APP Engineering, Inc.

APP-601 Multifunction Recorder

Featuring The
APP-601 Multifunction Recorder
DFR, SER, DDR, PMU, PQ, TW

RECORDING EQUIPMENT & ACCESSORIES FOR

-Distribution –Subtransmission –Transmission –Power Plants

-Wind Power –Solar Power –Industrial Plants

EXCEEDING NERC PRC-002-02

www.appengineering.com

Mission Statement

APP Engineering's mission is to become a leading provider of multifunction recording instrumentation and analysis software. In this quest, we pledge to provide high quality state of the art equipment and software, superior customer service, and competitive prices.

Our Profile

APP Engineering is an OEM (Original Equipment Manufacture) that specializes in the design, manufacturing. programming, and testing of multifunction recording instruments. Our equipment is primarily used by electric utility companies and large industrial plants to record power line interruptions, faults, disturbances, and power quality. APP Engineering is a customer oriented business with open access to top level management and product design engineers. The Directors of the company bring more than 50 years of combined experience as original equipment manufactures.
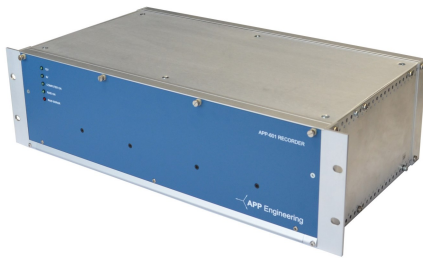
Our Quality Policy

APP Engineering, Inc. is committed to meeting customer specifications, customer satisfaction, quality of products, and on time shipments. We will achieve these by complying with the quality management system requirements of ISO9001:2015 and continually improving its effectiveness.
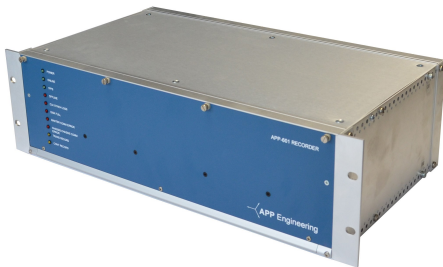
APP Engineering, Inc. is an ISO 9001:2015 - ANSI/ISO/ASQ Q9001-2015 Certified Company.

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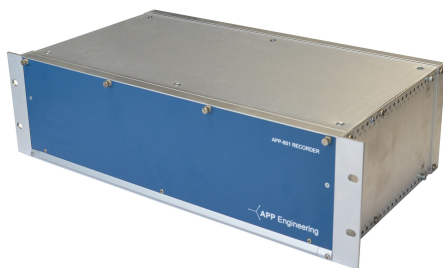www.appengineering.com

MULTIFUNCTION RECORDER (DME)
DFR, SER, DDR, PMU, PQ, TW

RUGGED COMPUTER CONTROL CHASSIS

MORE VERSATILITY WITH THE APP-601 Recorder

- **IP Addressable**
- **Distributed Or Centralized Architecture**
- **Expandable To Hundreds of Analog and Event Channels**
- **Reduced Chassis Depth (9.8")**
- **No Fans, Option for No Moving Parts**
- **Increased Operating Temperature Range**
- **Interoperability with APP-501 Recorder**
- **Tremendous Configuration and Integration Flexibility**
- **Multiple Data Chassis, One Easy To Retrieve Record**
- **Exceeds NERC PRC-002-02 & Regional Requirements**
- **Lightning and Distance to Fault Correlation**
- **Redundant Computer Control Option**
- **Traveling Wave Fault Location Option**

DATA CHASSIS - ANALOG & EVENTS

MONITOR & KEYBOARD CHASSIS
OPTIONAL

Centralized or Distributed Installation

General (APP-601)

Applications

- Transmission
- Generation
- Distribution
- Research
- Power Quality Monitoring
- Traveling Wave Fault Location

Features

Hardware:

- Main hardware
  Computer Control Chassis (one/system)
  Data Chassis (usually multiple/system)
  Monitor & Keyboard Chassis (option)
- Distributed or Centralized architecture
- Place multiple data chassis in a single panel, disperse them among several panels, or different buildings while maintaining a single all encompassing easy to retrieve COMTRADE record.
- Independent data chassis operation, if one chassis stops the others continue to operate
- Ethernet based
- Easy expandability
- All chassis IP configurable
- Fiber optic interface option
- Fanless
- No moving parts (option)
- High operating temperature (option)
- Short data chassis depth (9.8") for easy physical wiring, rack mountable
- Data aligned to 1PPS within 1usec
- Modulated or un-modulated IRIG-B
- Internal or external 1PPS
- Each analog channel can be configured for voltage or current input
- Wide voltage and current input range
- DC coupling
- Hot swappable cards
- Internally or externally wetted event cards
- Wide event card voltage range
- Pluggable event and alarm card connectors
- 8 output relays (16 optional)
- Easy plug and unplug power supply board
- Easy access power supply modules
- Easy access embedded computer board
- Excellent EFT and oscillatory immunity
- Simultaneous recording functions
- Traveling Wave Fault Location—Option

Features

Software:

- OS: Win 7, 10, Server, or Linux
- Main Software Programs
  APP Recorder
  APP ClearView (master station software)
- APP Recorder runs as a service
- APP ClearView is the master station analysis software and can be run locally at the recorder and run remotely on the master station computer
- Communication and file transfer is between APP ClearView and APP Recorder
- Secure protocol between Recorder and Clearview, password protections, and IP address permission settings
- Network, modem, DNP-3 communications
- Update APP ClearView from APP website
- Update recorder software via APP ClearView (master station software)
- Simple and intuitive recorder and master station configuration
- Setup the recorder configuration locally or from the master station and download
- View real-time metering, oscillographs, and event status at the recorder or via RDP from the master
- Toggle the recorder power from ClearView
- Mappable Alarm Outputs
- COMTRADE records directly from recorder
- Many automatic task such as; Com Names file naming, PQDIFF format, diagnostics, calling, polling, emailing, pushing records via FTP, record backups, software updates, alarm reporting, trace file generation, and printing
- Many manual functions such as; calling, test run, reboot, reinitialize, and defrag
- File transfer feature allows master station user to delete, cut, copy, or paste any file at the recorder and allows any file transfer between master station and recorder.
- Event channels configurable as DFR, SER, or both.
- Multiple triggers per analog channel
- Cross Triggering Ethernet or Hardwire
- Easy PMU Setup, Stream Multiple Lines
- IEC 61850 Goose Capture Digital, into SER
- PQDIFF, DNP3, MODBUS

Functions (APP-601)

Transient Oscillography Recording

Transient recording rates are 1200, 2400, 4800, 9600, 16,800 19,200, and 24,000 Hz. Voltages, currents, and events are recorded before, during, and after the fault. Each data sample is time stamped for convenient protection analysis, circuit breaker operation, clearance times, and waveform overlaying. Hundreds of Analog and Event channels can be simultaneously recorded and contained in a single record.

Transient records can be started by the following analog channel triggers:

- Voltage (over, under, both)
- Over current
- Frequency (over, under, both, step)
- Positive, Negative, and Zero Sequence
- THD and Harmonics
- Active Power (over, under, both, ROC for Osc.)
- Frequency Step & Sign for Osc. Detection

- Reactive Power (over, under, both)
- Impulse
- Rate of change for all
- Duration setting for all
- PQ: Voltage Sag, Swell, Dip, Surge
- Flicker
- Automatic post fault retriggering

TRIGGERED TRANSIENT RECORDING   SAMPLING 1.2KHz TO 24KHz   RECORD LENGTHS TO 40 SEC.
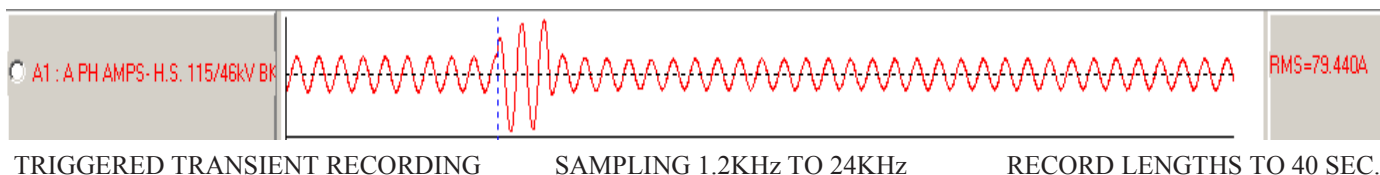
Extended Oscillography Recording

An extended oscillography record is generated each time the recorder trips and creates a transient record. The recording rates are 240, 480, 600, 960, or 1200 Hz. The maximum record length is 40 minutes. Data is recorded before, during, and after the fault. This feature is useful for calculating a variety of power system quantities, re-close events, and stability status. APP ClearView zoom, drag & drop, and signal converting features allow for fine detail viewing and analysis.

TRIGGERED EXTENDED RECORDING   SAMPLING 240Hz TO 1.2KHz   RECORD LENGTHS TO 40 MIN.

Extended RMS Recording

An extended RMS record is generated each time the recorder trips and creates a transient record. Analog inputs are sampled at 1 sample per cycle or slower. This RMS file is smaller in size and can be retrieved faster than the extended oscillography. Data is recorded before, during, and after the fault.

TRIGGERED EXTENDED RMS RECORDING   DOWN TO 1 RMS POINT/CYCLE   RECORD LENGTHS TO 40 MIN.

Functions (APP-601)
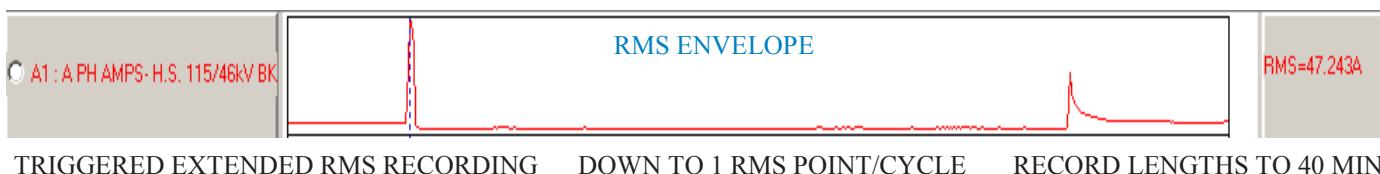
Continuous RMS, Frequency, and RMS + Phase Recording

All three recordings are enabled with a single setting. Data is recorded up to 99 days in a circular buffer. The user can retrieve any time slice over the recorded period. All channels or specific channels can be retrieved. Subtle events that may not have tripped the recorder can be retrieved and analyzed. By retrieving Phase + RMS data information such as apparent power, active power, reactive power, power factor, and phase impedances can be derived for long periods of time.

Files are automatically packed in COMTRADE format and named using the IEEE Com Names convention. Many APP ClearView features are available for fine detail viewing and analysis. After retrieving records, the Y-Scale can be changed to view very small deviations in RMS, frequency, or phase values.

As shown, Y-Scale set to "optimize" for displaying small changes in amplitude
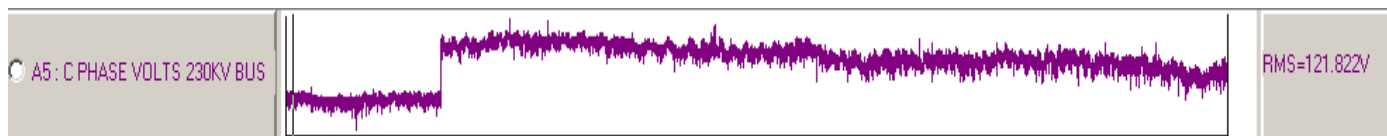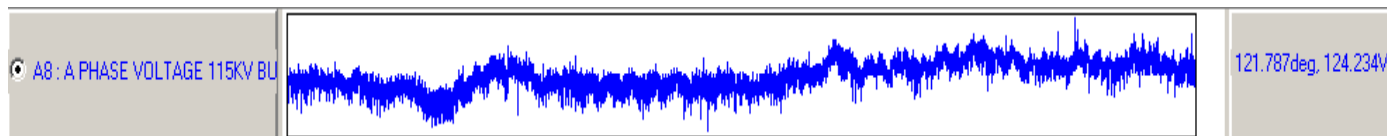

CONTINUOUS RMS RECORDING   DOWN TO 1 RMS POINT EACH CYCLE   RECORD LENGTHS TO 99 DAYS

ZOOM FOR DETAIL
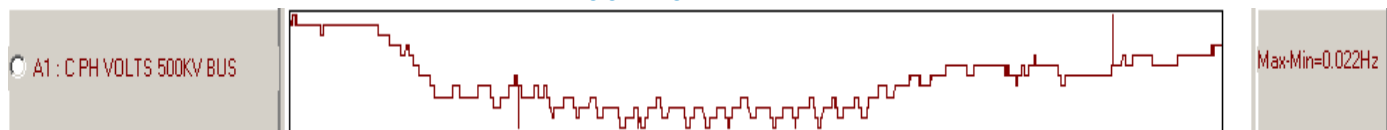
CONTINUOUS FREQ. RECORDING   1 POINT PER SEC. SLIDING WINDOW   RECORD LENGTHS TO 99 DAYS

CONT. RMS+PHASE RECORDING DOWN TO 1 RMS & PHASE POINT EA CYCLE RECORD LENGTHS TO 99 DAYS
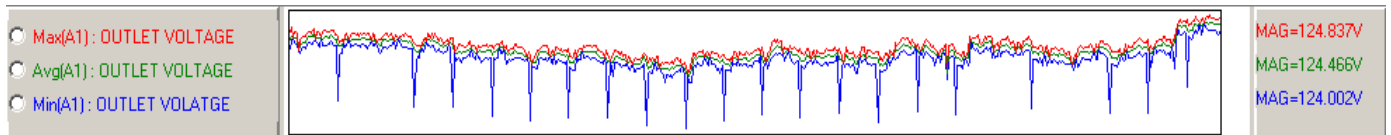
Continuous Oscillography Recording

Continuous oscillography recording rates are 240, 480, 600, 960, or 1200Hz. Data is recorded in a circular buffer having a typical period of 14 days. The user can retrieve any time slice over the recorded period. All channels or certain channels can be retrieved. Subtle events that may not have tripped the recorder can be retrieved and analyzed. Power and impedance values can be derived. Files are automatically packed in COMTRADE format and named using the IEEE Com Names convention. Many APP ClearView features are available for fine detail viewing and analysis.
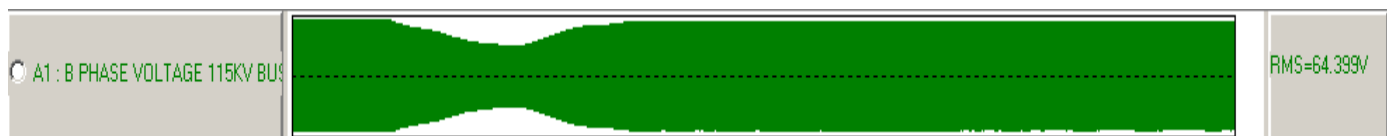
CONTINUOUS OSCILLOGRAPHY   SLOW SAMPLING 240Hz TO 1.2KHz   RECORD LENGTHS 14 DAYS or More

Functions (APP-601)

## Continuous Trending RMS and Frequency

Trends for these 2 continuous recording functions can be recorded for up to 99 days. The user can retrieve any trend time slice for the recorded period. All channels or specific channels can be retrieved. Maximum, Average, and Minimum trend plots are available for the continuous RMS, and Frequency recordings. If a user retrieves trend data they will view 3 plots (Maximum, Average, and Minimum) per channel. As shown below, the Y-Scale in the analysis software can be adjusted to show small changes in amplitude.

○ Max(A1) : OUTLET VOLTAGE		MAG=124.837V
○ Avg(A1) : OUTLET VOLTAGE		MAG=124.466V
○ Min(A1) : OUTLET VOLATGE		MAG=124.002V

CONTINUOUS TRENDING   CALCULATION INTERVAL DOWN TO 1 MIN.   RECORD LENGTHS TO 99 DAYS

Continuous One Cycle Snap Shot

For your power quality personnel, the APP-601 Recorder can capture a one cycle snap shot every minute (adjustable) at the transient sampling rate. This steady state information can be retrieved and viewed with APP ClearView or any other 3rd party power quality software. The systems ability to automatically put this information in PQDIFF format is useful for viewing with commercially available power quality software. Data is recorded in a circular buffer for up to 99 days. All channels or specific channels can be retrieved.

DATA SAMPLES SHOWN

○ A1 : B PHASE VOLTAGE 115KV BU   MAG=-41.875V
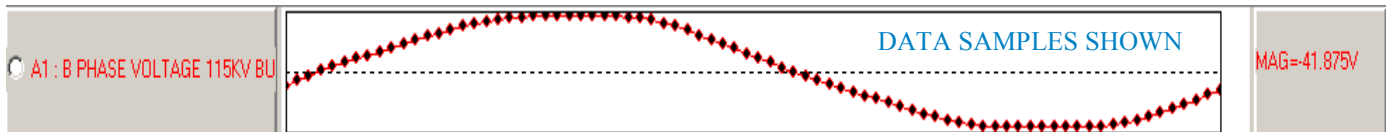
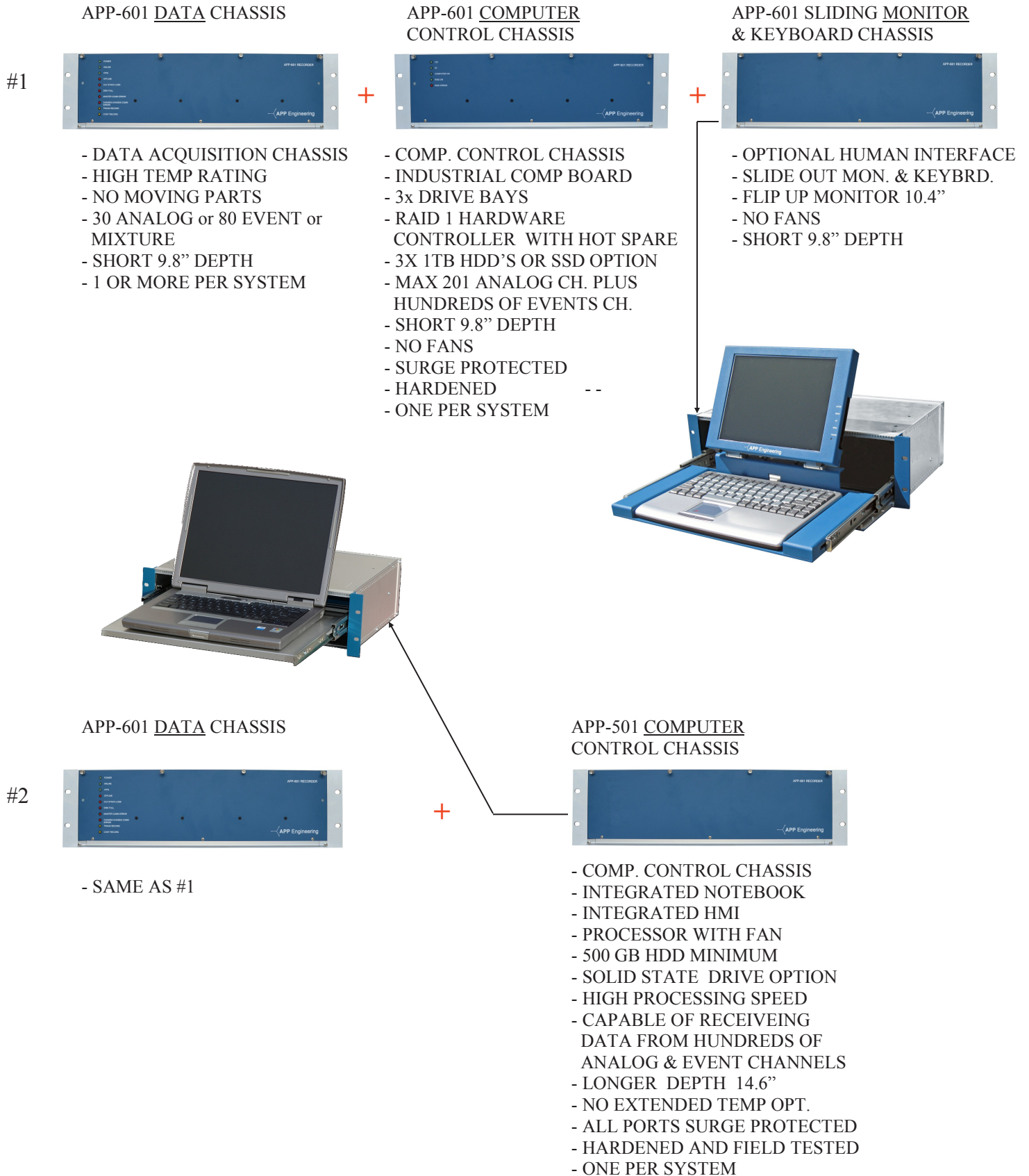TRANSIENT RATE OSCILLOGRAM   STEADY STATE PQ ANALY.   CAPTURED DOWN TO 1/MIN FOR 99 DAYS

Continuous Flicker, Harmonics, and Unbalance

For your power quality personnel, the APP-601 Recorder can capture Flicker, Harmonics, and Unbalance data once every 10 minutes.

- Flicker   (IEC 61000-4-15), P_{ST} Up To 1620 CPM, (13.5Hz)
- Harmonics (IEC 61000-4-7),   Max up to 13th and THD, with Max/Avg/Min Plots
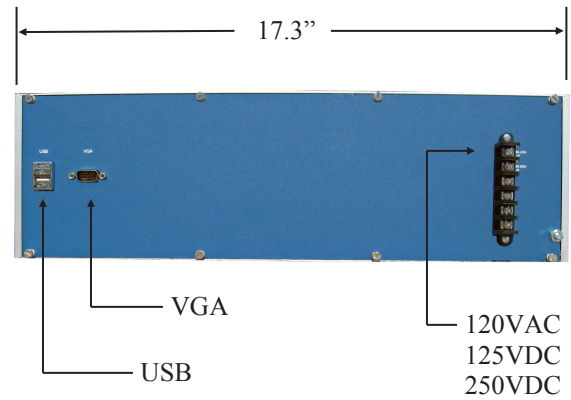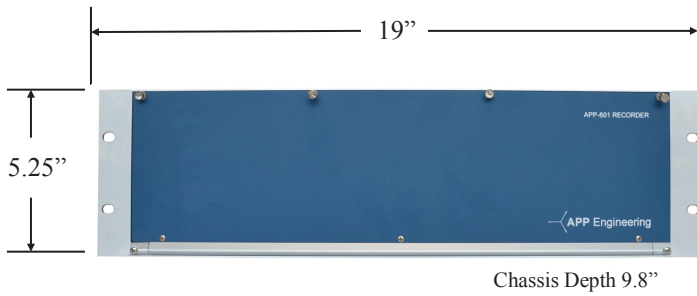- Unbalance (IEC 61000-4-30), 0seq/+seq, with Max/Min/Avg Plots
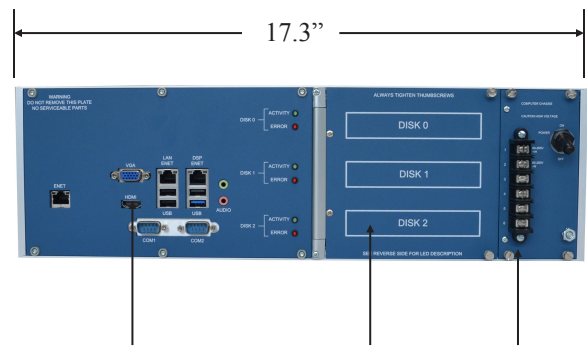
Hardware Choices (APP-601)

APP-601 <u>DATA</u> CHASSIS   APP-601 <u>COMPUTER</u> CONTROL CHASSIS   APP-601 SLIDING <u>MONITOR</u> & KEYBOARD CHASSIS

#1

 + +

- DATA ACQUISITION CHASSIS
- HIGH TEMP RATING
- NO MOVING PARTS
- 30 ANALOG or 80 EVENT or MIXTURE
- SHORT 9.8" DEPTH
- 1 OR MORE PER SYSTEM

- COMP. CONTROL CHASSIS
- INDUSTRIAL COMP BOARD
- 3x DRIVE BAYS
- RAID 1 HARDWARE CONTROLLER WITH HOT SPARE
- 3X 1TB HDD'S OR SSD OPTION
- MAX 201 ANALOG CH. PLUS HUNDREDS OF EVENTS CH.
- SHORT 9.8" DEPTH
- NO FANS
- SURGE PROTECTED
- HARDENED   - -
- ONE PER SYSTEM

- OPTIONAL HUMAN INTERFACE
- SLIDE OUT MON. & KEYBRD.
- FLIP UP MONITOR 10.4"
- NO FANS
- SHORT 9.8" DEPTH

APP-601 <u>DATA</u> CHASSIS   APP-501 <u>COMPUTER</u> CONTROL CHASSIS

#2

 +

- SAME AS #1

- COMP. CONTROL CHASSIS
- INTEGRATED NOTEBOOK
- INTEGRATED HMI
- PROCESSOR WITH FAN
- 500 GB HDD MINIMUM
- SOLID STATE DRIVE OPTION
- HIGH PROCESSING SPEED
- CAPABLE OF RECEIVEING DATA FROM HUNDREDS OF ANALOG & EVENT CHANNELS
- LONGER DEPTH 14.6"
- NO EXTENDED TEMP OPT.
- ALL PORTS SURGE PROTECTED
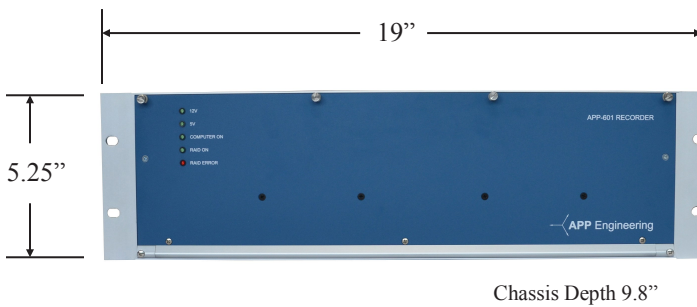- HARDENED AND FIELD TESTED
- ONE PER SYSTEM

- THE APP601 RECORDER IS EXTREMELY FLEXIBLE AND AS SUCH, SUBSTITUTIONS FOR OTHER COMPUTER CONTROL EQUIPMENT AS WELL AS HMI'S CAN BE ACCOMMODATED.

Chassis Layout (APP-601)

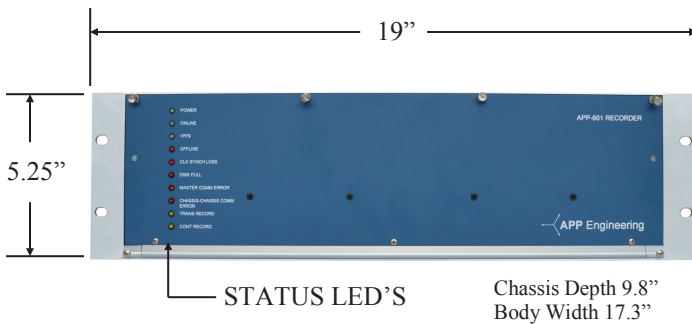## Optional - APP-601 Sliding Monitor & Keyboard Chassis

19"

5.25"

APP-601 RECORDER

APP Engineering

Chassis Depth 9.8"

17.3"

USB   VGA

VGA

USB

120VAC
125VDC
250VDC

APP-601 Computer Control Chassis

19"

5.25"

12V
5V
COMPUTER ON
RAID ON
RAID ERROR

APP-601 RECORDER

APP Engineering

Chassis Depth 9.8"

17.3"

WARNING
DO NOT REMOVE THIS PLATE
NO SERVICEABLE PARTS

ENET

VGA   LAN ENET   DSP ENET

HDMI

COM1   USB   USB   AUDIO

DISK 0   ACTIVITY   ERROR

DISK 1   ACTIVITY   ERROR

DISK 2   ACTIVITY   ERROR

ALWAYS TIGHTEN THUMBSCREWS

DISK 0

DISK 1

DISK 2

POWER

PORTS
ENET(3), HDMI,
USB (4), VGA,
COM (2), AUDIO

DRIVES
3 BAYS, RAID 1,
PLUS HOT SPARE,
HOT SWAPPABLE,

POWER
120VAC
125VDC
250VDC

APP-601 Data Chassis

19"

5.25"

POWER
ONLINE
1PPS
OFFLINE
CLK SYNCH LOSS
DISK FULL
MASTER COMM ERROR
CHASSIS-CHASSIS COMM ERROR
TRANS RECORD
CONT RECORD

APP-601 RECORDER

APP Engineering

STATUS LED'S

Chassis Depth 9.8"
Body Width 17.3"

- 10 slots available for Analog, Digital, or TW Cards (slots 1-6, 8-11)
- Fill with all Analog Cards for 30 Analog Channels
- Fill with all Digital Cards for 80 Event Channels
- Fill with all Traveling Wave (TW) Cards for 10 Lines
- Mix the chassis with a combination of all Card types
- Analog Cards have 3 channels configurable for voltage or current
- Event Cards have 8 channels & pluggable connector
- DSP Card is fixed in the 7th slot
- Alarm Card is fixed in the 12th slot (8 relay outputs)
- Traveling Wave Fault Location Board Option (not shown)

1PPS
In/Out

IRIG-B

DSP

DIGITAL

ALARM

ANALOG

Notes - Power Supply Card in Slot 13
- Term 1 & 2 Power Input Universal
- Term 3 & 4 Power Out for Enet Switch
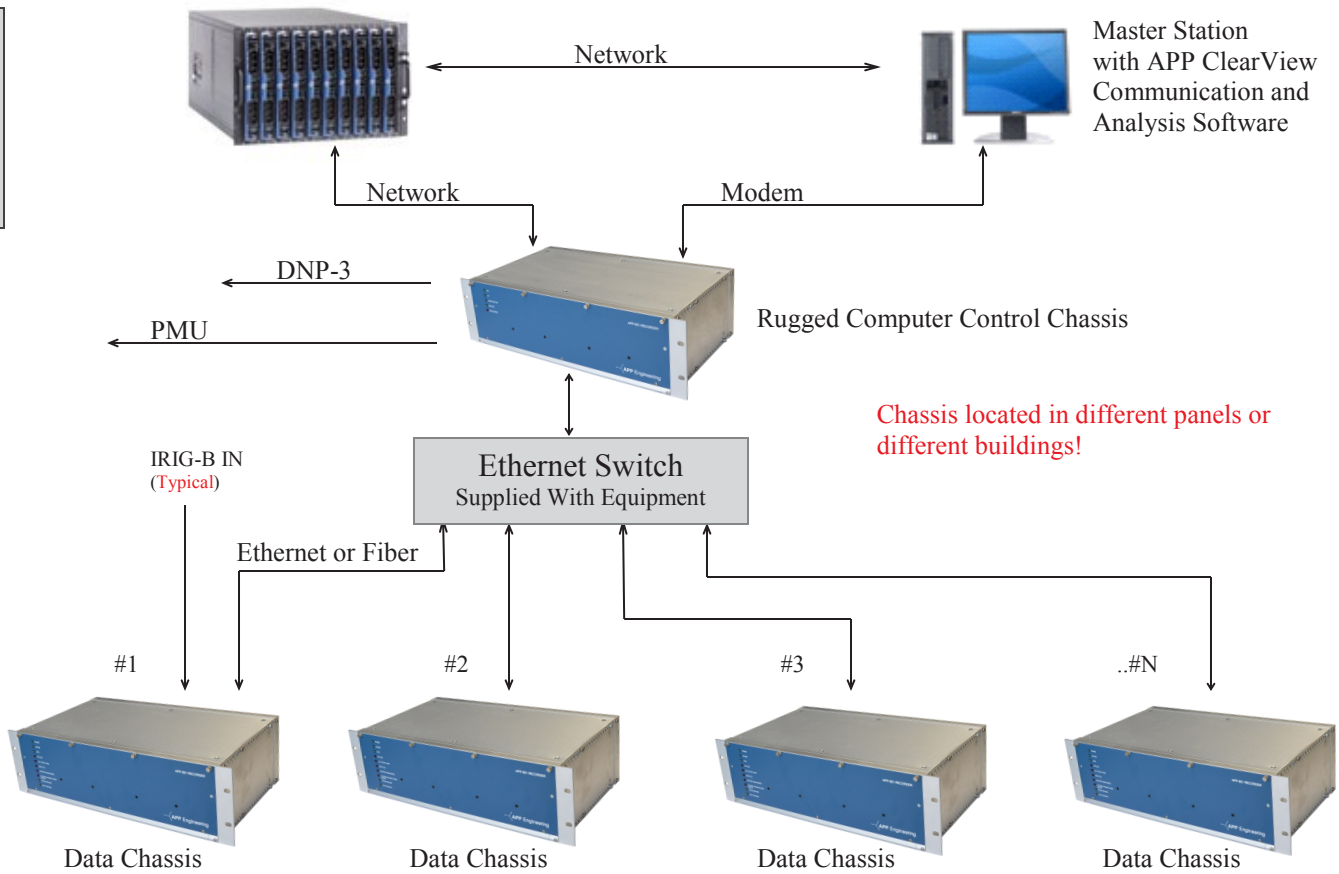- Term 5 & 6 Power Out for Comp Chassis

A complete system can have hundreds of analog and digital channels
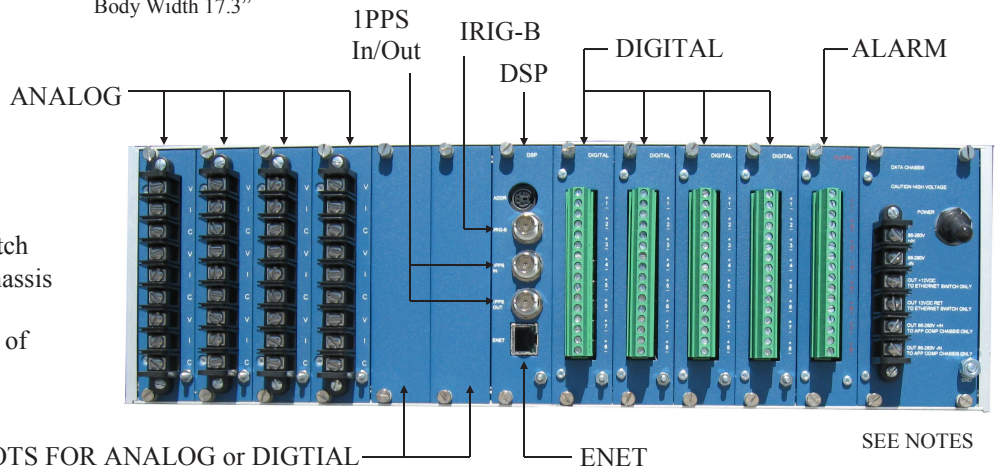
EXPANSION SLOTS FOR ANALOG or DIGTIAL

ENET

SEE NOTES

9

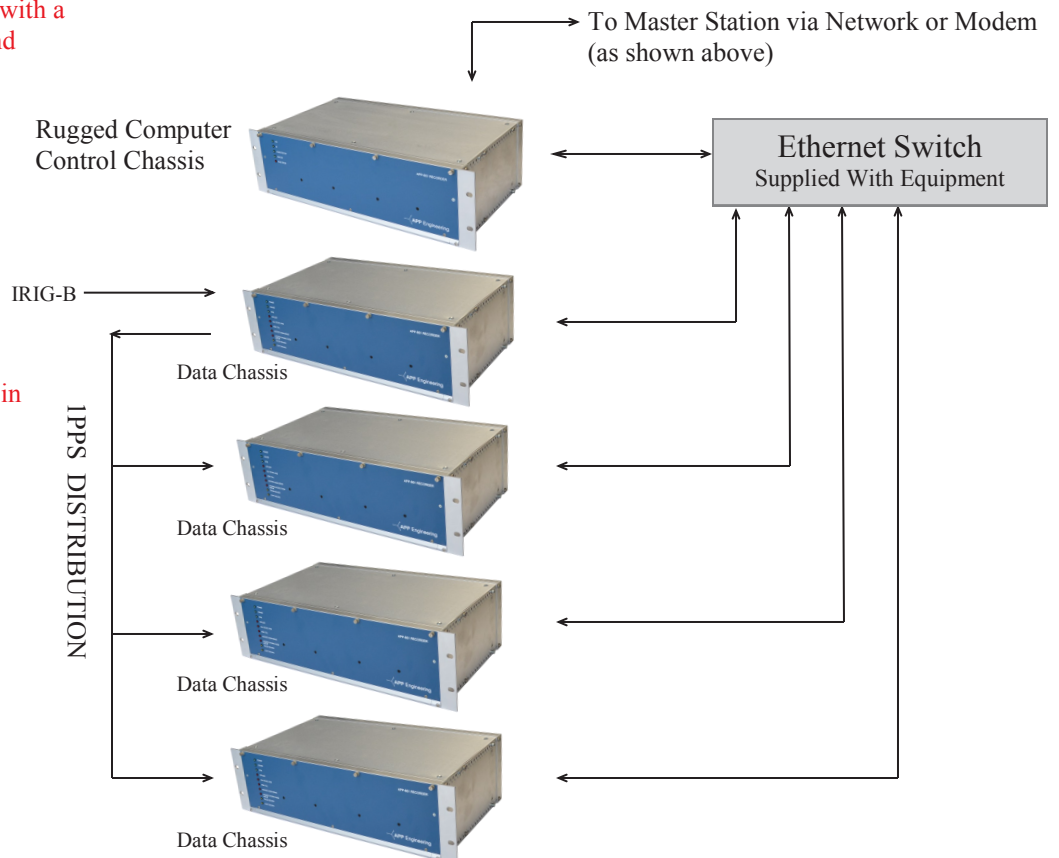# Configurations (APP-601)

Distributed

Network

Master Station with APP ClearView Communication and Analysis Software

Network

Modem

DNP-3

Rugged Computer Control Chassis

PMU

Chassis located in different panels or different buildings!

IRIG-B IN
(Typical)

Ethernet Switch
Supplied With Equipment

Ethernet or Fiber

#1 — Data Chassis

#2 — Data Chassis

#3 — Data Chassis

..#N — Data Chassis

Centralized

Chassis can be arranged with a mixture of centralized and distributed architecture

To Master Station via Network or Modem (as shown above)

Rugged Computer Control Chassis

Ethernet Switch
Supplied With Equipment

IRIG-B

Data Chassis

All or majority of chassis located in the same panel

1PPS DISTRIBUTION

Data Chassis

Data Chassis

Data Chassis

Data Chassis

Configurations (APP-601)

Reduce installation time and cost by purchasing a turn-key system.
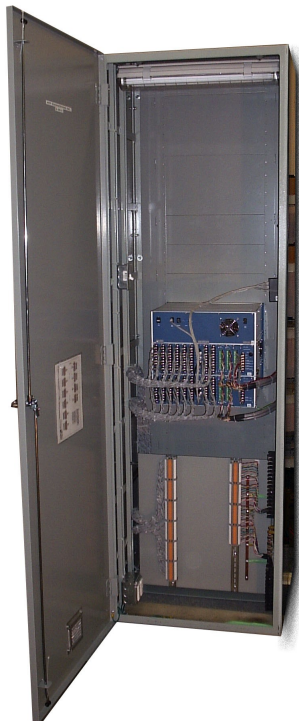
- Any cabinet or panel size
- Manufactured to your specifications
- Analog terminal blocks: straight strap, sliding link, or knife blade
- Event terminal blocks: straight strap, sliding link, or knife blade
- Test Switches
- Lights
- Convenience Receptacles
- Complete Wiring
- Complete software setup
- Comprehensive Testing
- Quick Turn
- Affordable
- Wall Mount Enclosures Available

Specifications (APP-601)

Analog Channels

Voltage:
   Up to 30 analog channels per chassis
   Up to 440VAC Max (66.4/115V RMS)
   AC or DC Input
   Burden 0.045VA@67V, 0.144VA@120V
   Accuracy 0.1% of Full Scale, Calibrated
   *If using Aux CT it outputs a voltage 5A=0.5V, calibrated
      current accuracy 0.1% of Full Scale.
   *If using Aux CT/Shunt 1A or 5A RMS Nominal.
Current:
   2mΩ Internal Shunt
   Burden 0.05VA@5A, 0.45VA@15A
   15A RMS Continuous
   140A RMS for 2 sec, 250Arms for 1/2 sec
   Accuracy 0.61% of reading + .005% of
   range (typical)
General:
   16 Bit A/D
   Data aligned with 1PPS rising edge
   Ch to Ch phase angle error <0.004°
   Cut-off frequency (-3db) 5KHz
   Common Mode Rejection 80dB Min
   Temperature Error 70ppm/°C
   Channel to channel isolation 3500VDC
   Channel to ground isolation 3500VDC

Event Channels

Up to 80 event channels per chassis
Standard input operating range 45-250VDC
125VDC Contacts, Settable for N.O. or N.C.
(Option 24VDC available)
(Option Cards with Internal Wetting Voltage)
Channel to channel isolation 3500VDC
Channel to ground isolation 3500VDC

Power Supply

Voltage Range: 86 to 370 VDC and
 88 to 264 VAC
Frequency Range: 47 to 63 Hz
Overload, Over Voltage,
Over Temperature Protection
Power @ 125VDC and 54 analog channels
and 96 event channels is approximately 140W
Input to ground isolation 3500VDC

Timing

Modulated or Un-modulated IRIG-B
Data aligned to 1PPS within 1usec
1PPS in/out chassis to chassis

Communications

Recorder to Master Station Com:
   TCP/IP Ethernet 10/100
    Fiber (option, Multi or Single Mode)
    Modem
 Chassis to Chassis Com:
   Ethernet 10/100
   Fiber (option, Multi or Single Mode)
 IEC 60870-5 (SCADA) for DNP3/Modbus
Com: TCP/IP or RS232
 Modbus Com: TCP/IP
 PMU Com: Ethernet or RS232
   (TCP,UDP,UDP-T,UDP-U)
 IEC61850 Goose Capture Digital

Status Relays

8 alarm outputs, N.O. or N.C, SPST
Contact ratings: 10A Cont. & Break 0.5A @
   125VDC, Break 0.35A @ 250VDC,
   Dielectric 5KVac
Alarms (Mappable)
   Power, Online, Offline, Clock Sync Loss,
   Chassis to Chassis Comm., Master Comm.,
   Disk Full, Temperature, Computer,
   Transient Record, SOE Record, Disturbance
   Record, Continuous Record, Analog Ch,
   Comp Health (additional outputs available)

Enclosure

19" Rack x 5.25"H x 9.8D"
Many cabinet/panel sizes available

Compliant Standards

ANSI/IEEE C37.90.1 (Surge Withstand)
IEC 60255-22-1 Cat III (Osc.)
IEC 60255-22-4 Cat IV (EFT)
IEC 60255-5 (Isolation, Impulse Cat III)
IEC 60068-2 –1 (Cold)
IEC 60068-2-2 (Hot)
IEC 60068-2-30 (Damp Heat)
ANSI/IEEE C37.111 (COMTRADE)
ANSI/IEEE C37.232-2007 (Com Names)
IEEE C37.90.3-2001 (ESD)
IEC 61000-4-6:2008 (Immun./Cond.RF)
IEC 61850 Goose Capture Digital
IEC 60870-5 (SCADA, DNP3/MODBUS)

Environment

Standard temperature range 0 to 55° C
Limiting factor is the computer HDD
Extended temperature option –25 to 70° C
Data Chassis –25 to 70° C standard
Humidity 0 to 95% non-condensing

Specifications (APP-601)

System Computer Options
APP-601 Computer Control Chassis
- Intel Atom Processor Quad-Core
- 4GB DDR3-1600 RAM
- 3x SATA-300, RAID1 + Hot Spare
- Drives Plug and Play, Hot Swappable
- 3x 10/100/1000 Mbs Ethernet Ports
- 1x VGA, 1x HDMI
- 1x Line Out Audio
- 4x USB 2.0, 1x USB 1.0
- Temp Range –20° to 70° C w/ SDD
- Power Requirement: 25W 3x HDD
- Power Input: 86-370VDC, 88-264VAC
- Frequency Range: 47 to 63Hz
- Processes up to 201 Analog Channels
- Win7, Win10, or Linux OS

Optional Monitor & Keyboard Specs
APP-601 Monitor & Keyboard Chassis
- Slide Out Monitor and Keyboard
- Keyboard with integrated 2 button touchpad
- Membrane key switches for longer life
- 88 Keys including 12 function keys
- 10.4" LCD flip up screen
- 800 x 600 Resolution, 262K Color
- 180:1 Contrast Ratio
- VGA Input, Wide Viewing Angle
- Power Input 125VDC, 250VDC, 120VAC
- Power Consumption 15W
- Temperature Range 5 to 55° C
- Humidity Up To 90% Operating
- Power On/Off Button
- Enter, Down, Up, & Menu Buttons
- 9.8" Chassis Depth
- Rear Power, VGA, USB Connectors

APP-601 Computer Chassis

APP-601 Monitor & Keyboard Chassis Optional

Or

APP-501 Computer Control Chassis
- With Cooling Fan
- Notebook Computer - Surge Tested
- Intel Dual Core 2GHz, 800MHz Buss
- 4GB RAM or better
- 1TB HDD Typical for OS and Data
- Solid State Drive Option (SLC)
- Processes at least 220 Analog Channels
- 1x Ethernet 10/100, 1x Ethernet Converter,
- 1x USB Rear, 3x USB Internal, 1x RS232 Rear
- Internal Modem, Integrated 15" Monitor
- Integrated Keyboard and Touch Pad
- 8x DVD / RW
- Std Temp Range 5 to 55° C, No Battery
- See Picture on Page 9

Other Recorder Options
- Redundant Computer
- Extended Temperature Range
- Additional Alarm Outputs
- Satellite Controlled Clock For Multiple IED's
- Traveling Wave Fault Location (Board and CT's)
- Computer Upgrade
- External HDD or Flash Disk
- Recorder Printer
- Fiber Optic Chassis To Chassis Interface
- Portable Configuration
- Clamp On CT
- APP ClearView™ Multi-User License
- Master Station Computer
- Extended Warranty
- Service Contract

Software APP Recorder [™]

The APP Recorder[™] Program provides another means for human interface, controls the functionality of the Recorder, and includes many features to make setup quick and easy. APP Recorder runs as a system service. It automatically starts when the recorder is powered up, and automatically restarts if a user exits the program. Permissions, passwords, administrative rights, and allowable IP addresses can be setup to limit access to important settings and sensitive information. Major duties of the APP Recorder program are listed below.

View		Configure	
Fault number	Event Status	Point assignments	Auto-Call-In
Recorder Settings	Analog Trigger Status	Line groups	Passwords
RMS Metering	SER Log	Printing	Emailing
Frequency Metering	Communication Status	Directories	FTP
Phase Metering	Distance to Fault	Auto Backups	PMU

All critical settings can be configured locally or remotely and downloaded

Easy single click software updates via APP ClearView

View real-time phase voltages and currents, analog triggers, event status, and perform any required calibration with the "Oscope Function"
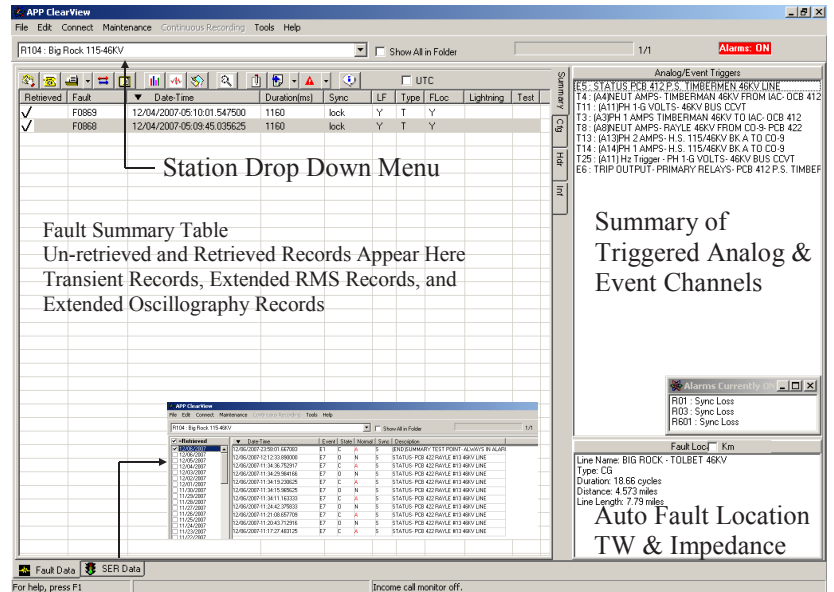
Software APP ClearView ™

One of APP Engineering's premier strengths is our ability to provide time saving, valuable, and user-friendly software. Years of experience in software development, logical algorithm formulation, engineering, mathematics, and customer service, has given us the tools to provide world class software solutions. Our commitment to provide software that is truly valuable is enhanced by our ability to respond quickly to customer requested changes and upgrades.

The APP-601 Recorder™ includes our **APP ClearView**™ **Program** and our **APP Recorder**™ **Program**. The APP ClearView™ program is run on your master station computer and it is loaded on the recorder for "on the spot" record review and analysis. Use this software to not only view COMTRADE records from your APP Recorder but open any COMTRADE record for viewing and analysis. The APP ClearView™ Program will run on Windows 95, 98, NT, 2000, XP, Vista, 7, or 10. Call or email us today for a demo version of APP ClearView.

APP ClearView™ -summary table

View	Configure	Functions
Fault number	Printing	Easy station selection
Triggered channels	Directories	Manually retrieve data
Fault date	Backups	Auto retrieve data
Fault time	Auto polling	Test runs
Synch status	Passwords	Diagnostics
Event reports	Emailing	Time check
Fault location	Phone numbers	Time synch
Polling report	IP addresses	Recorder restart
Recorder config	Point assignments	Recorder updates
Comm. status	Line groups	Sorting
	Recorder setup	Analysis

JUST DOUBLE CLICK ON A RETREIVED FAULT RECORD AND SEE THE DATA IN THE GRAPHICS SCREEN

Station Drop Down Menu

Fault Summary Table
Un-retrieved and Retrieved Records Appear Here
Transient Records, Extended RMS Records, and
Extended Oscillography Records

Summary of
Triggered Analog &
Event Channels

Auto Fault Location
TW & Impedance

POWERFUL FAULT ANALYSIS SOFTWARE

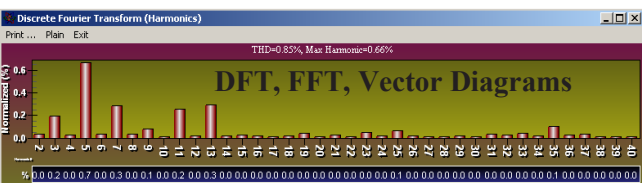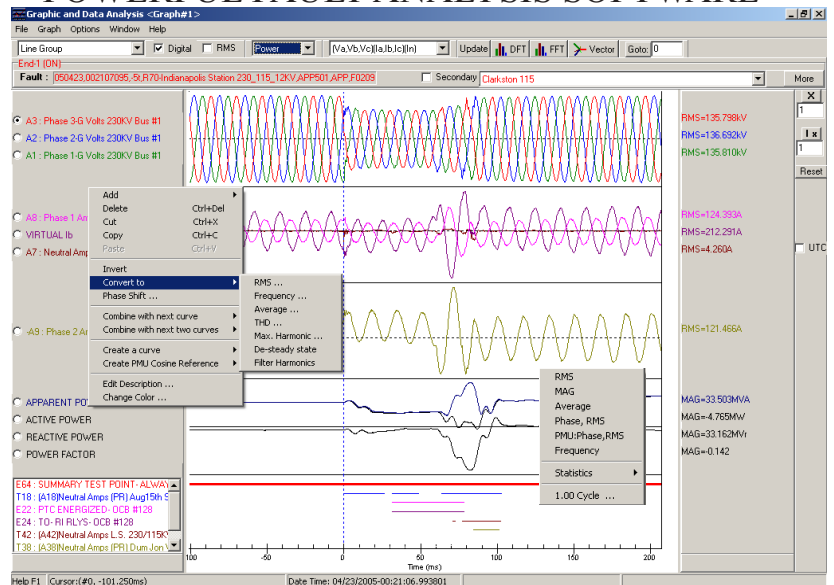## APP ClearView™-analysis

Highlights
Quick viewing of retrieved records
Open any COMTRADE record
Overlay or merge 2 records
Re-Save data in binary or ASCII
Multiple setups for viewing channels
Drag & drop waveforms
Convenient screen resizing
Versatile digital viewing
Easy zoom in, zoom out, Y-scale setup
User annotation drag & drop
Extended printout capabilities
Export

Measurements & Math
Magnitude, RMS, DC, Phase
Frequency, Peak, Average,
Max, Min, Max-Min, Positive
Sequence, Negative Sequence,
Zero Sequence, Add, Subtract,
Invert, Phase shift, Wide Vari-
ty Of Math Functions, FFT,
Vector, Delta Measurements,
Cut, Copy, Paste, Filter Har-
monics, Double Ended Fault
Location

DFT, FFT, Vector Diagrams

Drag & Drop Waveforms, Open Any COMTRADE Record, Open Multiple Graphics Screens Simultaneously

APP-00848 Split Core Current Transformer ™

Applications
√ Watt-hour meters
√ Sub-metering
√ Power Monitoring
√ Current Measurements
√ Over/Under Current Sensing

Features
√ High Accuracy
√ Low Phase Angle Error
√ Small Size
√ Nickel Alloy Core
√ Removable Leg

Specifications
Standard: 5A=0.5V
Accuracy: 0.5A to 100A 0.6% @ 60Hz
Continuous Rating 100A
Maximum Current 130A
Max Phase Angle Error: +/-60min @ 60Hz
Voltage Rating: 600VAC
Bandwidth: 40Hz to 1KHz
Operating Temperature: -20ºC to 50ºC
Operation: Indoor
Case Material: ABS Thermoplastic
Removable Leg Screws: Knurled Nylon
Overallsize: 2"H x 2.5"W x 1"D
Conductor Thru Hole Diameter: 0.4"
Up to 100' Twisted Leads
Black Wire Pos. W/ Arrow Towards Current Source

Ordering Information
Part Number = APP-00848-XXXmV
Where XXX = Your Desired Millivolt
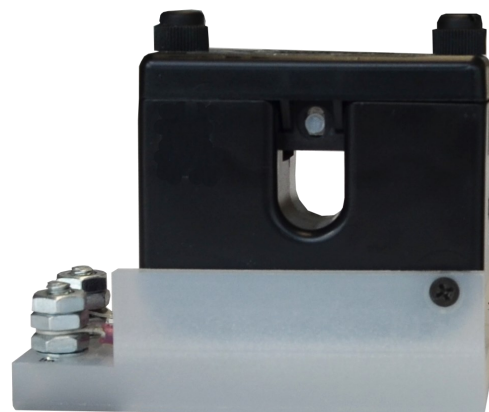Output with 5 Amps Through the Primary

Example: APP-00848-500mV
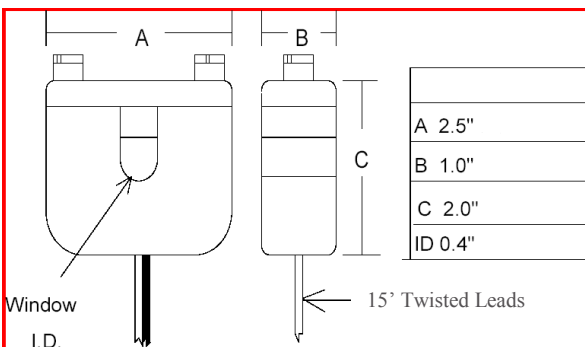Example: APP-00848-125mV

APP-00848 Clamp On CT
Tested from 0.5A to 120A @ 60Hz
Tested and Calibrated with EXTERNAL 100KΩ and 50nF
to Simulate DFR Analog Channel Input

	A 2.5"
	B 1.0"
	C 2.0"
	ID 0.4"

Window I.D.

15' Twisted Leads
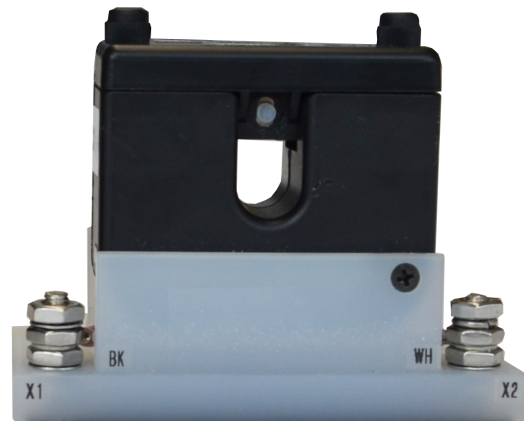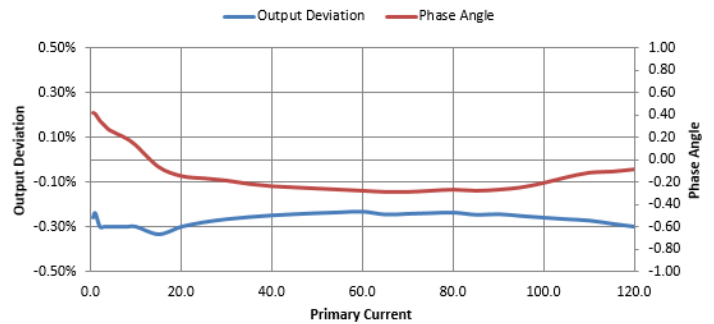
Assembly P/N: APP00849 for 5A=500mV

Assembly P/N: APP00851 for 5A=500mV

Notes
- Based on your desired output voltage, CT turns ration will be adjusted to meet published specifications.
- Internal resistors are 1/4W.
- Longer lead lengths available.
- Removable leg contains a lapped spring loaded core that mates with the precision core in the main housing.

APP-601 Portable Multifunction Recorder ™

APP00281 (Shown)

Uses & Specifications

Use for Emergency Investigation of Power System Problems, Extended Monitoring and Recording of Events on Transmission or Distribution Lines, Case Studies, or Research.
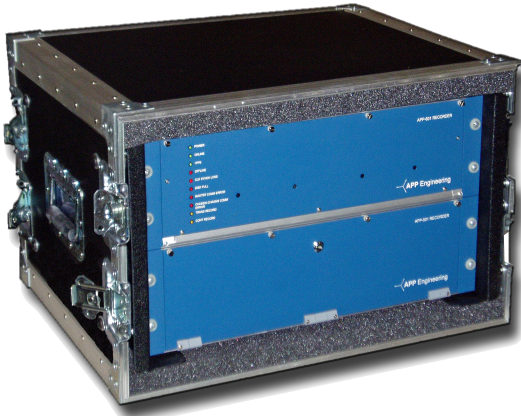

Dimensions	25.5" x22" x14"
Total Weight	49 Lbs
Weight without Covers	33 Lbs
Power	Universal 120VAC, 220VAC 125VDC, 250VDC 80W @ 125VDC
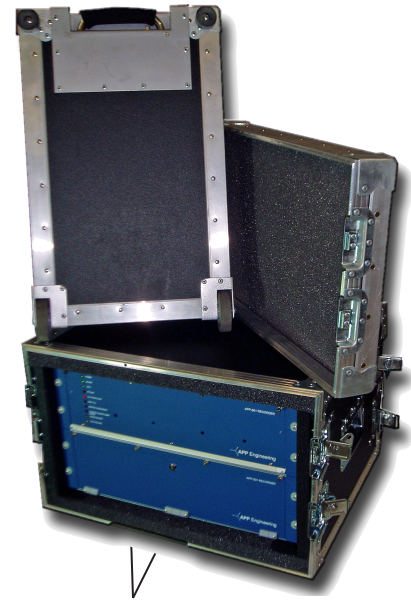
Easy Latch Protective Covers

(Optional) Carrying case with handles, wheels, removable front cover, removable rear cover, retractable pull handle, front & rear rack mounting rails, and interior foam walls. The exterior is capped off with aluminum U-Cap edging for enhanced strength and protection.

Extending Handle and Rolling Wheels Make the APP-601 Easily Portable To Take Into the Field
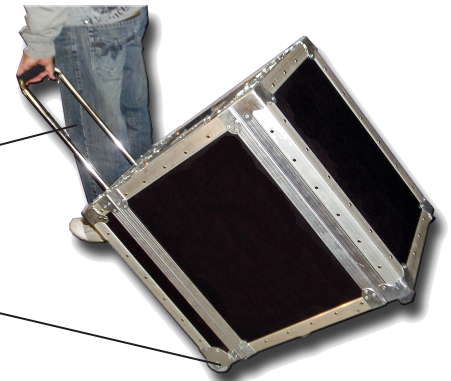
Includes

- Ten Slots for Analog and/or Digital Cards
  (Shown with 9 Analog Channels, 16 Digital Channels)
- On Board APP Clear View Analysis Software
- Eight Alarm Outputs (Shown)
- APP-501 Comp. Chassis w/ Pull Out Drawer
- APP-601 Data Chassis
- AC Power Cord
- Chassis to Chassis Interconnecting Cables
- Protective Carrying Case (Can also Be Purchased without Case)
- Option: Purchase Data Chassis Only and Use Your Computer

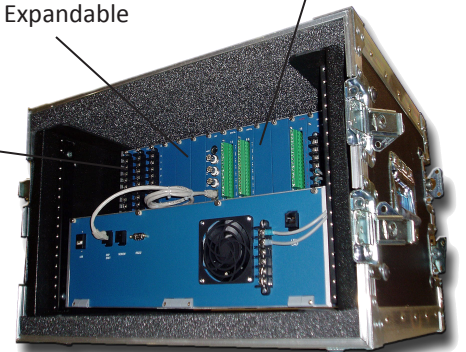See APP-601 Sales Literature for Recording Details and Other Options

Easy Access Computer with Slide Out Drawer

8 Channels per Digital Card

Expandable

3 Channels per Analog Card

APP Engineering, Inc.

APP Traveling Wave Fault Location

Summary

The APP traveling wave technology is a scalable and configurable solution that can locate a fault with high accuracy. With an accuracy of 200 feet or better, this will significantly reduce the down-time of correcting the fault.

Add to any existing APP-601 system. Can create any configuration of analog, digital and/or just traveling wave boards in each data chassis (over one million different configurations)

Both double end and single end configurations are possible

This is an accurate and reliable solution has the bottom line of reducing down time and ultimately saving costs.

Highlights

- High Level of Accuracy

- Double Ended or Single Ended Configurations

- Megahertz Sampling Frequency

- Highly Configurable

- Up to 10 Cards per Chassis

- Low Learning Curve

- Easy to Maintain

- Add to any existing APP-601 Recorder

- 10-Year Warranty on All Traveling Wave Hardware
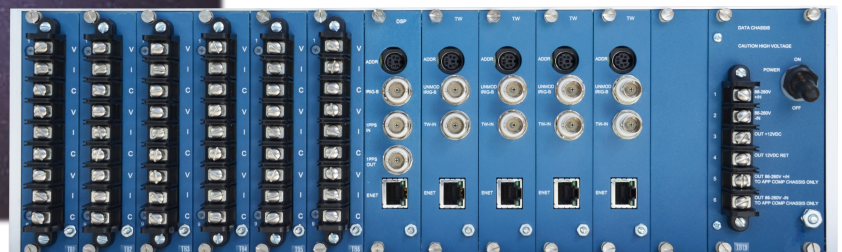
Concept for TW

Travelling wave fault location (TWFL) is a method to determine the location of a fault on an electrical line.

By using the information about the length of the line, the time of when the fault was recorded, and the velocity at which the fault moves along the line (information which is known at the time of setup), the Recorder's TWFL feature can determine the location of the fault along the line.

The Bewley diagram shows the relationship between the fault and the respective reflections being picked up by the DFR(s).
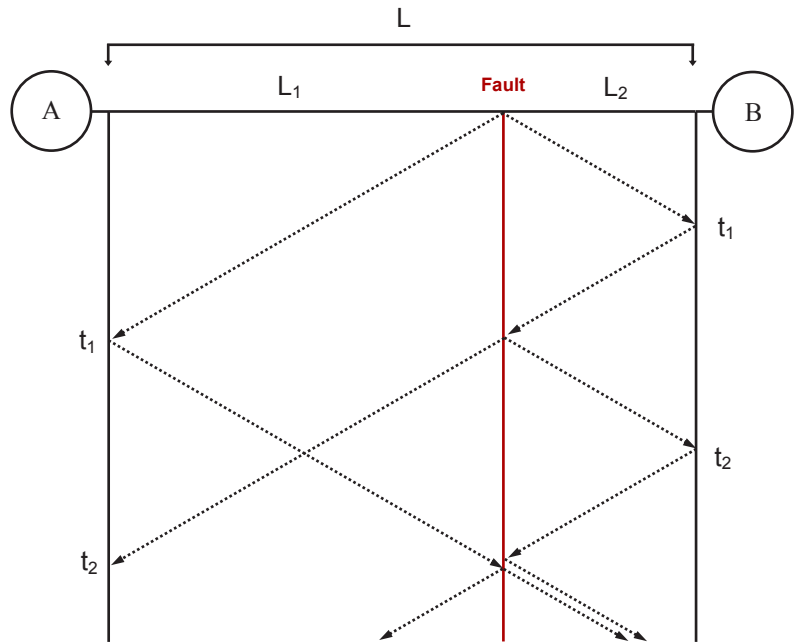
Block Diagram

- The signal is picked up by a high bandwidth, 500:1 CT that connects via BNC

- The signal runs through a high-pass filter which refines the presence of the fault

- The signal is split between a high frequency ADC and a voltage-threshold trigger

- The threshold trigger records the time-mark of the fault at the nanosecond precision and is recorded to the INF file
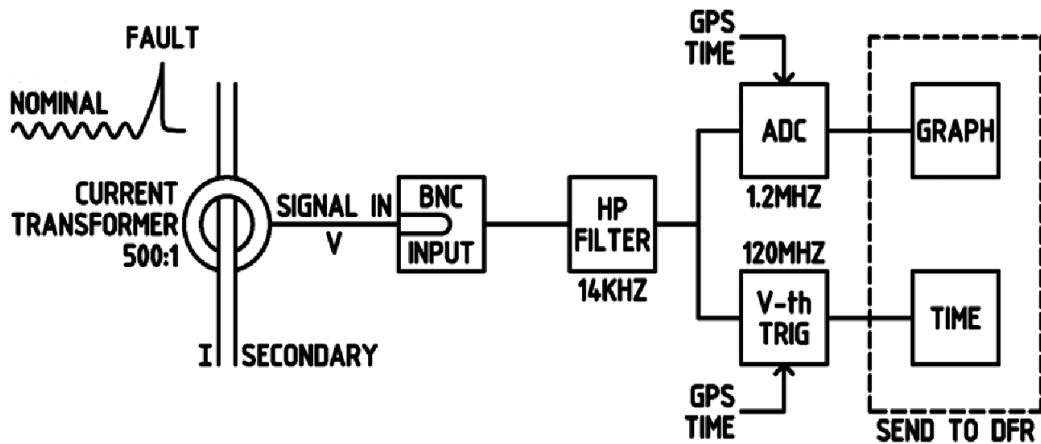
Easy Addition to Any APP Recorder

1) Install traveling wave board
2) Connect unmodulated IRIG-B signal
3) Connect to DFR ethernet switch
4) Install split core traveling wave CT
5) Connect traveling wave CT to traveling wave board
6) Add to DFR setup file

Hardware

- Traveling wave circuit board P/N: **PCBTW-1-POP-KIT**
  Includes: Card, IRIG-B Jumper, BNC-T Ethernet Cable

- Traveling Wave Split Core CT P/N: **APP-00829-TW**
  (with 15' twisted wire leads)

TW Circuit Board
P/N: PCBTW-1-POP

Configurations

- Add traveling wave cards & traveling wave CTs to existing APP DFR/DME data chassis that have open card slots
- Purchase an APP-601 data chassis with traveling wave cards and CTs and add to an existing APP DFR/DME
- Purchase new APP-601 DFR/DME with any combination of Analog, Event, and TW cards
- Purchase a standalone APP-601 DFR/DME in which all cards are traveling wave
- Double ended with communication or double ended no communication or single ended

TW Split Core CT
P/N: APP00829-TW

Note

One traveling wave CT per phase or we recommend one traveling wave CT clamped around phases A, B, C then one traveling wave CT clamped around neutral (2 boards and 2 CT's per line) or just one traveling wave CT clamped on the neutral (1 board and 1 CT per line.

Specifications for TW

Accuracy   <   ±200 feet

Features   Sampling Frequency: 1.2MHz

Trigger Frequency: 120MHz

Programmable Trigger Threshold

Interface & Comm   Viewable Record in COMTRADE

Ethernet to APP DFR Switch

Each TW Card IP Programmable

Fully Integrable with APP DFR (DME)

Alarms   8 Alarm Outputs

Configuration   One Channel per Board

Up to 10 Boards per Data Chassis

Up to 250 Boards per System

Environmental   Temperature: -25° to 70°C

Humidity: 95% Non–Condensing

Warranty   10-year on all traveling wave hardware

CT   500:1 Ratio

100Hz to 1MHz

Connector: via BNC

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The most advanced, affordable, and user friendly recorders on the market