. To minimize the error caused by this drift, regular Calibration is recommended for Field Units using Reference Units more than 200 miles away.



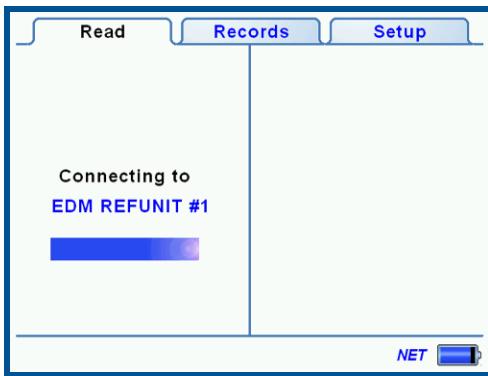
Using the Field Unit

Power-Up

On each power-up, the AP30 acquires GPS signals and network connection. The status LEDs below the screen light up as these steps are completed.



The AP30 connects with the Primary Reference Unit. If the Primary Reference Unit is not available, it automatically tries to connect with the Secondary Reference Unit. The entire power-up process takes about 95 seconds to complete, and most of this time is necessary for acquisition of the network.

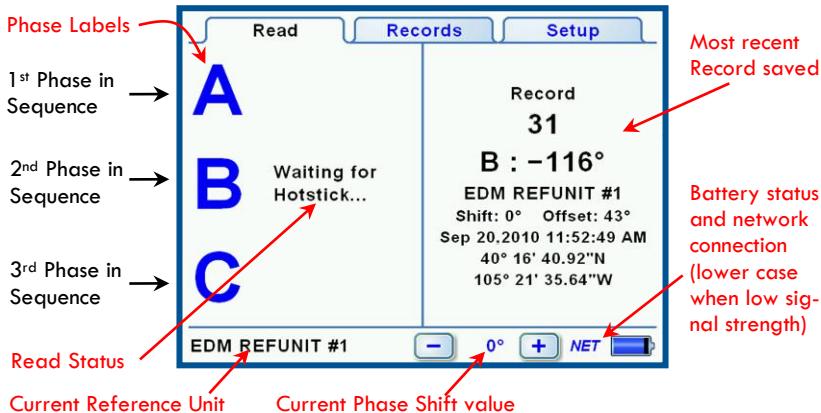


Tip: The AP30 can be left powered on between work locations to remain on the network and minimize the time required to resume phase identification at the next location.



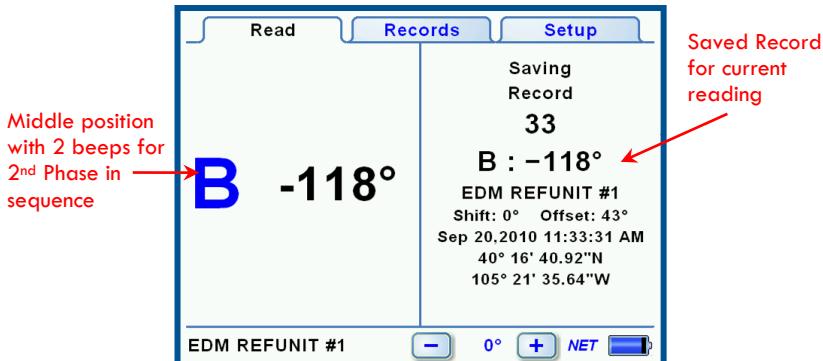
Identifying Phases

The Read tab allows readings to be taken. On the left are displayed the phase labels according to selected Phase Preferences. The phase labels are always displayed in order of time sequence with the label for 0° first. The right half of the screen shows the most recent record in the list.



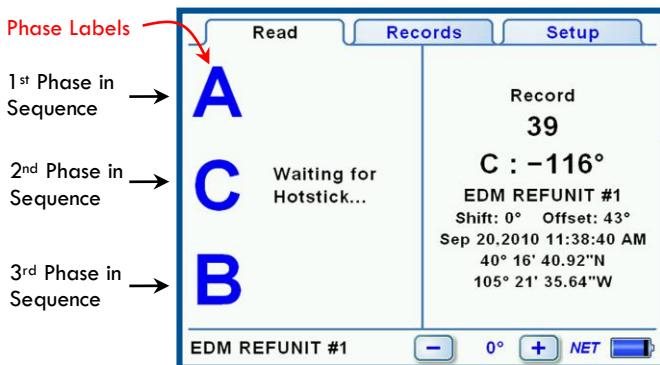
When a signal is received from the Hotstick Unit, the timing information is compared with the Reference Unit and a phase angle is calculated. If the phase angle is within the configured Degree Tolerance (default 25°) of a configured Phase Angle, the phase is identified on the display. After a stable measurement is obtained (default is 3 consecutive readings within 5°), a new Record is saved. The degree tolerance and parameters for determining a stable reading can be changed using the PhaseTrakker Utility.

When a phase is identified, the measured phase angle is displayed next to the label of the phase identified and an audible signal is given: Top position with 1 beep for the 1st Phase in time sequence, middle position with 2 beeps for the 2nd Phase, and bottom position with 3 beeps for 3rd Phase.





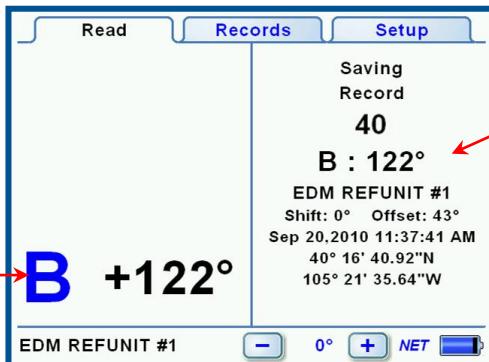
When the Field Unit is configured for **ACB Phase Sequence**, the order of the phase labels is automatically changed on the display. The positions and audible signals, however, continue to reflect the time sequence order of the phases. If the Sequence is set to ACB for AP20, the 2nd and 3rd Phase beeps are switched for the convenience of users accustomed to the previous model.



Angles for 1st,
2nd, and 3rd
Phases remain
as set in the
Phase Angles
menu

Phase Labels displayed are automatically reordered to reflect ACB sequence

The phase identifications for ACB Phase Sequence are the same. The measured phase angle is displayed next to the label of the phase identified and an audible signal is given: Top position with 1 beep for the 1st Phase in time sequence, middle position with 2 beeps for the 2nd Phase, and bottom position with 3 beeps for 3rd Phase.

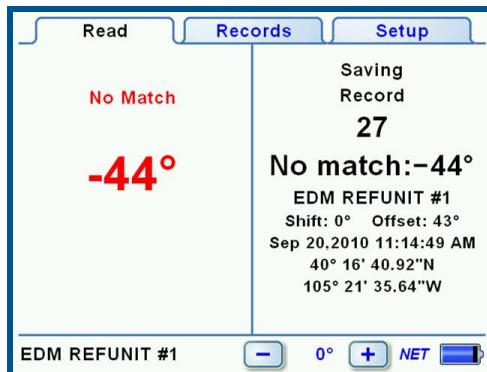


* 2nd and 3rd Phase beeps are switched when Sequence is set to ACB for AP20 compatibility



“No Match” Readings

For each phase measurement, the Field Unit compares the measured angle to the three configured phase angles and attempts to assign a phase label. A configured Degree Tolerance is used to determine whether a measurement can be assigned to a phase angle. The Field Unit reports a “No Match” reading when the difference between the measured phase angle and the nearest phase angle exceeds the configured Degree Tolerance. The default Degree Tolerance is 25° and can be changed using the PhaseTrakker Utility.



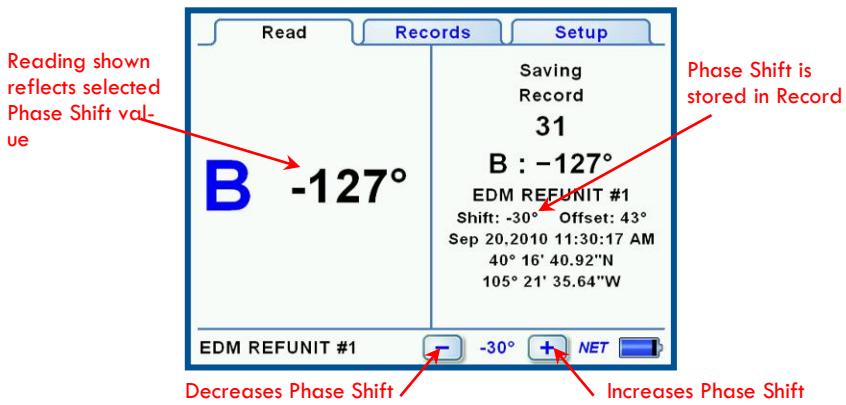
A “No Match” reading can sometimes be resolved by adjusting the Phase Shift setting (see next section). For more information on handling “No Match” readings, refer to the section **Phase Measurement Tips**.

For “No Match” readings, it is important to notice the phase angle reported. “No Match” phase angles can provide clues to understand the situation and take the appropriate action.



Adjusting for Phase Shift

When taking phase readings in some locations, it may be desirable to adjust for phase shifts without recalibrating the Field Unit to the Reference Units. On the Read Screen, the and buttons are used to quickly adjust the degree measurement by -60° , -30° , 0° , $+30^\circ$, $+60^\circ$, or 180° to account for shifts due to transformers (e.g. switching between transmission and distribution voltage). The selected Phase Shift value is reflected immediately in subsequent readings, and is stored with each saved Record. Calibrating the Field Unit sets the Phase Shift value to 0° .

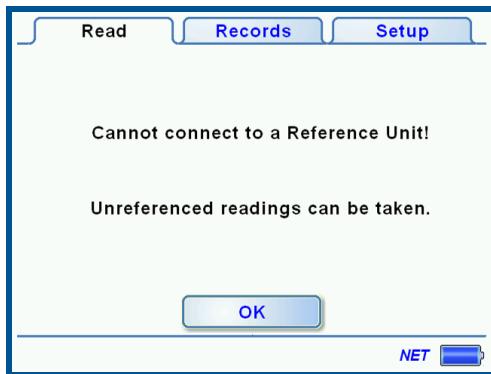


Important: The measurements for a set of three phases should be taken with the same Field Unit Phase Shift setting. If the Phase Shift setting is changed, take all three measurements again.

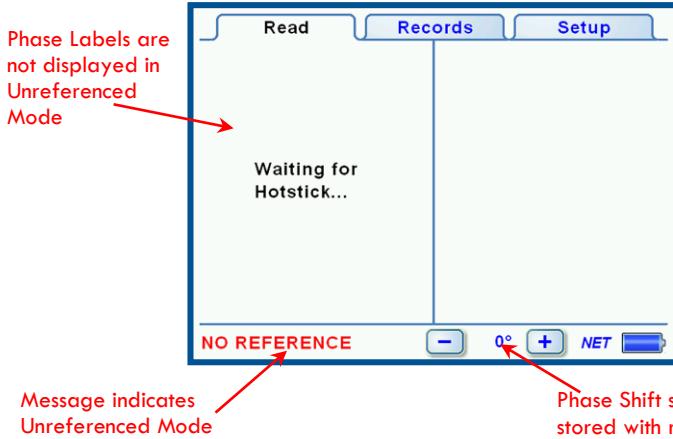


Unreferenced Readings

If the Field Unit cannot connect to either of the configured Reference Units, the following screen is displayed with an error sound.

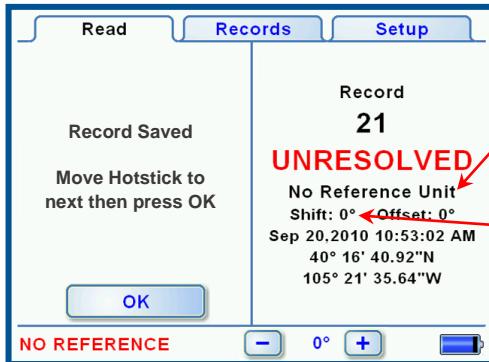


The AP30 can take readings even when it cannot connect to a Reference Unit. Unreferenced readings are recorded as **UNRESOLVED**, and will be automatically resolved when a Reference Unit comes back online. Press OK or simply continue taking readings with the Hotstick Unit.





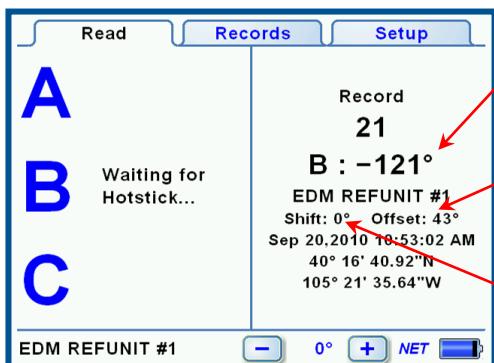
Note: In Unreferenced Mode, the AP30 cannot detect changes in phase from the Hotstick Unit signal. To move to next phase, you must remove the Hotstick Unit away from energized sources to interrupt the signal, or place the Hotstick on next and then press OK in the screen below.



UNRESOLVED
Records have no
Reference Unit
or Reference
Offset

Phase Shift set-
ting when read-
ing was stored

The Field Unit will continuously attempt to re-establish connection with the configured Reference Unit(s). When either the Primary or Secondary Reference Unit becomes available, the Field Unit will automatically connect and resolve any UNRESOLVED Records. Resolving takes place in the background and does not interrupt any phase readings being taken. The AP30 Reference Unit can hold up to one month of data, so the Field Unit can resolve UNRESOLVED Records taken up to one month ago.



When Record is
resolved, Phase
ID and Phase
Angle are stored

Reference Unit
name and Ref-
erence Offset
are stored

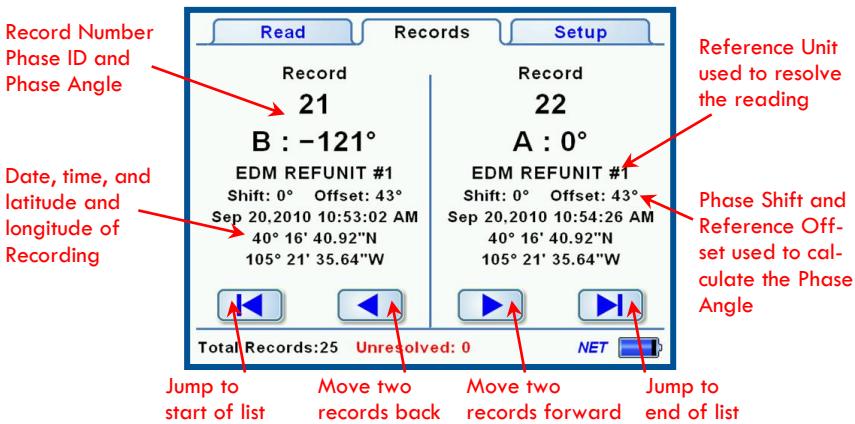
Stored Phase
Shift is used to
resolve record

Note: If the UNRESOLVED records are not automatically resolved when a Reference Unit comes back online, turn the Field Unit power off and then on again.



Viewing Records

The Records tab allows you to step through the records saved on the Field Unit. The total number of records and the number of unresolved (no reference) records are listed in the summary line at the bottom of the screen. The Field Unit holds 1000 records. When the record memory is full, the oldest records are overwritten by the new records, and phasing work can continue. The navigation arrows advance the screen by two records forward or backward, or jump to the beginning or end of the list.





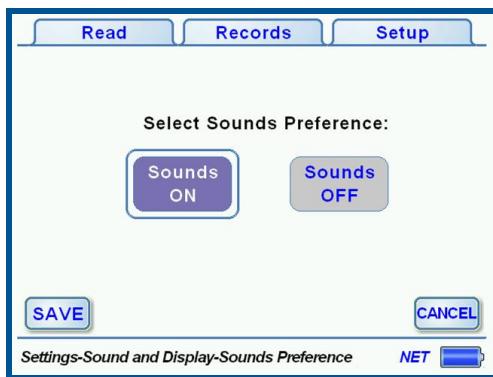
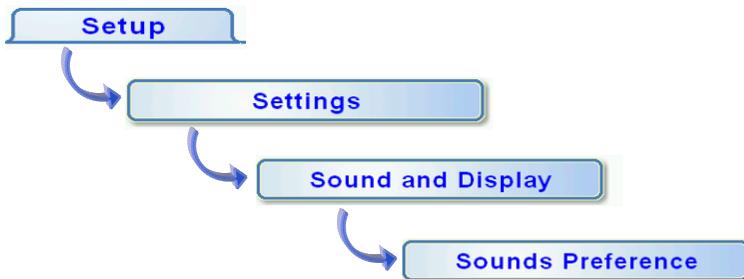
Field Unit Sounds

The AP30 Field Unit uses certain audible signals to indicate specific events.

Sound	Event
• Four beeps rising -----	Power-up self test
• “Tick” sound -----	Screen touch, signal received, or Reference lost
• Two beeps- low, high ---	Ready (GPS, Network and Reference acquired)
• One short beep-----	Identified 1 st Phase (top position on screen)*
• Two short beeps -----	Identified 2 nd Phase (middle position on screen)*
• Three short beeps -----	Identified 3 rd Phase (bottom position on screen)*
• Two beeps- short, long--	Record saved
• One long beep -----	“No Match” or lost GPS

* 2nd and 3rd Phase beeps are switched when Sequence is set to ACB for AP20 compatibility. Refer to the section **Setting Phase Sequence** for details.

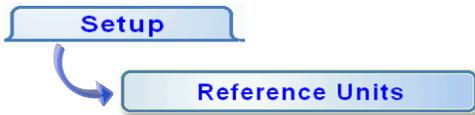
The AP30 sounds may be turned on and off using the Setup Menu. The screen touch “tick” sounds always remain on.





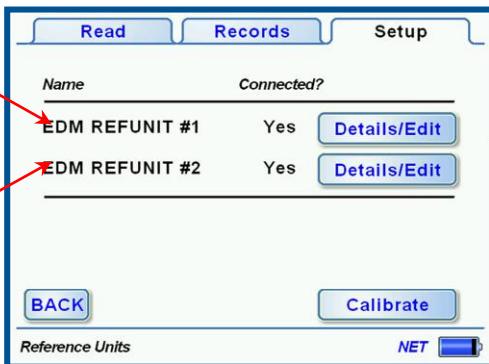
Using a Secondary Reference Unit

The AP30 Field Unit allows two Reference Units to be configured. These Reference Units are listed using the Setup menu. The primary Reference Unit is listed first and is the preferred one used in resolving phase readings. The secondary Reference Unit is listed second and will be used to resolve phase readings only when the primary unit is offline or has not been calibrated.



The Primary Reference Unit will be used whenever possible

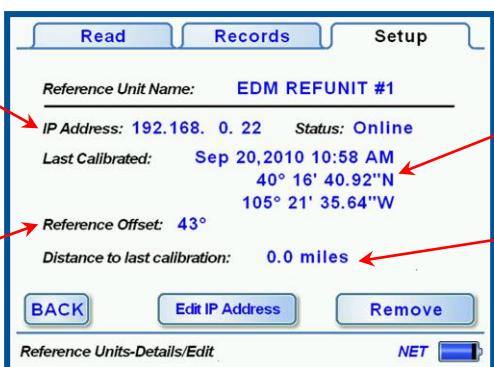
The Secondary Reference Unit will be used only when Primary is unavailable



The Reference Unit detail screen shows

IP Address and current Status of Reference Unit

Degree offset to Phase A (0°) determined at last successful Calibration



Date, time, and location of Field Unit at the last successful Calibration to this Reference Unit

Distance from current location to the location of last successful Calibration



Charging the Field Unit Battery

The AP30 Field Unit battery can be charged from either an auto cigarette lighter or AC outlet. The charging port is in the storage compartment on the left side. The battery does not have charge memory, so it can be recharged anytime. The battery charger drops to a trickle charge when the battery is fully charged, so it can be left plugged in.

The Charging Status LED signals the battery charging status:

- **Red** – Fast charge in progress
- **Green** – Trickle charge in progress





Atomic Field Unit

New AP30 Field Units may be ordered with the Atomic option, and standard AP30 Field Units may be upgraded to Atomic units. Atomic Field Unit can make phase measurements underground, indoors, and in other locations without GPS reception.



 Atomic Field Units display a special logo on the storage compartment lid and on the outside of the case under the handle.

The AP30 Atomic Field Unit must be powered up in a location with GPS signal for several minutes before the Atomic can be used. The GPS LED on the front panel displays the status.

GPS Status Light for Atomic Field Units

GPS Light	Status Description
OFF	Acquiring GPS lock
Blinking ON/OFF	GPS locked and unit is synchronizing (several minutes). Remain within GPS reception. Phase measurements can now be made.
ON Solid	Atomic unit has been synchronized, and the unit may be taken to area with no GPS reception. Leave the unit powered on.

If the Field Unit is powered off before phasing work is completed, it must be powered up again in a location with GPS signal.

If the cell network is not available for phasing work, unreferenced readings will be stored and automatically resolved when the cell network becomes available.

Timing values used by the PhaseTrakker system reset at 12:00 am Coordinated Universal Time on the first day of each month. If the Field Unit is phasing from the Atomic without GPS at this time, the GPS LED will turn off and the unit must be resynchronized with GPS.

Note: Some Atomic Field Units use a Cesium clock. Cesium has many isotopes (variants of a chemical element that differ in the number of neutrons). Cesium-133 is the only stable, non-radioactive isotope of Cesium. It poses no radioactive health risk.

For information on ordering and upgrading Atomic Field Units, visit www.avistarinc.com or contact EDM at info@edmlink.com or 970-204-4001



Phase Measurement Tips

Handling “No Match” Readings

The Field Unit reports a “No Match” reading when the difference between the measured phase angle and the nearest phase angle exceeds the configured Degree Tolerance. Possible situations where a reading of “No Match” may be encountered:

Situation	Action
• Delta-Wye transformer 30° phase shift	-----Adjust Phase Shift  or 
• Field Unit has moved long distance	-----Calibrate Field Unit
• Distant Reference Unit, seasonal drift	-----Calibrate Field Unit
• Reference Unit power has changed	-----Calibrate Field Unit
• Single-phase transformer	-----180° Shift-see tips section
• Other transformer shifts	-----Draw phasor diagram
• Interference from adjacent phase	-----Reposition Hotstick Unit
• Interference from other sources	-----Reposition Hotstick Unit

For “No Match” readings, it is important to notice the phase angle reported. “No Match” phase angles can provide clues to understand the situation and take the appropriate action.



Single-Phase Transformers

Single-phase transformers normally have one primary connection to supply voltage and one primary connection to ground. In this situation, one secondary connection will be in phase with the primary, while the other will be 180° out of phase. The transformer polarity determines which of the secondary connections will be in-phase. The Field Unit can be set to compensate for this phase shift (refer to the section **Adjusting for Phase Shift**)

Note: The table below assumes that all measurements (primary and secondary) were taken with the *same* Field Unit Phase Shift setting.

Single-Phase Transformer Phase Readings

Primary	Secondary In Phase	Secondary Out of Phase
A 0°	A 0°	“No Match” 180°
B -120° (240°)	B -120° (240°)	“No Match” 60°
C 120°	C 120°	“No Match” -60° (300°)

Phase angle readings will typically vary within 20° of values shown.

Phase angles and labels shown are the AP30 default values.



Three-Phase Transformer Banks

The secondary phases of a three-phase transformer bank (three standard single-phase transformers connected to each other) will either match the primary phases or be offset by 180° from the primary phases, depending on transformer polarity and bank connections. The Field Unit can be set to compensate for this phase shift (refer to the section **Adjusting for Phase Shift**)

Note: The table below assumes that all measurements (primary and secondary) were taken with the same Field Unit Phase Shift setting.

Three-Phase Transformer Bank Phase Readings

Primary	Secondary In Phase	Secondary Out of Phase
A 0°	A 0°	"No Match" 180°
B -120° (240°)	B -120° (240°)	"No Match" 60°
C 120°	C 120°	"No Match" -60° (300°)

Phase angle readings will typically vary within 20° of values shown.

Phase angles and labels shown are the AP30 default values.



Three-Phase Transformers, Delta-Wye

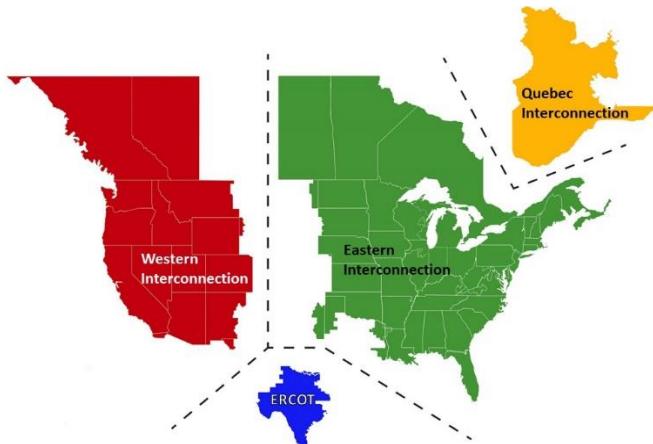
The three-phase transformers commonly used in distribution substations have a delta arrangement for the primary connections and a wye arrangement for the secondary connections. This results in a 30° phase shift between the primary and secondary phases. The Field Unit can be set to compensate for this phase shift (refer to the section **Adjusting for Phase Shift**).

Note: The table below assumes that all measurements (primary and secondary) were taken with the same Field Unit Phase Shift setting.

Three-Phase Transformer (Delta-Wye) Readings		
Primary	Secondary Standard 30° Lag	Secondary Non-Standard 30° Lead
A 0°	“No Match” -30°	“No Match” 30°
B -120° (240°)	“No Match” -150° (210°)	“No Match” -90° (270°)
C 120°	“No Match” 90°	“No Match” 150°

*Phase angle readings will typically vary within 20° of values shown.
Phase angles and labels shown are the AP30 default values.*

Regional Reference Units



There are four main AC power interconnections (grids) in the U.S and Canada. The electric utilities within an interconnection are electrically tied together and operate at a synchronized frequency of 60Hz. Interconnections are connected via DC ties, which permit the flow of energy but isolate the independent AC frequencies of each side. The relative timing of a phase between any two grids is continually changing. Within each of the four grids, however, the phase timing is the same.

To identify phases successfully, a Field Unit and its configured Reference Units must be on the same interconnection. EDM provides Regional Reference Units for use by PhaseTrakker customers on each interconnection. Some customers purchase their own Reference Unit to use as Primary. For best results, configure the nearest Reference Unit as the Primary, and the next nearest as Backup. Contact EDM for the locations of currently available Regional Reference Units.

For some customers, it may be necessary to use a Reference Unit hundreds of miles away. Variation in load on the grid causes variation in relative phase timing between the Reference Unit and Field Unit. As a result, phase angle measurement error may change little or may increase greatly from one day to the next. Calibration recalculates the relative timing offsets and minimizes error until the next significant change in load.

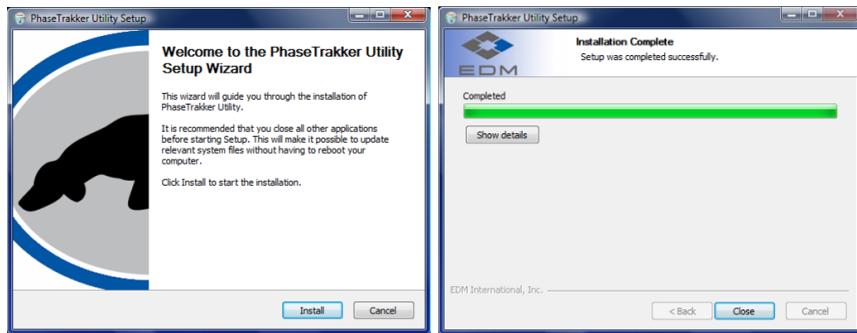
Note: When using distant Reference Units, load changes can cause measurement errors over time. Calibrate frequently to avoid errors.



PhaseTrakker Utility

Installing the PhaseTrakker Utility

The PhaseTrakker Utility is installed from the CD included with the AP30 System. Installation should start automatically when the disc is inserted. If it does not start automatically, run **PhaseTrakkerSetup.exe** from the disc.



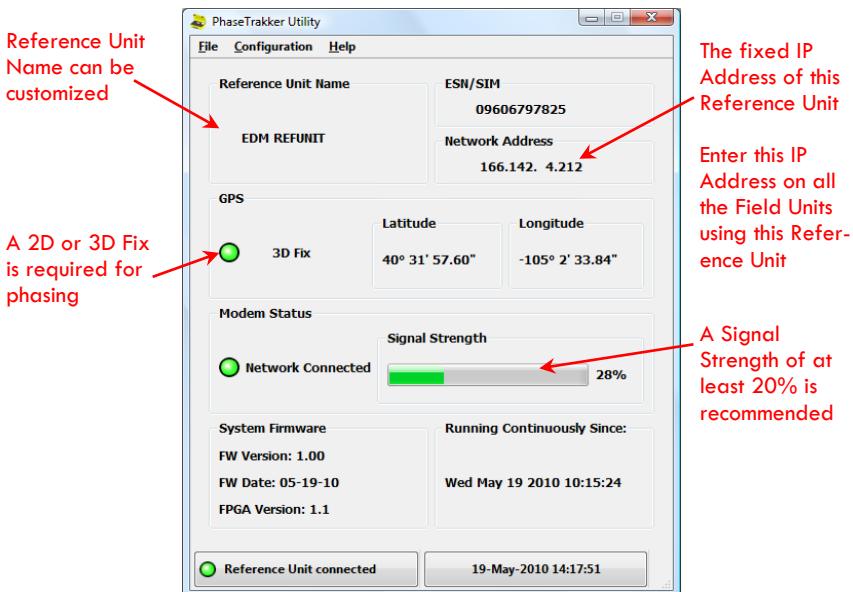
The installation will place a PhaseTrakker icon  on the Desktop. You must be connected to a PhaseTrakker Field Unit or Reference Unit to run the PhaseTrakker Utility. Connect a Field Unit or Reference Unit to your PC and power on the Unit. Wait for Windows to automatically detect and configure the new USB device, then click on the PhaseTrakker icon to start the Utility.





Using the Utility with Reference Unit

Connect a USB cable to the Reference Unit and the PC. Turn on the Reference Unit and click on the PhaseTrakker Field Unit icon  to start the Utility. Once the Utility has connected to the Reference Unit, the following window is displayed.



Checking Reference Unit Status

When connected to a Reference Unit, the PhaseTrakker Utility main screen displays the settings and current status of the unit. The Reference Unit needs a 2D or 3D GPS Fix to log phase timing data. It is recommended that the Reference Unit and its antenna be located to achieve a network signal strength of at least 20%. The Network LED on the front panel will blink if the signal strength is less than 20%. A weak network signal strength may cause delays or dropped connections during phasing operations.

Verifying the Reference Unit Network Address

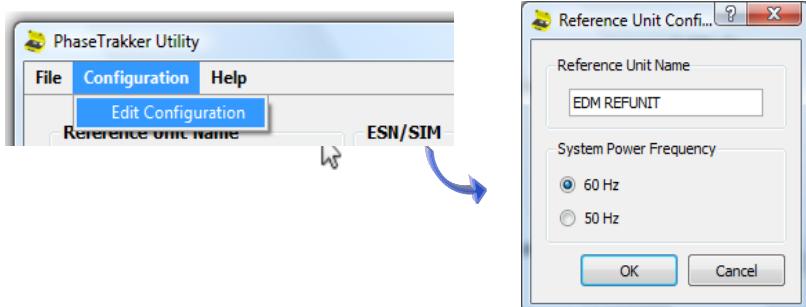
The Network Address of the Reference Unit is displayed at the upper right on the PhaseTrakker Utility main screen. This is the fixed IP address of the unit's wireless networking device and is the IP address to be entered on all the Field Units that will be using this Reference Unit.

Configuring the Reference Unit

By default, the Reference Unit is set with system frequency of 60 Hz and the name "RUnnnnnnnnnnn", where nnnnnnnnnnn is the SIM number of the unit's

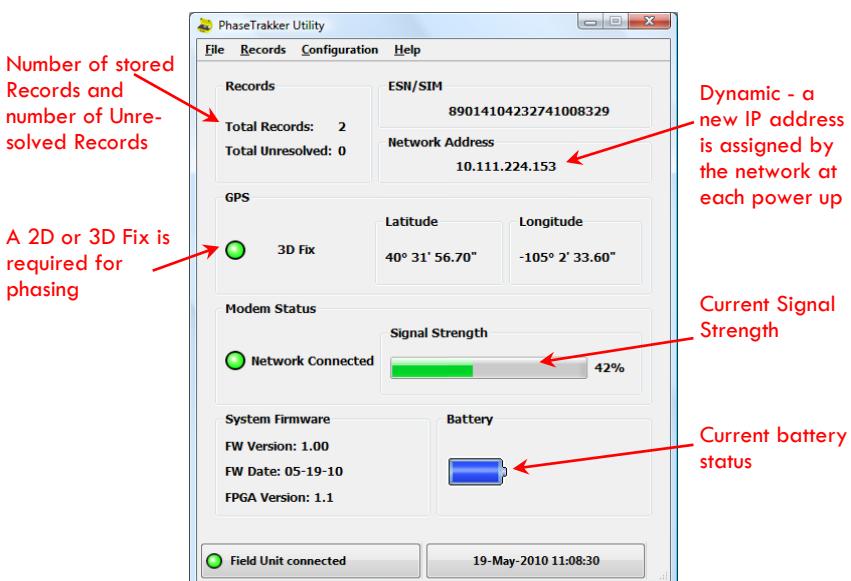


wireless networking device. The PhaseTrakker Utility is needed only to change the Reference Unit system frequency (50 or 60 Hz) or a customized name (alpha-numeric, 16 characters). Select “Configuration” and “Edit Configuration” to customize the name and set the system frequency.



Using the Utility with Field Unit

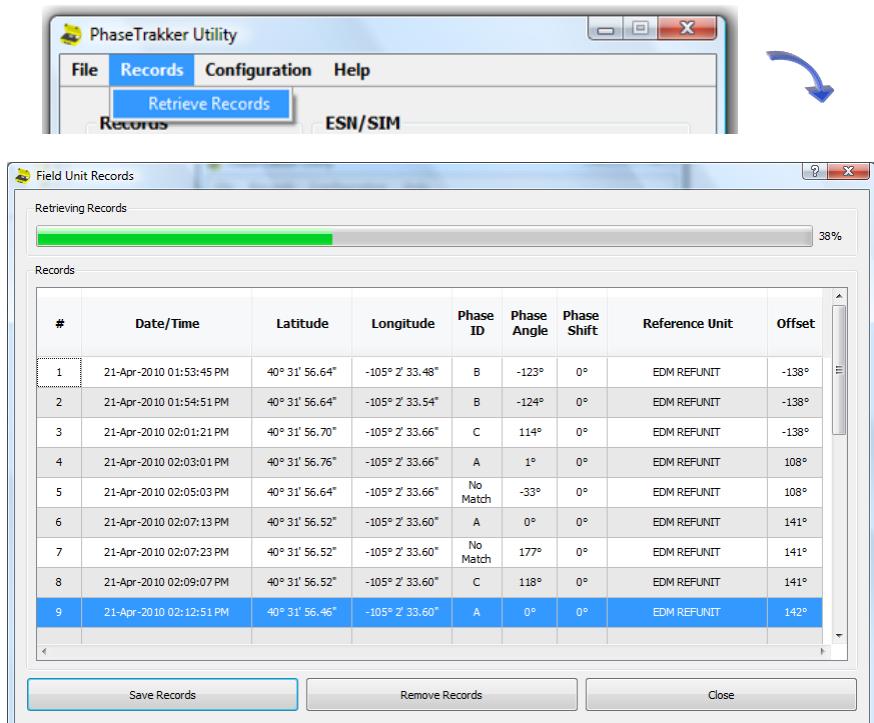
Connect a USB cable to the Field Unit and the PC. Turn on the Field Unit and click on the PhaseTrakker Field Unit icon  to start the Utility. Once the Utility has connected to the Field Unit, the following window is displayed.





Retrieving Records from the Field Unit

The AP30 Field Unit records can be saved to a PC. In the PhaseTrakker Utility main window, select “Records” and then “Retrieve Records.” A new window opens and the records are read by the Utility.

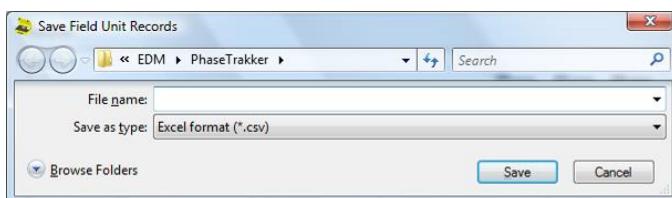


The screenshot shows the PhaseTrakker Utility application window. The menu bar includes File, Records (which is highlighted in blue), Configuration, and Help. The sub-menu under Records is "Retrieve Records". The main window is titled "Field Unit Records" and displays a table of "Retrieving Records". The table has columns for #, Date/Time, Latitude, Longitude, Phase ID, Phase Angle, Phase Shift, Reference Unit, and Offset. The data is as follows:

#	Date/Time	Latitude	Longitude	Phase ID	Phase Angle	Phase Shift	Reference Unit	Offset
1	21-Apr-2010 01:53:45 PM	40° 31' 56.64"	-105° 2' 33.48"	B	-123°	0°	EDM REFUNIT	-138°
2	21-Apr-2010 01:54:51 PM	40° 31' 56.64"	-105° 2' 33.54"	B	-124°	0°	EDM REFUNIT	-138°
3	21-Apr-2010 02:01:21 PM	40° 31' 56.70"	-105° 2' 33.66"	C	114°	0°	EDM REFUNIT	-138°
4	21-Apr-2010 02:03:01 PM	40° 31' 56.76"	-105° 2' 33.66"	A	1°	0°	EDM REFUNIT	108°
5	21-Apr-2010 02:05:03 PM	40° 31' 56.64"	-105° 2' 33.66"	No Match	-33°	0°	EDM REFUNIT	108°
6	21-Apr-2010 02:07:13 PM	40° 31' 56.52"	-105° 2' 33.60"	A	0°	0°	EDM REFUNIT	141°
7	21-Apr-2010 02:07:23 PM	40° 31' 56.52"	-105° 2' 33.60"	No Match	177°	0°	EDM REFUNIT	141°
8	21-Apr-2010 02:09:07 PM	40° 31' 56.52"	-105° 2' 33.60"	C	118°	0°	EDM REFUNIT	141°
9	21-Apr-2010 02:12:51 PM	40° 31' 56.46"	-105° 2' 33.60"	A	0°	0°	EDM REFUNIT	142°

At the bottom of the window are buttons for "Save Records", "Remove Records", and "Close".

Select “Save Records” to save the Records as a file in Excel format (.csv file).



The screenshot shows the "Save Field Unit Records" dialog box. It has a file path dropdown set to "EDM > PhaseTrakker". Below it are fields for "File name:" and "Save as type:". The "Save as type:" dropdown is set to "Excel format (*.csv)". At the bottom are "Save" and "Cancel" buttons.



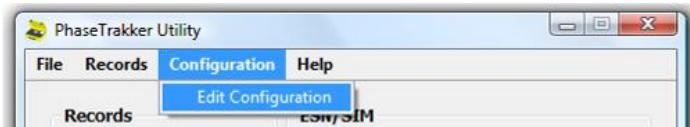
Clearing Records on the Field Unit

The Field Unit can store 1000 records. When the record memory is full, the oldest records are overwritten by the new records, and phasing work can continue. *It is never necessary to remove the records the Field Unit memory*, but this function is provided as a management tool. In the Field Unit Records window, select “Remove Records” to clear all of the stored records on the Field Unit. You will be prompted to confirm this action before the field unit records are removed. The Utility will retain the records on the Field Unit Records window until the window is closed.



Setting the Field Unit Configuration

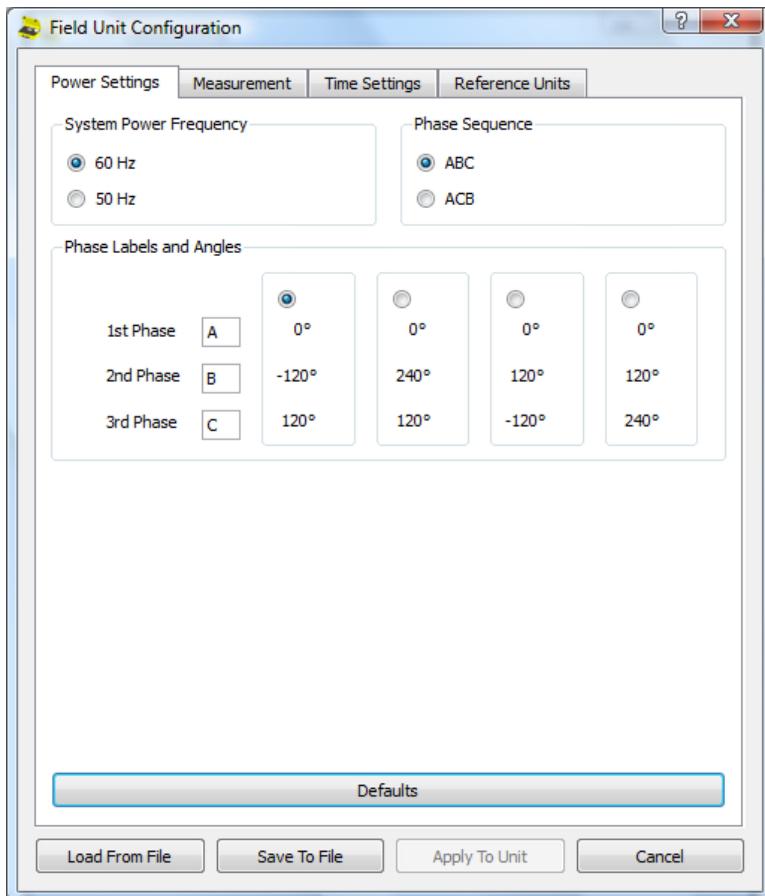
Most of the Field Unit configuration settings can be changed using either the Field Unit touch screen or the PhaseTrakker Utility. Phase measurement preferences for saving readings and tolerance for identifying phases cannot be set on the Field Unit, and must be set using the PhaseTrakker Utility. To change settings using the PhaseTrakker Utility, select “Configuration” and then “Edit Configuration.”





Power Settings and Phase Preferences

The Phase Settings tab of the PhaseTrakker Utility's Field Unit Configuration menu allows configuration of the same values that are set by the System Frequency and Phase Preferences menus on the Field Unit.



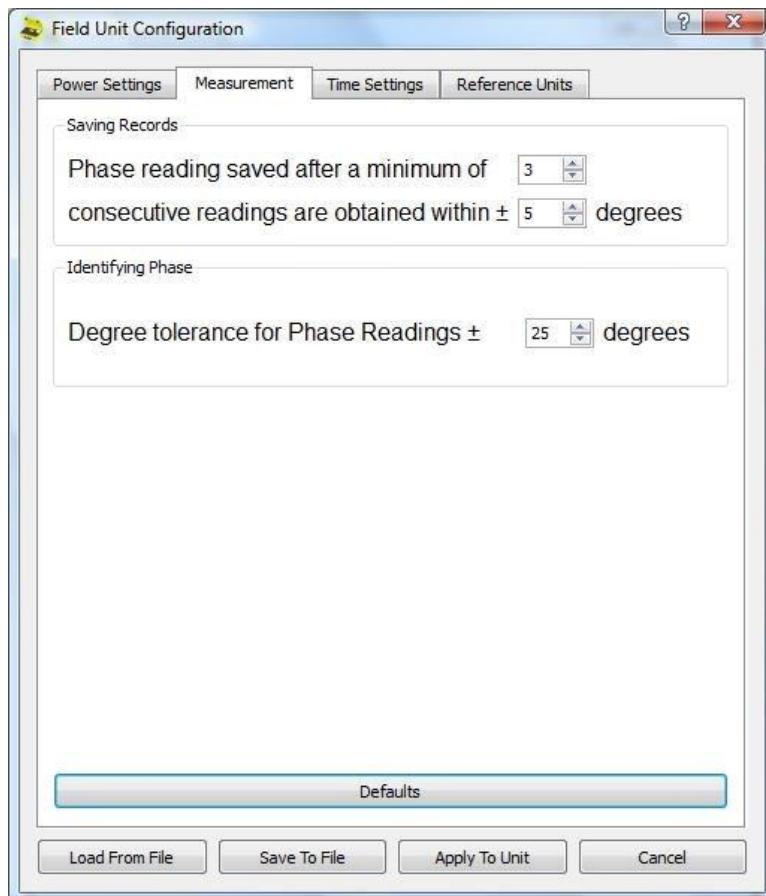
Select "Defaults" to set these preferences to factory default values. After preference selections are made, click "Apply To Unit" to write them to the Field Unit.



Measurement Preferences

The values on the Measurement tab of the PhaseTrakker Utility's Field Unit Configuration menu cannot be set on the Field Unit. *These values can be set only by using the PhaseTrakker Utility.* Once set, these values do not typically need to be changed.

The Saving Records group sets the criteria to ensure a stable phase reading before a record is saved. By default, a new record will be saved after 3 consecutive phase readings within 5° tolerance. The Identifying Phase group sets the Degree Tolerance used when matching measurements to the configured Phase Angles.

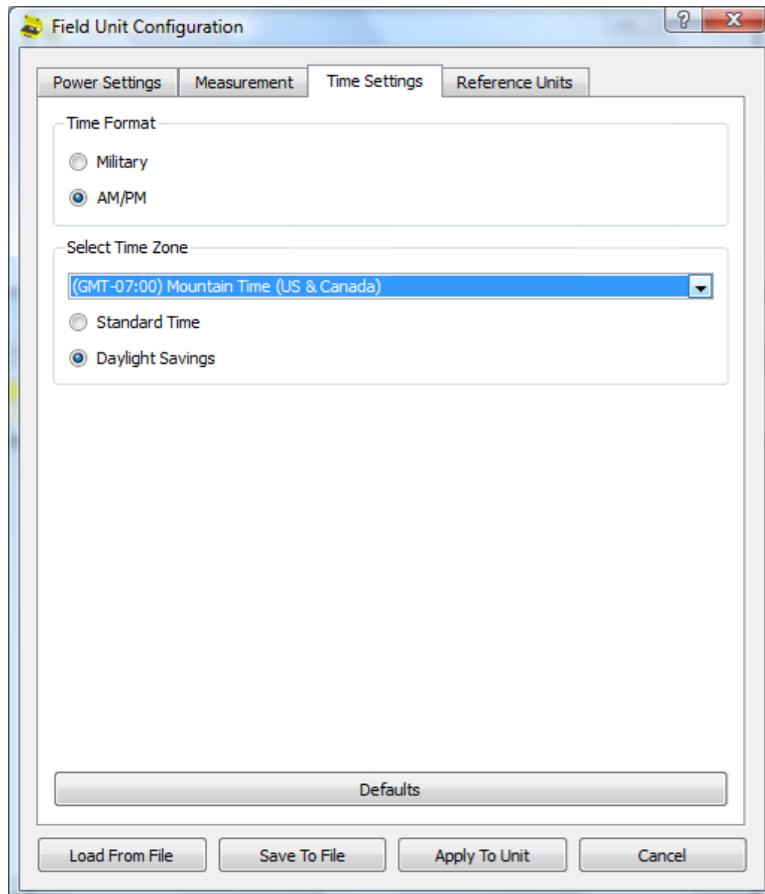


Select "Defaults" to set these preferences to factory default values. After preference selections are made, click "Apply To Unit" to write them to the Field Unit.



Time Zone and Time Format

The Time Settings tab of the PhaseTrakker Utility's Field Unit Configuration menu allows configuration of the same values that are set by the Time Zone menus on the Field Unit.

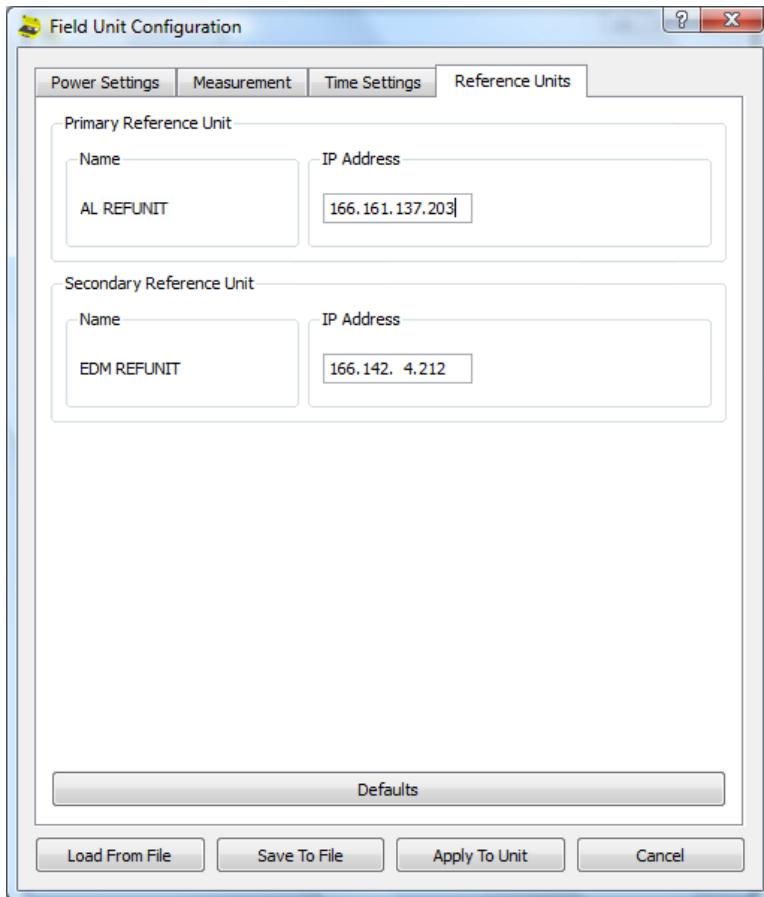


Select “Defaults” to set these preferences to factory default values. After preference selections are made, click “Apply To Unit” to write them to the Field Unit.



Reference Units

The Reference Units tab of the PhaseTrakker Utility's Field Unit Configuration menu allows configuration of the same values that are set by the Reference Units menus on the Field Unit. The IP Addresses for the primary and secondary Reference Units are entered. Enter all zeros to remove a Reference Unit.

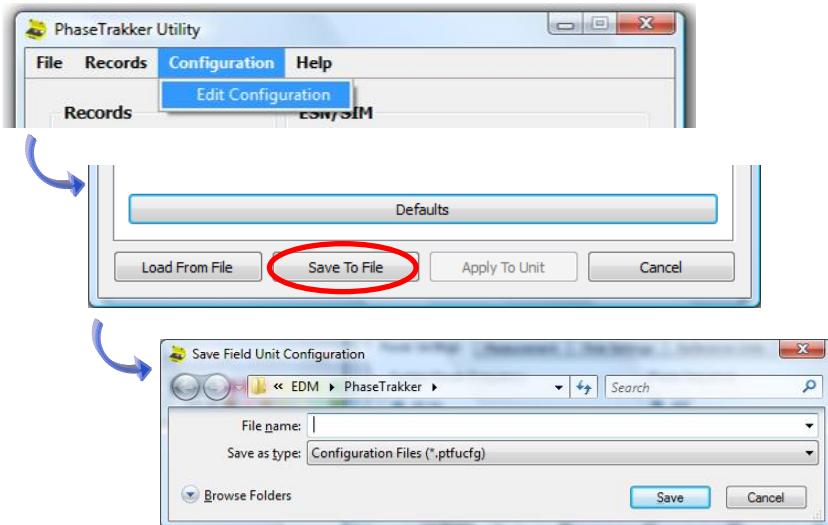


Select “Defaults” to set these preferences to factory default values. After the Reference Unit addresses are entered, click “Apply To Unit” to write them to the Field Unit.



Saving Field Unit Configuration to a File

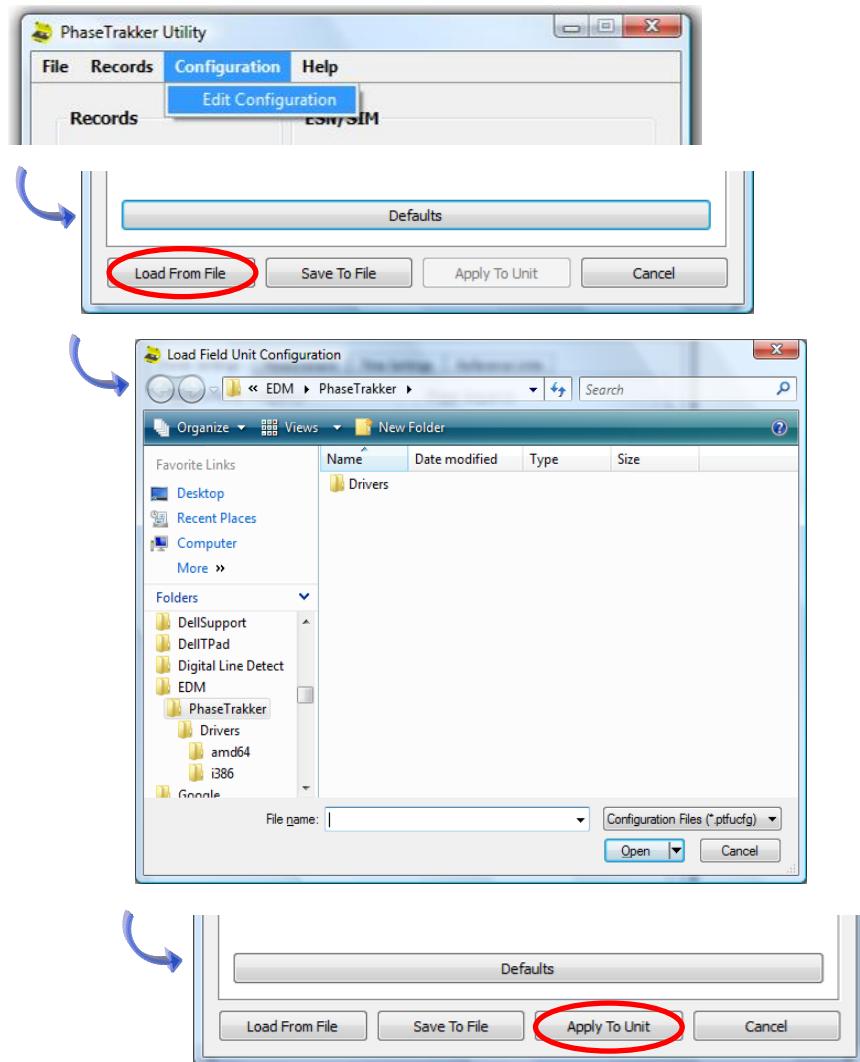
The Field Unit configuration can be saved to a file to serve as a backup or a template. Once saved, the configuration can be loaded into other AP30 Field Units. The configuration is saved using the Field Unit Configuration screens.





Loading a Saved Field Unit Configuration

The Field Unit configuration can be loaded from a saved configuration file and applied to an AP30 Field Unit. A saved configuration is loaded using the Field Unit Configuration screens.





Troubleshooting

Reference Unit

- **The Reference Unit GPS LED does not light.**

Make sure the antenna has a clear view of the sky.

- **The Reference Unit Network LED does not light or is flashing.**

The Reference Unit Network LED is off when no network signal is received. The Network LED flashes if the network signal strength is less than 20%. A Reference Unit location allowing a strong network signal is recommended.

Field Unit

- **The Field Unit is not acquiring the network consistently.**

The field unit uses a wireless network device provisioned for data service. The received signal strength may not correspond to personal cell phones configured to optimize voice reception. The Network Status screen displays details on the network reception which can be useful for troubleshooting.





- **All the status lights are on, but the Field Unit sometimes makes long pauses while taking phase reading.**

This is usually due to communication problems on the cell network, on either the Field Unit or Reference Unit end, such as a weak signal (-120 dBm to -100 dBm), network congestion, busy cell towers, or signal interference from high E-fields.

- **The Field Unit is not receiving the Hotstick Unit Signal.**

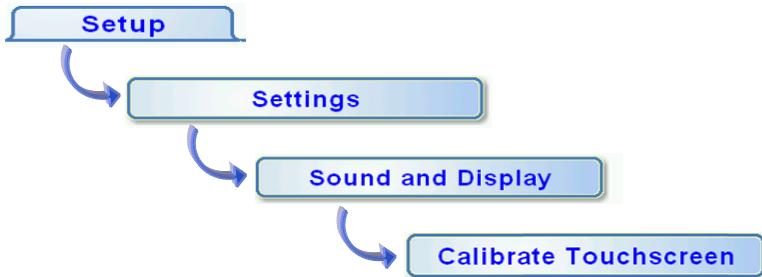
Make sure the Hotstick Unit displays a solid green light. Orient the Hotstick Unit faceplate toward the field unit. Orient the Field Unit lid so it is perpendicular to the direction of the Hotstick Unit. Elevate the Field Unit off the ground (place it on a cement block, for example).

- **Phase angle readings appear inaccurate.**

Accuracy of phase readings can be compromised in configurations where a nearby phase interferes with the phase being measured. Situations include cutouts, transformer banks, double circuits, circuits crossing, distribution built under transmission, and secondary bushings on overhead transformers.

- **The touch screen is not responding properly.**

The touch screen may need calibration. Navigate to the touch screen calibration page and touch the crosshairs as directed.



PhaseTrakker Utility

- **The Utility is not able to connect to the Field Unit (or Reference Unit).**

Make sure the Unit is turned on and the USB cable is connected. If the Utility does not recognize the Field Unit or Reference Unit on the first attempt, close the Utility, disconnect the USB cable, reconnect it, and start the Utility again.

Compatibility with AP10 and AP20

- *Can I use an AP30 Field Unit with my existing AP10 or AP20 Reference Unit?*
No. The methods of communication for the two systems are incompatible. Contact EDM for information on upgrading your system.
- *Can I use my existing AP10 and AP20 Field Units with an AP30 Reference Unit?*
No. The methods of communication for the two systems are incompatible. Contact EDM for information on upgrading your system.

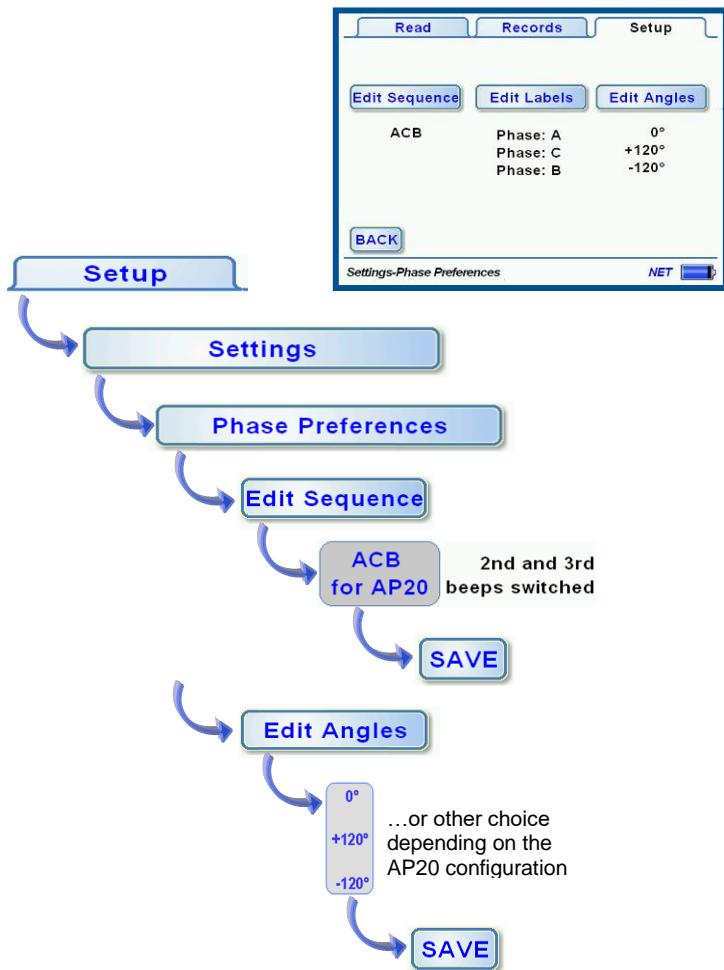


- *Can I still purchase AP20 Field Units to operate with my AP20 Reference Unit?*
No. The AP10 and AP20 systems are obsolete, but both will continue to be supported.
- *I have some extra AP20 Hotstick Units. Can I use them with the AP30?*
Yes. The Hotstick Units for AP10, AP20 and AP30 are fully compatible. Calibration is recommended when Hotstick Units are changed.
- *Our system uses the ACB sequence and we have been using the AP20 for phase identification. The AP20 beeps once for phase A, twice for B, and three times for C. How can I configure the AP30 for compatibility with the AP20 on ACB systems?*

Because of the AP20's fixed display of "ABC", compromises were necessary to report phases for ACB systems. AP30 users may prefer to configure the AP30 Field Unit to assign phase beeps and angles as the AP20 did. This is easily accomplished by setting the Sequence and Angles pref-



erences as shown below. The AP30 will then provide beep identifications and phase angles expected by AP20 users.



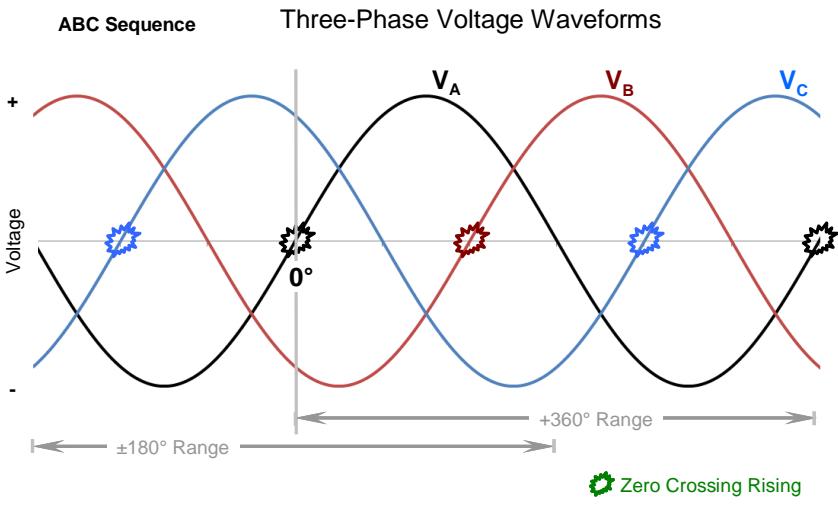


AP30 Phasing Conventions

There is variation in the terms used to label phase sequence and phase angles among different utilities supplying three-phase power. For example, some utilities refer to phases in ABC sequence and some use ACB. Some use negative angles to refer to phase lag and some use positive angles. Some use angles in the $\pm 180^\circ$ range and some prefer the 0° to 360° range.

ABC Sequence

ABC sequence is the most commonly used to label phases. The order of the voltage waveforms through time are labeled A, B, and C. The AP30 detects the zero crossing of a voltage waveform as it rises to its positive peak. By convention in the AP30, the first waveform is always A and its zero crossing rising is always 0° .

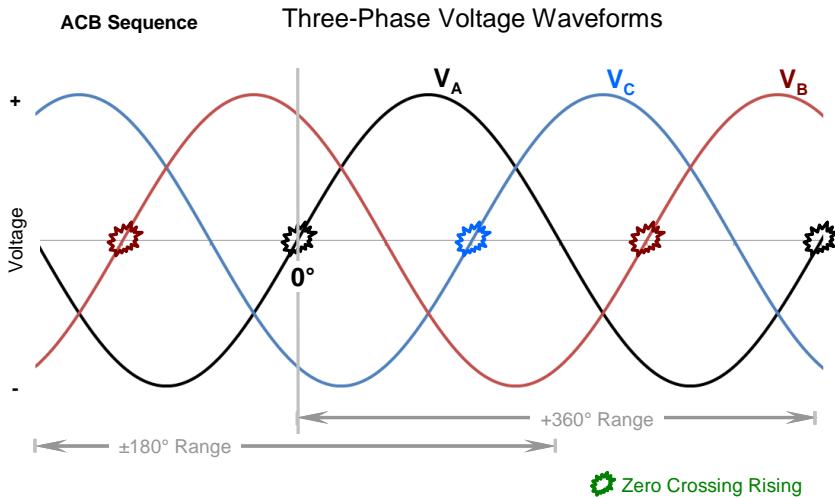


The terms *lag* and *lead* refer to the relative timing of the zero crossings, and the amount of lag or lead is expressed by the degrees separating the zero crossings for the voltage waves. Because the sine waves are cyclic and continuous, a wave can be viewed as either lagging or leading another. Lag can be indicated with either negative or positive phase angle, according to which convention is preferred.



ACB Sequence

In the ACB sequence, the order of the voltage waveforms through time is A, C, and B. For the AP30, the first waveform is always A and its zero crossing rising is always 0° .

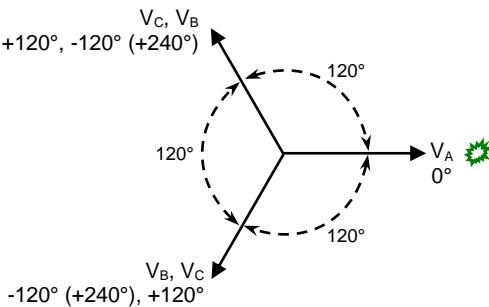


V_C lags V_A by 120°
 V_B leads V_A by 120°

V_C leads V_A by 240°
 V_B lags V_A by 240°

Phase Angles

The AP30 allows customization of phase sequence, labels, and angles to suit the preferences of the user. The phase angles are 120° apart, and can be labeled according to preference.





Specifications

System

- System Accuracy: $\pm 5^\circ$
- Repeatability: $\pm 2^\circ$

Reference Unit

- Power source: 120 V (108 V – 132 V), 60 Hz or 50 Hz
- Demand draw: 0.1 Amps
- Data storage: 1 month of records to resolve phase identifications
- Operating temperature: -20° to 150° F
- Size
 - Portable: 14.2" L x 11.4 " W x 6.5" H
 - Rack mount: 14.0" L x 17.0" W x 3.5" H
- Weight
 - Portable: 8.7 lbs
 - Rack mount: 8.0 lbs

Field Unit

- Operating temperature: -32° to 150° F
- Size: 19.2" L x 15.2" W x 7.3" H
- Weight: 25.2 lbs (including Hotstick Unit and accessories)
- Battery: 6 V, 12 Ah rechargeable
- Battery life: 6 hours continuous use
- Battery charge times
 - AC: 6 hours
 - Auto: 7 hours

Hotstick Unit

- Universal hotstick attachment
- $\frac{1}{4} \times 20$ threaded hole for tip attachments
- Test lead attachment on sensor
- Voltage Range: 120 V to 500 kV, 60 Hz and 50 Hz
- Transmitter: 914 MHz FM, Range 50'
- FCC ID: 2A9GX-AP30HS
- Battery: 9 V
- Battery Life
 - Active: 18 hours or about 500 readings at 2 minutes each
 - Shelf: 1 year
- Size: 11.3" L x 3" W x 3" H (sensor: 4.9" L x 2.7" W x 1.3" H)
- Weight: 1.4 lb (sensor: 0.3 lb)

**LowVolt Sensor (Optional Accessory, Alternate Hotstick Unit)**

- Low voltage attachments
- Voltage Range: 0.5 V to 300 V, 60 Hz and 50 Hz
- Transmitter: 914 MHz FM, Range 50'
- Battery: 9 V
- Battery Life
 - Active: 18 hours or about 500 readings at 2 minutes each
 - Shelf: 1 year
- Size: 4.9" L x 2.7" W x 1.3" H
- Weight: 0.3 lb

Non-Contact Sensor (Optional Accessory, Alternate Hotstick Unit)

- Voltage Range: 120 V to 500 kV, 60 Hz
- Transmitter: 914 MHz FM, Range 75'
- Battery: 9 V
- Battery Life
 - Active: 18 hours or about 500 readings at 2 minutes each
 - Shelf: 1 year
- Size: 4.75 L x 3.1" W x 1.3" H
- Weight: 0.3 lb



Accessories and Related Products

Accessories

- **Cellular Amplifier Kit.** This kit amplifies network signals several times, and is recommended when phase identification is needed in areas of intermittent network reception. The kit comes with network signal amplifier, two antennas, rechargeable battery and battery charger.



- **LowVolt Sensor.** This handheld sensor is used in place of the AP30 Hotstick Unit for voltages between 0.5V and 300V. The sensor comes with red and black test leads. Because the test leads connect directly to the sensor, measurements are not affected by nearby E-fields. The LowVolt sensor can be used to identify phases and phase angle at recloser terminals down to 0.5 V.



- **Non-Contact Sensor.** This handheld sensor is used in place of the AP30 Hotstick Unit when physical contact with the energized source is less convenient or not practical. The sensor is not operable in substations because of the multiple strong E-fields present. New AP30 Field Units can be ordered to include the Non-Contact Sensor, and it can also be purchased separately.



- **Rain Cover for Field Unit.** This custom vinyl cover slips over the opened lid and protects the front panel and storage compartment in rainy weather. A clear panel in the cover allows continued operation of the touchscreen.



- **Remote Antenna for Field Unit.** This dual antenna attaches to the antenna ports in the storage compartment of the Field Unit and takes the place of the Field Unit's built-in antenna. This allows the Standard Field Unit to operate in vaults or other locations where GPS and Cell signals are unavailable. The Remote Antenna is mounted on a handy wind-up reel with 50 feet of cable.



Related Product

- **AP30 Reference Unit.** This is the Base Unit that provides reference timing for the AP30 Field Unit and PhaseTrakker Jr. The difference in phase timings between a Field Unit and a distant Reference Unit can drift with changes in power flow on the grid. One solution is to perform Calibration regularly, and another is to install a local Reference Unit.
- **PhaseTrakker Jr.** At less than half the price of the AP30 Field Unit / Hotstick Unit bundle, EDM's PhaseTrakker Jr is a phase identification tool in one small package. Like the Standard AP30 Field Unit, the Jr requires GPS, and can store readings when cell service is not available. It incorporates non-contact sensing and uses standard AP30 Reference Units.

How to Order

For information on ordering, visit www.edmlink.com or contact EDM at info@edmlink.com or 970-204-4001.



Warranty and Service

Limited Warranty

EDM International, Inc. (EDM) products are warranted against defects in materials and manufacturing for one (1) year from date of shipment. In the event of product failure due to materials or workmanship, EDM will repair or replace the product.

EDM and its suppliers, and its licensors shall in no event be liable for any damages arising from the use or inability to use this product. This includes business interruption or any other loss which may arise from the use of this product.

Service and Support

For service and technical support, visit www.edmlink.com or contact EDM at support@edmlink.com or 800-687-4196. Products returned for service require prior authorization.

Service Contracts

Service contracts are available for AP30 Field Units, Hotstick Units, and Reference Units. Contact EDM at support@edmlink.com or 800-687-4196.



EDM
reliability & innovation

EDM International, Inc.
4001 Automation Way
Fort Collins, CO 80525 USA
Tel: (970) 204-4001
Fax: (970) 204-4007
www.edmlink.com

Technical Support
(800) 687-4196
support@edmlink.com