APP Engineering, Inc.™

PRODUCT CATALOG

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

Capable of Meeting
- NERC PRC-002-04
- NERC PRC-028-01
- IEEE-2800
  (Table 19 Applicable Requirements)

RECORDING EQUIPMENT & ACCESSORIES FOR

-Distribution –Sub-transmission –Transmission –Power Plants

-Wind Power –Solar Power –Industrial Plants

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 70 years of combined experience as original equipment manufactures.

Our IMS Policy

It is the policy of APP Engineering, to ensure our clients' requirements are fulfilled regarding provision of quality services and consistently achieving customer satisfaction, we are equally committed to protecting the integrity, confidentiality, and availability of information, while delivering reliable customer services. This policy will be subjected to regular management review to assure the integrated management system is effectively implemented, managed, is meeting established goals and objectives, and strives for continuous improvement. Furthermore, that it remains relevant for the range of products and services provided, and that we meet all applicable legal, regulatory, and industry requirements.

APP Engineering, Inc. is an ISO 9001:2015 - ANSI/ISO/ASQ Q9001-2015 & ISO 27001-2022 Certified Company.

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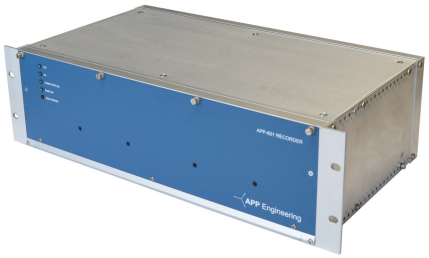
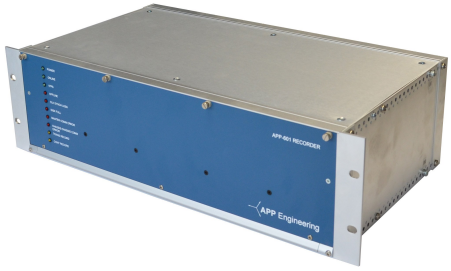
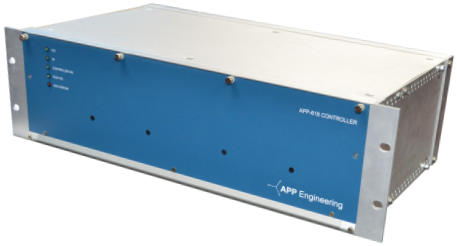
MULTIFUNCTION RECORDER (DME)
DFR, SER, DDR, PMU, PQ, TW, TIR



RUGGED COMPUTER CONTROL CHASSIS



DATA CHASSIS - ANALOG & EVENTS



SV CONTROLLER CHASSIS OPTION

MONITOR & KEYBOARD CONSOLE
OPTIONAL

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, 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 & IEEE Recording Requirements**
- **Lightning and Distance to Fault Correlation**
- **Redundant Computer Control Option**
- **Traveling Wave Fault Location Option**
- **61850 Goose Capture**
- **61850 SV Subscribe Option**

Centralized or Distributed Installation

General (APP-601)

Applications

- Transmission
- Generation
- Distribution
- Research
- Case studies
- Power Quality Monitoring

Features

Hardware:

- Main hardware
  Computer Control Chassis (one/system)
  Data Chassis (usually multiple/system)
  SV Controller Chassis (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
- High operating temperature
- Short data chassis depth (9.8”) for easy physical wiring, rack mountable
- Data aligned to 1PPS within 1usec
- Modulated or un-modulated IRIG-B
- PTP Option
- Internal or external 1PPS
- Each analog channel can be configured for voltage or current input
- Wide voltage and current input range
- AC & DC Measuring Capability
- Hot swappable SSD’s
- Internally or externally wetted event cards
- Wide event card voltage range
- Pluggable event and alarm card connectors
- 8 output relays
- Easy plug and unplug power supply board
- Easy access power supply modules
- Easy access embedded computer board
- Excellent EFT and oscillatory immunity
- Simultaneous recording & PQ functions
- Traveling Wave Fault Location, Option

Features

Software:

- Windows OS: Win 10 Pro, Win 10 IoT
- Option: Linux OS or Win Server
- 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 Clear-view, password protections, and IP address permission settings
- Network, modem, DNP-3 communications
- Update APP ClearView from APP website
- Update recorder software via APP Clear-View (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 be-tween 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 Line Groups
- IEC 61850 Goose Capture
- IEC 61850 SV Subscribe Option
- PQDIFF, DNP3, MODBUS
- File Compare

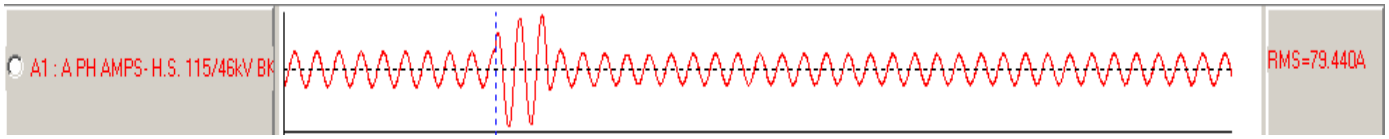
Functions (APP-601)

Transient Oscillography Recording

Transient recording rates at 60 Hz are 2400, 4800, 9600, 11520, 15360, 16800 19200, 24000. 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
- Harmonics
- Active Power (over, under, both)
- Reactive Power (over, under, both)
- Impulse
- Magnitude
- Unbalance
- 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 30.72 KHz RECORD LENGTHS TO 40

Extended Oscillography Recording

An extended oscillography record is generated each time the recorder trips and creates a transient record. The recording rates are 240, 360, 480, 720, 960, 1440, and 1920 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 1.92KHz 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.

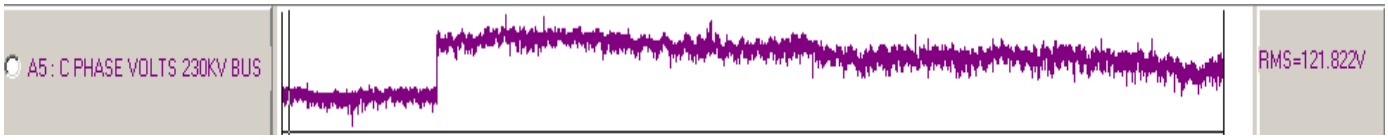
Functions (APP-601)

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.

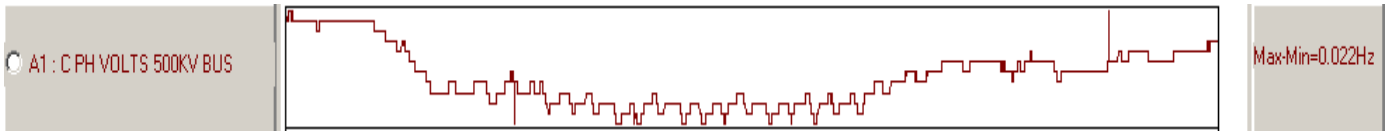
Files are automatically packed in COMTRADE format and named using the IEEE Com Names convention. Many APP ClearView features are available for fine detail viewing and analysis. After retrieving records, the Y-Scale can be changed to view very small deviations in RMS, frequency, or phase values.

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

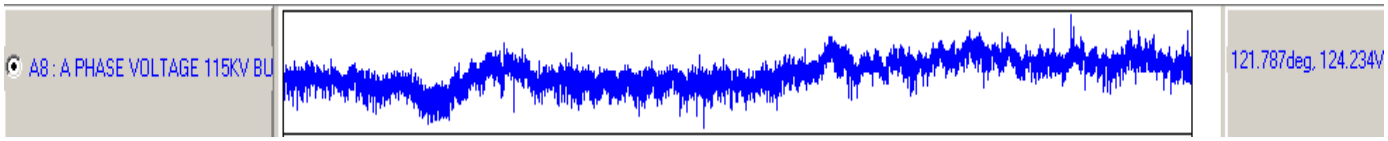


CONTINUOUS RMS RECORDING DOWN TO 1 RMS POINT EACH CYCLE RECORD LENGTHS TO 99 DAYS

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

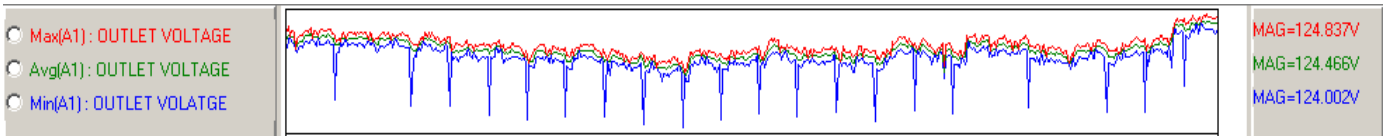
Continuous oscillography recording rates are 240, 360, 480, 720, 960, 1440, and 1920Hz. Data is recorded in a circular buffer having a typical period of 14 days. The user can retrieve any time slice over the recorded period. All channels or certain channels can be retrieved. Subtle events that may not 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 1.92KHz RECORD LENGTHS 14 DAYS or More

Functions (APP-601)

Continuous Trending RMS and Frequency

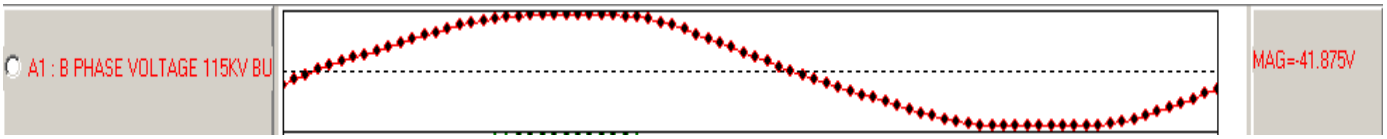
Trends for these 2 continuous recording functions can be recorded for up to 99 days. The user can retrieve any trend time slice for the recorded period. All channels or specific channels can be retrieved. Maximum, Average, and Minimum trend plots are available for the continuous RMS, and Frequency recordings. 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. Daily trend files automatically converted to a COMTRADE record at the end of each day.



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.



TRANSIENT RATE OSCILLOGRAM STEADY STATE PQ ANALY. DATA SAMPLES SHOWN CAPTURED

Continuous PQ Recording

With PQ enabled, APP Recorders will begin creating the following continuous PQ files. In COMTRADE format and ready to view (each one file per day, user defined circular buffer).

- Flicker Files:
  A flicker trend file with Pst & Plt, 10 min and 2 hour recording rates respectively, with max, min, and avg plots for selected voltages channels.
- 3-Second File:
  A 3-second file containing plots for analog channels mapped to an analog trigger with a sample by sample calculation aggregated every 3 seconds using the transient sample rate.
- Trend Files, 10-Minute & Weekly:
  These files are created from the 3 second file and contain max, min, and avg plots for analog channels mapped to a trigger.

PQ recording types can include:

-Flicker Pst & Plt	(61000-4-30)
-RVC at 0.5 Cycles	(61000-4-30)
-HD very short term, 50th, 3sec	(61000-4-7, 61000-4-30)
-HD short term, 50th, 10min	(61000-4-7, 61000-4-30)
-HD long term, 95 weekly percentile, 1-year option	(61000-4-7, 61000-4-30)
-RMS, Unbalance, MW, MVAR and Others	

The methodology significantly follows and is based on the standards above, and related standards, in conjunction with good engineering judgement for digital signal processing and efficient software operation. RVC is limited to the first six triggers per data chassis. Unbalance trigger is limited to two if frequency triggers are used.

Hardware Choices (APP-601)

APP-601 DATA CHASSIS

#1

- DATA ACQUISITION CHASSIS
- HIGH TEMP RATING
- NO MOVING PARTS
- UP TO 30 ANALOG or 80 EVENT CHANNELS OR MIXTURE, SAMPLE RATE DEPENDENT
- SHORT 9.8” DEPTH
- 1 OR MORE PER SYSTEM
- 3RU

+

APP-601 COMPUTER CONTROL CHASSIS

- COMP. CONTROL CHASSIS
- INDUSTRIAL COMP BOARD
- 3x DRIVE BAYS
- RAID 1 HARDWARE CONTROLLER WITH HOT SPARE
- 3X 1TB SSD
- MAX 324 ANALOG CH. PLUS HUNDREDS OF EVENTS CH.
- SHORT 9.8” DEPTH
- NO FANS
- SURGE PROTECTED
- HARDENED
- ONE PER SYSTEM
- OPTION 2TB SSD
- OPTION: 2ND FOR REDUNDANCY

+

APP-618 SV CONTROLLER CHASSIS OPTION

- IEC 61850 SAMPLED VALUES DATA ACQUISITION CHASSIS MULTIPLE STREAMS ETHERNET CONNECTION TO PROCESS BUS
- PTP Clock
- SHORT 9.8” DEPTH3x DRIVE BAYS
- RAID 1 HARDWARE CONTROLLER WITH HOT SPARE
- 3X 1TB HDD’S OR SSD OPTION
- 1 OR MORE PER SYSTEM WHEN SUBSCRIBING SV
- 3RU

+

APP-904 SLIDING MONITOR & KEYBOARD Console

- OPTIONAL HUMAN INTERFACE
- SLIDE OUT MON. & KEYBRD.
- FLIP UP MONITOR 12.1”
- NO FANS
- SHORT DEPTH
- THREE MONITORING DEPTHS
- 1RU

Hardware Choices (APP-601)

#2

APP-601 DATA CHASSIS

- SAME AS #1

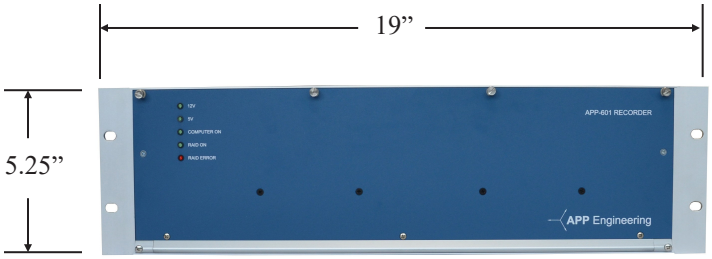
+

APP-501 COMPUTER
CONTROL CHASSIS

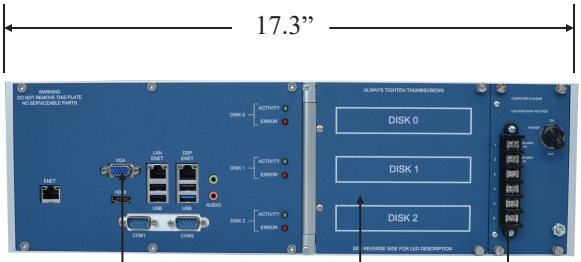
- COMP. CONTROL CHASSIS
- INTEGRATED NOTEBOOK
- INTEGRATED HMI
- PROCESSOR WITH FAN
- 1TB HDD MINIMUM
- SOLID STATE DRIVE OPTION
- HIGH PROCESSING SPEED
- CAPABLE OF RECEIVEING DATA FROM HUNDREDS OF ANALOG & EVENT CHANNELS
- LONGER DEPTH 14.6”
- NO EXTENDED TEMP OPT.
- ALL PORTS SURGE PROTECTED
- HARDENED AND FIELD TESTED
- ONE PER SYSTEM
- 3RU

Chassis Layout (APP-601)

APP-601 Computer Control Chassis



9.8” Deep

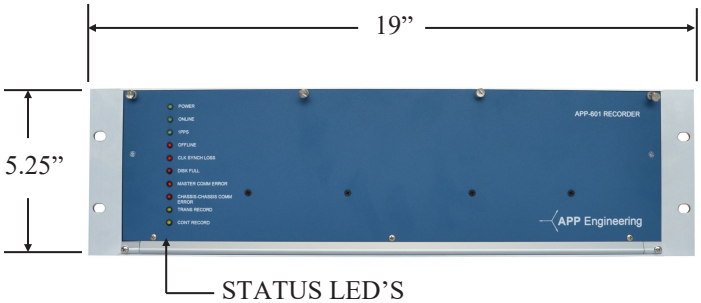


PORTS
ENET(3), HDMI, USB (4), VGA, COM (2), AUDIO

DRIVES
3 BAYS, RAID 1, PLUS HOT SPARE, HOT SWAPPABLE, PLUG & PLAY

POWER
120VAC
125VDC
250VDC
See spec. page for ranges

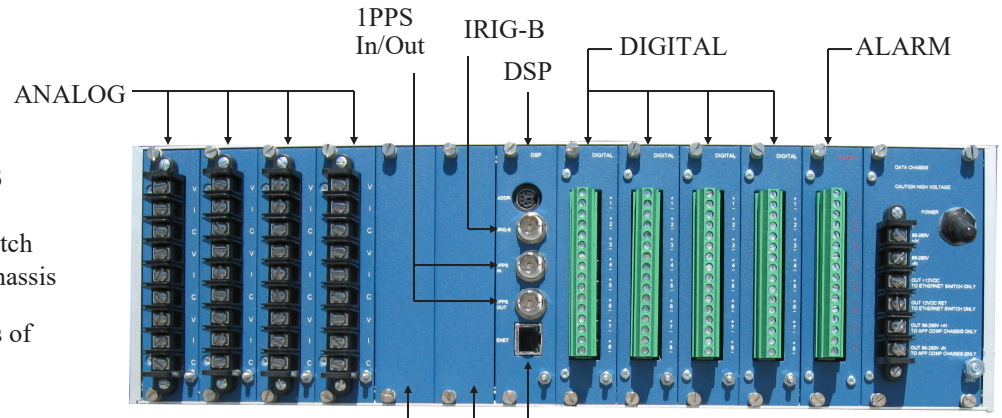
APP-601 Data Chassis



9.8” Deep

- 10 slots available for Analog or Digital Cards (slots 1-6, 8-11)
- Fill with all Analog Cards for 30 Analog Channels
- Fill with all Digital Cards for 80 Event Channels
- Mix the chassis with a combination of Analog & Digital Cards
- 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)
- Sample rate can impact number of analog cards
- Power 120VAC, 125VDC, 250VDC (see spec. page for ranges)

SAMPLE SHOWN

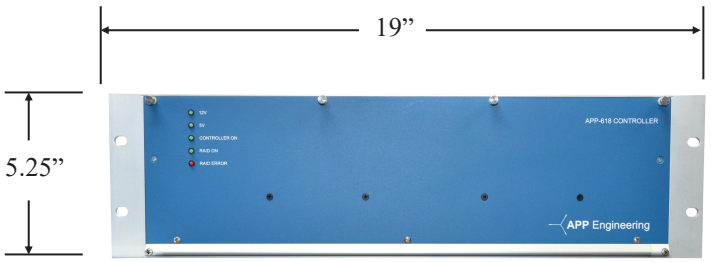


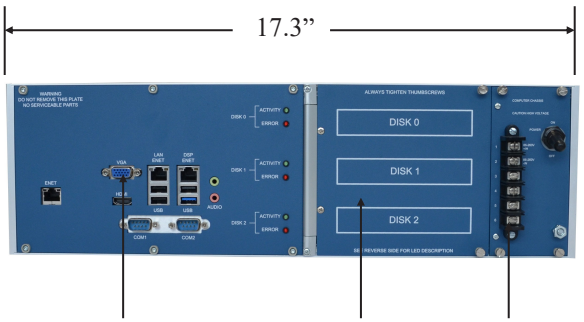
Notes - Power Supply Card in Slot 13
- Term 1 & 2 Power Input Universal
- Term 3 & 4 Power Out for Enet Switch
- Term 5 & 6 Power Out for Comp Chassis

A complete system can have hundreds of analog and digital channels

Chassis Layout (APP-618 Controller)

APP-618 SV Controller Chassis





- IEC 61850 SAMPLED VALUES (SV) DATA ACQUISITION CHASSIS
- HIGH TEMP RATING
- NO MOVING PARTS
- MULTIPLE STREAMS
- SHORT 9.8” DEPTH
- 1 OR MORE PER SYSTEM WHEN SUBSCRIBING SV
- 3RU

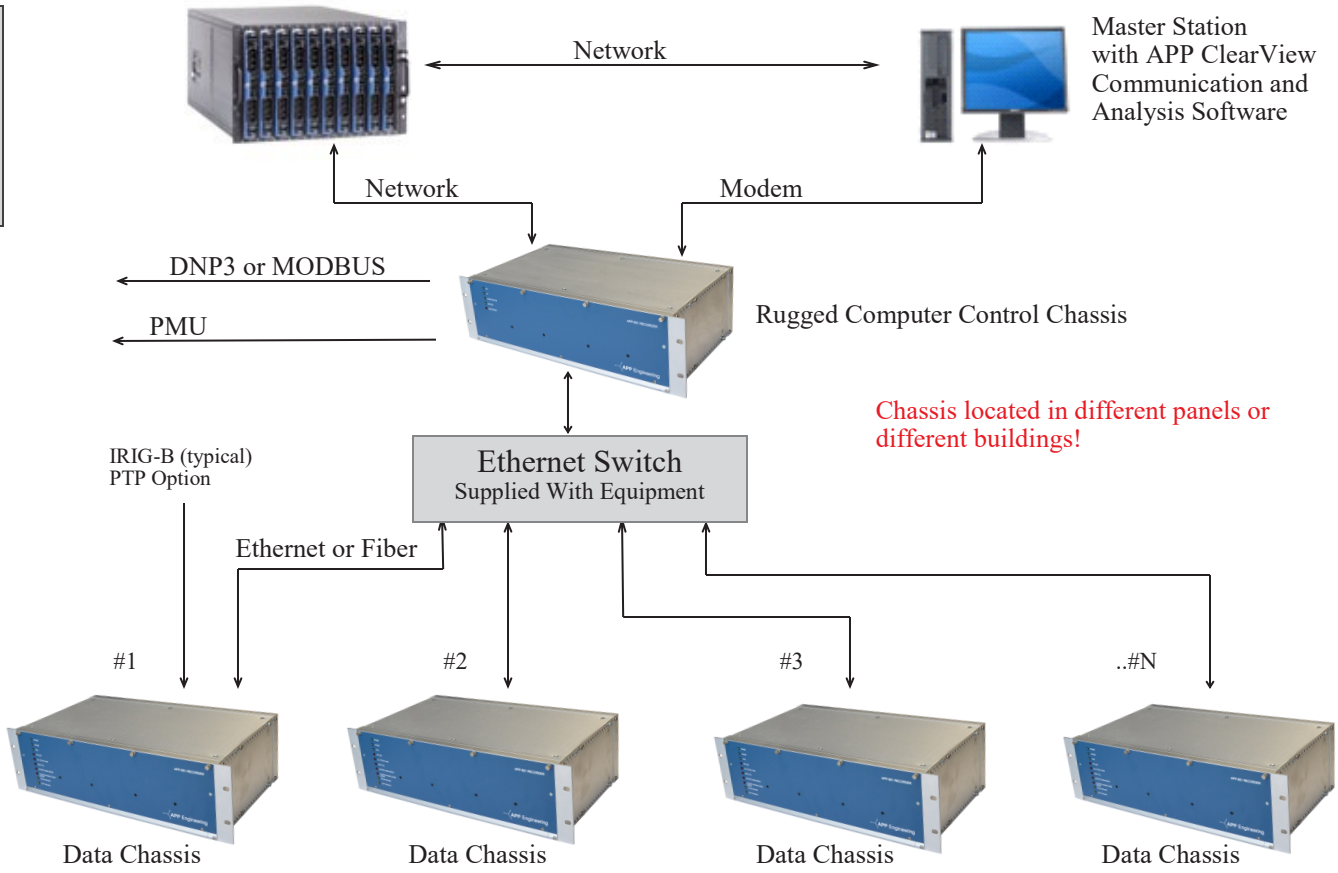
PORTS
ENET(3), HDMI, USB (4), VGA, COM (2), AUDIO

DRIVES
3 BAYS, RAID 1, PLUS HOT SPARE, HOT SWAPPABLE, PLUG & PLAY

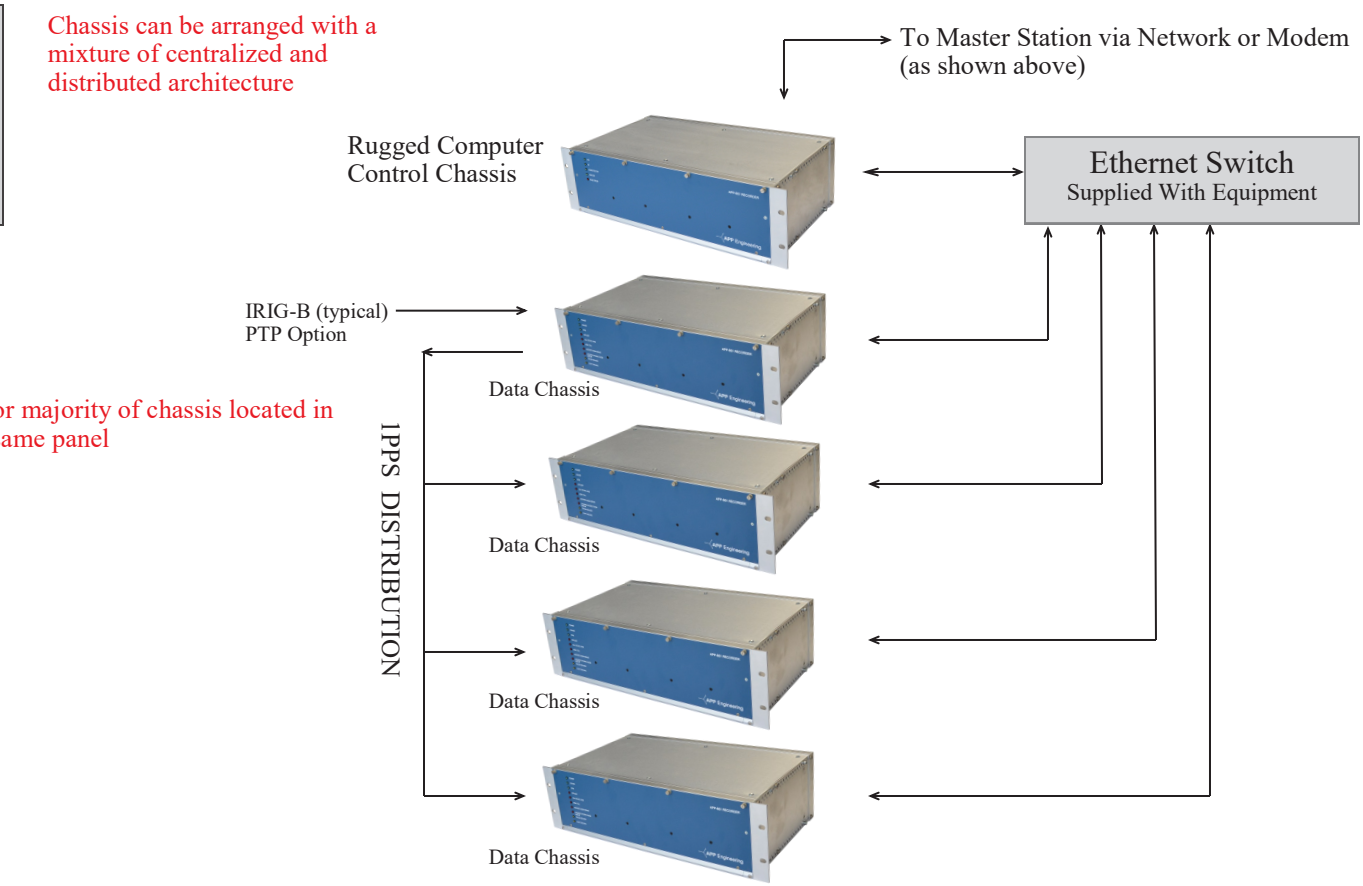
POWER
120VAC
125VDC
250VDC
See spec. page for ranges

Configurations (APP-601)

Distributed



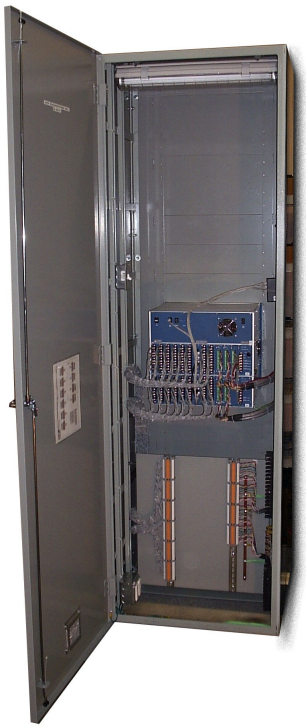
Centralized



Configurations (APP-601)

Turn-key

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
- AC or DC Input
- Burden 0.045VA@67V, 0.144VA@120V
- Accuracy 0.15% of reading + 0.005% of range (typical)

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 <0.004º
- Cut-off frequency (-3db) 5KHz
- Common Mode Rejection 80dB Min
- Temperature Error 70ppm/ºC
- 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
(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
Internal 1PPS backup
PTP Option

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)

DNP3/Modbus Com: TCP/IP or RS232
Modbus Com: TCP/IP
PMU Com: Ethernet or RS232
(TCP,UDP,UDP-T,UDP-U)

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”
(Note, APP-501 Comp Chassis is 14.6” Deep)
Many cabinet/panel sizes available

Compliant Standards

ANSI/IEEE C37.90.1 (Surge Withstand)
IEC 61000-4-2, 4-3, 90.2 (RF Immun., Keying)
IEC 61000-4-17, 90.3 (ESD)
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)
IEC 61000-4-17 (Pwr. Immunity)
IEC 61000-4-5 (Surge DC Ports)
IEC 61000-4-6:2008 (Immun./Cond. RF)
IEC 61000-4-8 & 4-10 (Mag Field Immun.)
ANSI/IEEE C37.111 (COMTRADE)
ANSI/IEEE C37.232-2007 (Com Names)
IEEE C37.118-2011 (PMU)
IEC 61850 (Goose Capture, SV Subscribe)
Plus More

Environment

Standard temperature range –25 to 70° C
Humidity 0 to 95% non-condensing

Specifications (APP-601)

System Computer Options

APP-601 Computer Control Chassis

Intel Atom Processor Quad-Core
8GB DDR3-1600 RAM
3x SATA 1TB SSD's (optional 2TB & 4TB)
Drives Plug and Play, Hot Swappable
3x 10/100/1000 Mbs Ethernet Ports
1x VGA, 1x HDMI
1x Line Out Audio
3x USB 2.0, 1x USB 1.0
RAID 1 plus Hot Spare
Temp Range –20° to 70° C w/ SSD
Power Requirement: 25W 3x HDD, 125VDC
Voltage Range: 86 to 370VDC, 88 to 264VAC
Processes up to 324 Analog Channels
(limitations may apply)
OS: Win10 IoT or Win Server or Linux

APP-601 Computer Chassis

Or

APP-501 Computer Control Chassis
With Cooling Fan
Notebook Computer - Surge Tested
Intel 4-Core 2GHz, 800MHz Buss
4GB RAM or better
1TB SSD Typical for OS and Data
Processes up to 324 Analog Channels
1x Ethernet 10/100, 1x Ethernet Converter,
1x USB Rear, 3x USB Internal, 1x RS232 Rear
Internal Modem, Integrated 14" Monitor
Integrated Keyboard and Touch Pad
Std Temp Range 5 to 55° C, No Battery
See Picture on Hardware Choices Pages

Optional Monitor & Keyboard Specs

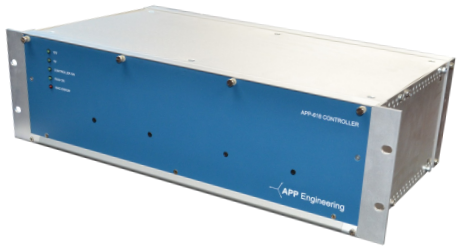
APP-904 Monitor & Keyboard Console

Console, 1RU, (1.75") 19" Rack Mount, 13" Deep
Three Available Mounting Depth, Flush Mount, 2" Mount, 3.5" Mount,
2", and 3.5" allow for greater monitor tilt angle
Rear Ports: 1 USB Type A, 1 LVI-D, 1 VGA, 1 Three Pos Power Terminal Block
Universal Power Input 86-370Vdc, or 88-264Vac, 17W
Power Input Frequency Range 47Hz to 63Hz
Operating Temperature Range –25C to 70C
Storage Temperature Range –30C to 80C
Humidity 0 to 85% Non-Condensing
Pull out drawer with 12.1" flip up Industrial TFT, High Brightness, XGA Monitor, 1024 x 768 Res
Waterproof, Washable Membrane, 104 Key US Layout, with Touchpad
Auto Power-Off via Windows OS
Convenient Front Grip Handle
Easy Glide Ball Bearing Slides

APP-904 Monitor & Keyboard Console
Optional

Other Recorder Options

Redundant Computer
Satellite Controlled Clock For Multiple IED's
Traveling Wave Fault Location (Board and CT's)
Computer Upgrade
2TB or 4TB SSD
External SSD
Recorder Printer
Fiber Optic Chassis To Chassis Interface
Portable Configuration
Clamp On CT
APP ClearView™ Multi-User License
Master Station Computer
Service Contract



APP-618 SV Controller Chassis Option

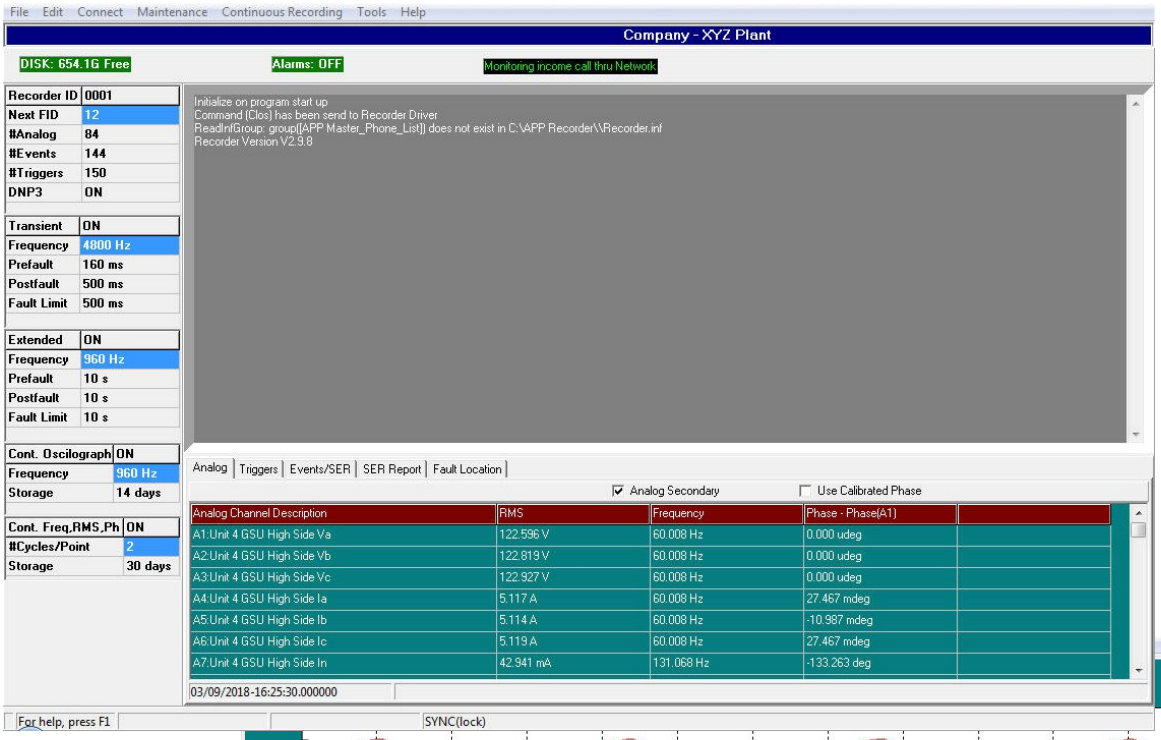
APP-618 SV CONTROLLER CHASSIS OPTION

Intel Atom Processor Quad-Core
8GB DDR3-1600 RAM
3x SATA 1TB SSD's
Drives Plug and Play, Hot Swappable
3x 10/100/1000 Mbs Ethernet Ports
1x VGA, 1x HDMI
1x Line Out Audio
3x USB 2.0, 1x USB 1.0
RAID 1 plus Hot Spare
Temp Range –20° to 70° C
Power Requirement: 25W 3x SSD, 125VDC
Voltage Range: 86 to 370VDC, 88 to 264VAC
OS: Linux
Processes Two SV Streams

Software APP Recorder ™

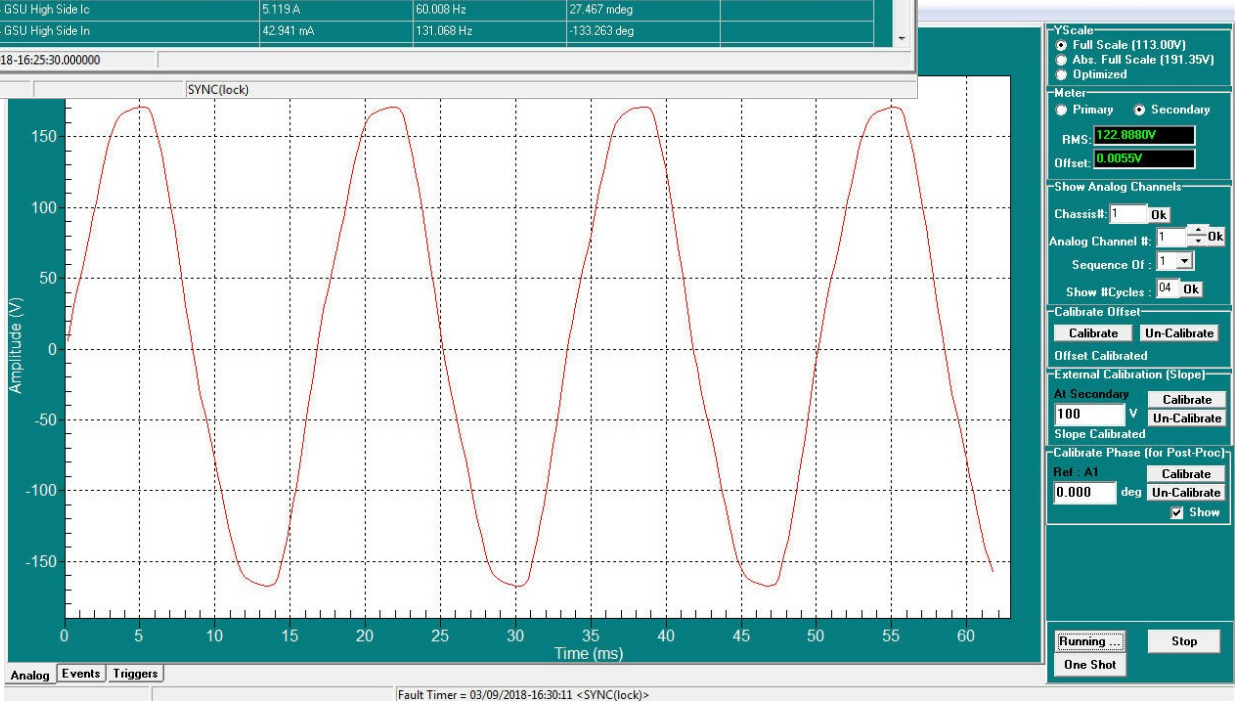
The APP Recorder™ Program provides another means for human interface, controls the functionality of the Recorder, and includes many features to make setup quick and easy. APP Recorder runs as a system service. It automatically starts when the recorder is powered up, and automatically restarts if a user 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”

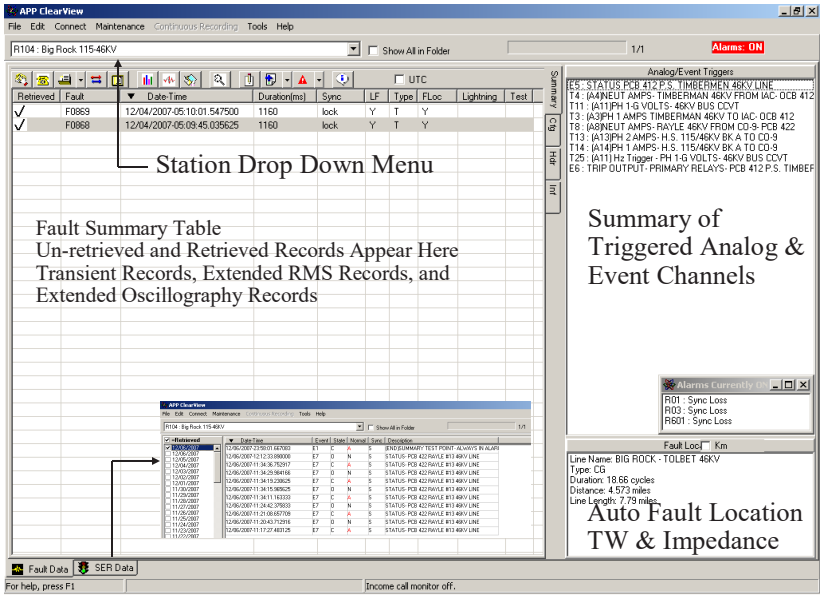
Software APP ClearView ™

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 COMTARDE 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, 10, or Server. Call or email us today for a demo version of APP ClearView.

APP ClearView™ -summary table

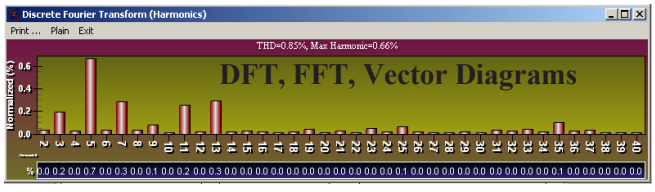
View	Configure	Functions
Fault number	Printing	Easy station selection
Triggered channels	Directories	Manually retrieve data
Fault date	Backups	Auto retrieve data
Fault time	Auto polling	Test runs
Synch status	Passwords	Diagnostics
Event reports	Emailing	Time check
Fault location	Phone numbers	Time synch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



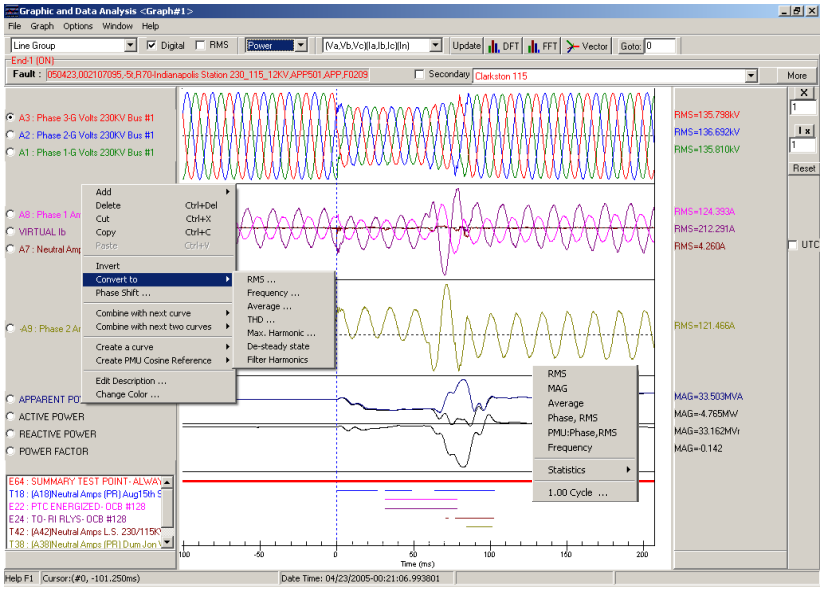
JUST DOUBLE CLICK ON A RETREIVED FAULT RECORD AND SEE THE DATA IN THE GRAPHICS SCREEN

APP ClearView™-analysis

Highlights	Measurements & Math
Quick viewing of retrieved records	Magnitude, RMS, DC, Phase
Open any COMTRADE record	Frequency, Peak, Average,
Overlay or merge 2 records	Max, Min, Max-Min, Positive
Re-Save data in binary or ASCII	Sequence, Negative Sequence,
Multiple setups for viewing channels	Zero Sequence, Add, Subtract,
Drag & drop waveforms	Invert, Phase shift, Wide Vari-
Convenient screen resizing	ty Of Math Functions, FFT,
Versatile digital viewing	Vector, Delta Measurements,
Easy zoom in, zoom out, Y-scale setup	Cut, Copy, Paste, Filter Har-
User annotation drag & drop	monics, Double Ended Fault
Extended printout capabilities	Location
Export	



POWERFUL FAULT ANALYSIS SOFTWARE



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

APP-00848 Split Core Current Transformer ™

Applications

√ Sub-metering
√ Power Monitoring
√ Current Measurements
√ Over/Under Current Sensing

Ordering Information

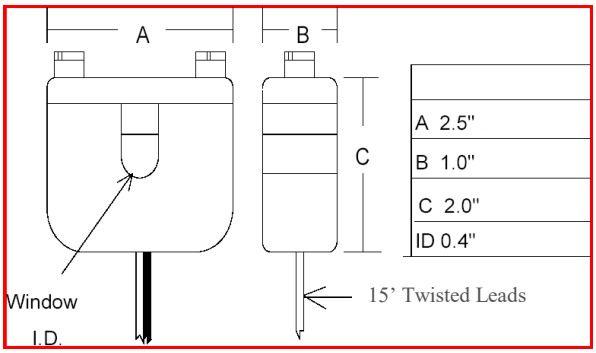
Part Number = APP-00848-500mV
Output with 5 Amps Through the Primary

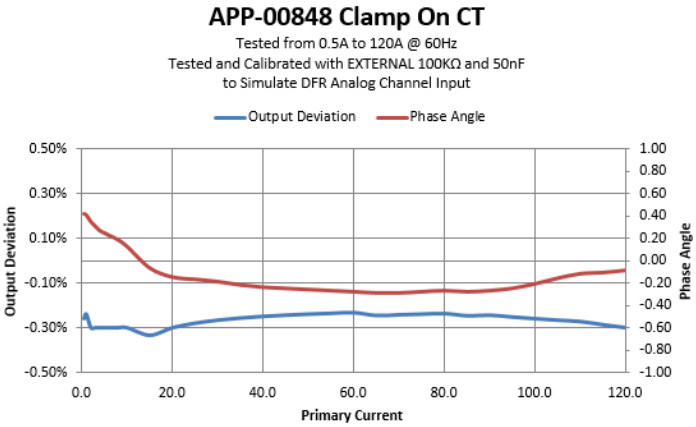
Features

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

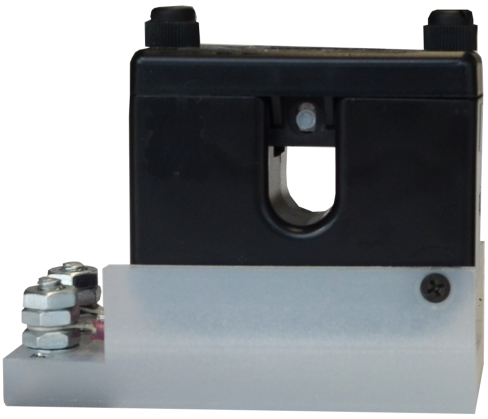
Specifications

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”
50’ Twisted Leads, 22AWG
Black Wire Pos. W/ Arrow Towards Load





Assembly P/N: APP00849 for 5A=500mV



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

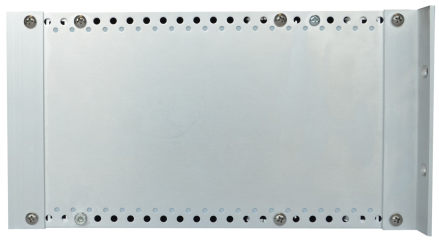
Notes

- 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 Rugged Computer Chassis™

APP601-C601-00A-00E-N

Side View

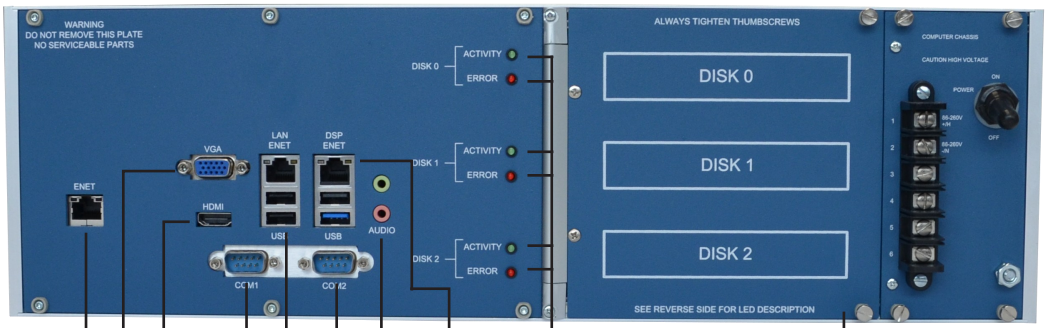


9.8”

Front View

19”

Rear View



5.25”
3U

Ethernet
VGA
HDMI
RS-232
Ethernet & 2x USB
RS-232
Line-Out & Mic-In
Ethernet & 2x USB

Activity and Error lights for HDDs for easy monitoring and management

Hinged door access to SSD’s for easy plug and play maintenance.
RAID 1 + Hot Spare

Meets or exceeds

IEEE C37.90.1:2002 (Surge)

IEC 60255-22-1:2005 (Osc.)

IEC 60255-22-4:2002 (EFT)

IEC 60068-2-1 (Cold)

IEC 60068-2-2 (Hot)

IEC 60068-2-30 (Damp Humidity)

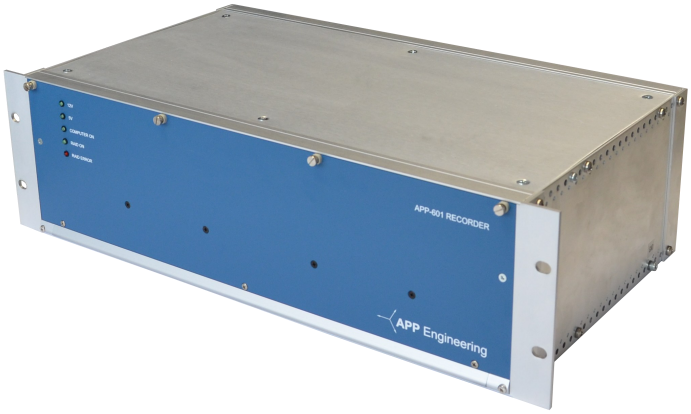
IEC 61000-4-6:2008 (Immunity Conducted RF)

IEC 60255-5:2000 (Impulse, Dielectric, Insulation)

IEEE C37.90.3-2001 (Electrostatic Discharge)

IEEE 1613-2009 (100mm Free Fall)

IEC 60255-21-1:1988 (Vibration)



Use for recorder computer, master station computer, security camera computer or other computer applications.

APP-601 Rugged Computer Chassis™ Specifications
P/N: APP601-C601-00A-00E-N

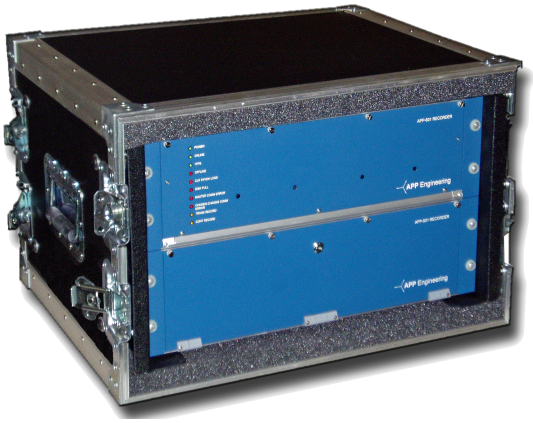
CPU	Intel Atom processor E3845 quad core
System Memory	8GB DDR3-1600 RAM
Chipset	System-on-Chip integrated; Intel HD Graphics; Shared System memory; Display interface 1 x VGA, 1 x HDMI
BIOS	American Megatrends Inc. BIOS
Supported OS	Win7; Win10; Win10 IoT, Windows Server or Linux
Power Input	86-264Vac (50Hz/60Hz) or 86-370Vdc Computer auto power on AC/DC power
Power Requirements	25W (using 3 x 2.5” hard drives) @ 125VDC
Dimensions and Weight	19” (483mm)(W) x 5.25” (133mm)(H) x 9.8” (249mm)(D); 3U 12lbs (5.4kg)
Operating Temperature	-20°C ~ 70°C (-4°F ~ 158°F)
Relative Humidity	10% ~ 95% relative humidity, non-condensing
Module Input/Output	2 x RS-232
SATA	3 x SATA-300
Ethernet	3 x 10/100/1000 Mbps ethernet ports
Display Ports	1 x VGA, 1 x HDMI
Audio	1 x Line-out; 1 x Microphone-in
USB	3 x USB 2.0; 1 x USB 3.0
LED Indicators	Front: 5 (12V + 5V power; Computer + RAID 1 power; RAID error) Rear: 6 (1 activity light + 1 error indicator light per hard drive)
RAID	RAID 1 + Hot spare (Two 1TB HDDs in RAID 1 configuration with one 1TB HDD as hot spare to automatically substitute failed HDD)
Hard Drive or SSD	3 x 1TB SSD Standard (Optional 2TB or 4TB)
Warranty	10 year warranty

APP-601 Portable Multifunction Recorder™

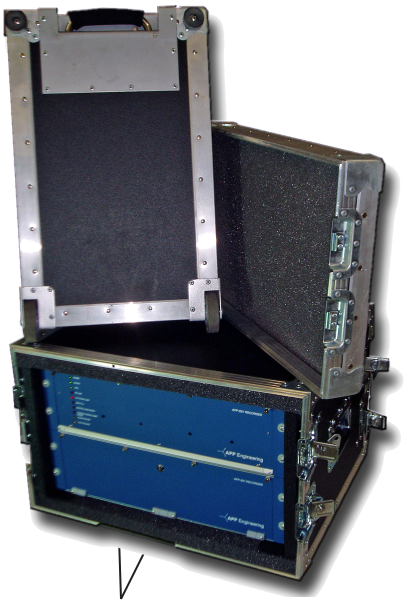
APP00281 (Shown) See also the APP-702

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.

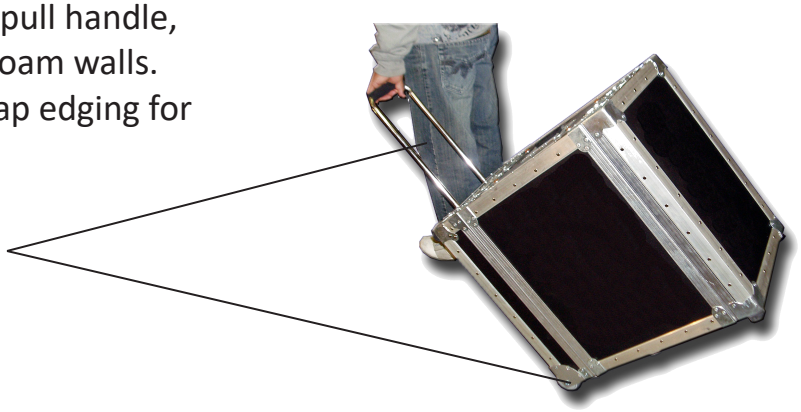


Dimensions	25.5” x22” x14”
Total Weight	49 Lbs.
Weight with-out Covers	33 Lbs.
Power	Universal 120VAC, 125VDC, 250VDC 80W @ 125VDC



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

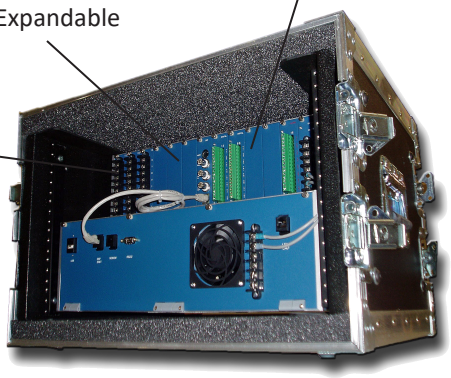
See APP-601 Sales Literature for Recording Details and Other Computer Chassis Choices

Easy Access Computer with Slide Out Drawer

8 Channels per Digital Card

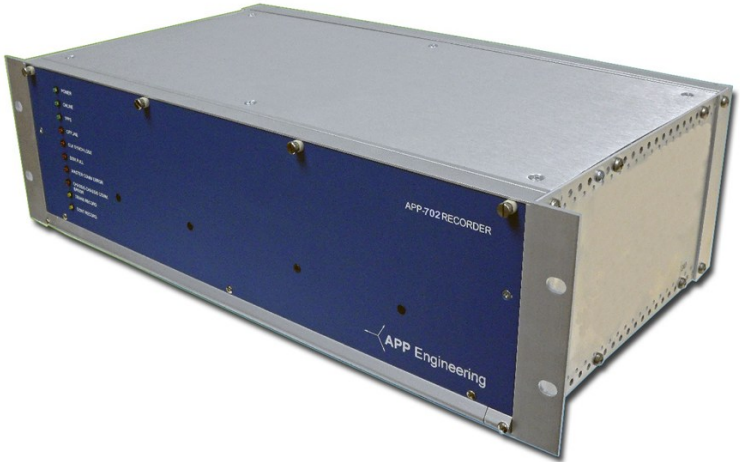
Expandable

3 Channels per Analog Card



APP-702 Compact Recorder ™

Multifunction DFR, SER, DDR, PMU, PQ
Use as permanent install or portable



Recording

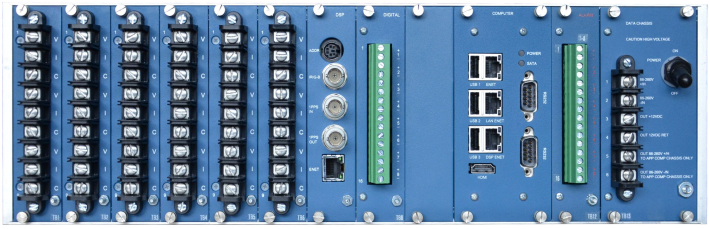
- Transient Recording
- Extended RMS Recording
- Extended Oscillography Recording
- Continuous Oscillography Recording
- Trend Recording
- Continuous RMS, Phase, Frequency Recording

Computer

- Embedded Industrial Computer
- 1TB Solid State Drive
- No Moving Parts

Options

- 601 Monitor & Keyboard Chassis
- Fiber
- Clamp On CT's
- Channel expansion with APP-601 Data Chassis
- Use as a Portable Unit (carrying case available)



Rear

Seven Configurable Analog/Event Card Slots
(18 Analog, 8 Events Shown)

Features

Hardware

Easy Expandability (Add 601 Data Chassis)

IP Configurable

Data Aligned to 1PPS within 1usec

Modulated or Un-Modulated IRIG-B

Configured to Voltage or Current

Wide Voltage & Current Input Range

AC or DC Measurements

Eight Output Relays

Easy Access Power Supply Modules

Easy Access Embedded Computer Board

Software

Includes APP Recorder & APP ClearView

Password Protection, IP Address Permissions, & Comm Logging

Configure Locally or from the Master Station

COMTRADE Records Directly from Recorder

Automatic Tasks: Comm Names, PQDIFF, Diagnostics, Calling Polling, Emailing, FTP, Record Backups, Updates, Alarm, Reporting, Trace Files, & Printing

File Transfer Feature Allows Any File Transfer from Recorder To Master, Local/Remote Test Run, Reboot, Reinitialize

Specifications (APP-702)

Analog Channels

Voltage:
- Base 18 analog channels (Can be expanded)
- Up to 440VAC Max True DC Coupling
- Rin 100KΩ
- Accuracy 0.15% of reading + 0.005% of range (typical)

Current:
- 2mΩ Internal Shunt
- 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 ‹0.004º , Cut-off frequency (-3db) 5KHz, Common Mode Rejection 80dB, Channel to channel isolation 3500VDC Channel to ground isolation 3500VDC

Event Channels

Base 8 event channels (Can be expanded)
Standard input operating range 45-250VDC (24VDC option available)
Channel to channel isolation 3500VDC Channel to ground isolation 3500VDC

Power Supply

Voltage Range: 86 to 370 VDC or
88 to 264 VAC
Frequency Range: 47 to 63 Hz
Overload, Over Voltage,
Over Temperature Protection
Power @ 125VDC and 18 analog channels and 8 event channels is approximately 25W. Input to ground isolation 3500VDC

Timing

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

Communications

Recorder to Master Station
- TCP/IP Ethernet 10/100

DNP-3, Modbus
- RS-232
- Ethernet 10/100

PMU
FTP

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
- Power, Online, Offline, Clock Sync Loss, Chassis to Chassis Comm., Master Comm., Disk Full, Temperature, Computer, Tran Record, SOE Record, Disturbance Record, and Continuous Record (additional outputs available)

Enclosure

19" Rack x 5.25"H x 9.8D"
Weight: Approximately 15lbs

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 Cat IV (Isolation), ANSI/IEEE C37.111 (COMTRADE), ANSI/IEEE C37.232-2007 (Com Names)

Environment

Temperature range –40° to 55°C

APP-904 Rack Mount Monitor & Keyboard Console™

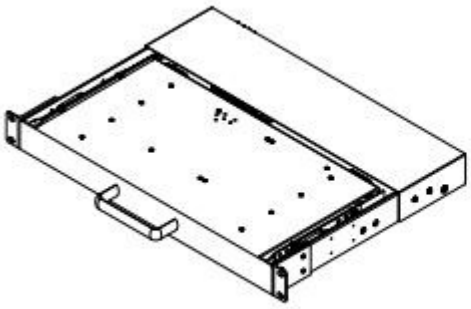
P/N: APP00904

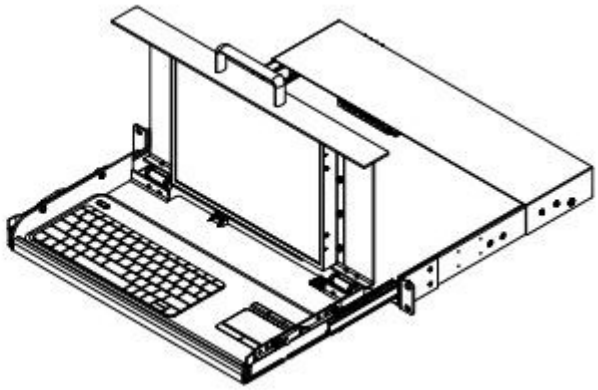
Standard Specifications

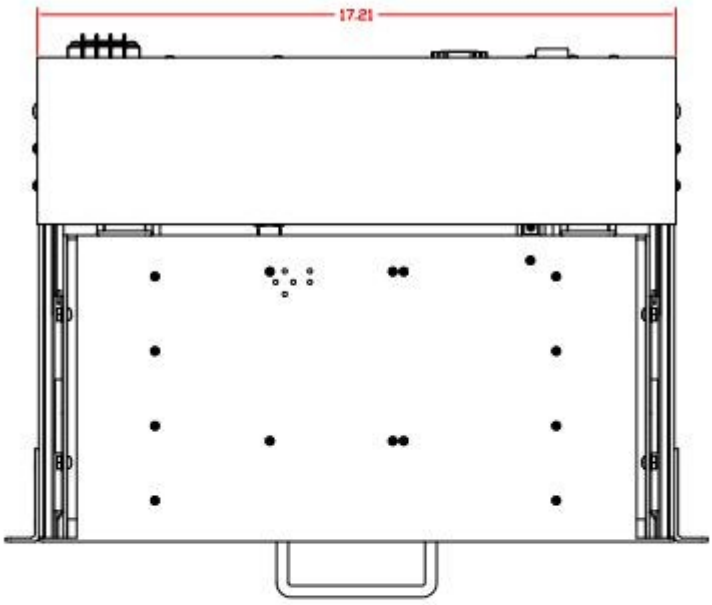
Console, 1RU, (1.75”) 19” Rack Mount, 13” Deep if Flush Mount
Three Available Mounting Depth, Flush Mount, 2” Mount, 3.5” Mount, cont’d
2”, and 3.5” allow for greater monitor tilt angle and less depth into panel.
Rear Ports: 1 USB Type A, 1 LVI-D, 1 VGA, 1 Three Pos Power Terminal Block
Universal Power Input 86-370Vdc, or 88-264Vac, 17W @ 125VDC
Power Input Frequency Range 47Hz to 63Hz
Operating Temperature Range –25C to 70C
Storage Temperature Range –30C to 80C
Humidity 0 to 85% Non-Condensing
Pull out drawer with 12.1” flip up Industrial TFT, High Brightness, cont’d
XGA Monitor, 1024 x 768 Res
Waterproof, Washable Membrane, 104 Key US Layout, cont’d
with Touchpad
Auto Power-Off via Windows OS
Convenient Front Grip Handle
Easy Glide Ball Bearing Slides
See Dimensions on next page

APP-904™

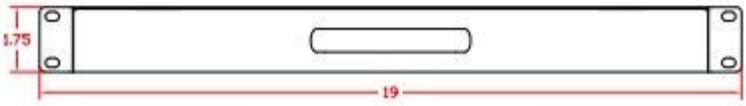
APP-904 Rack Mount Monitor & Keyboard, cont'd



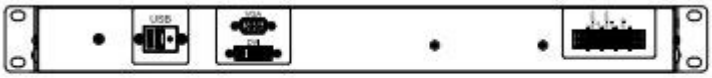




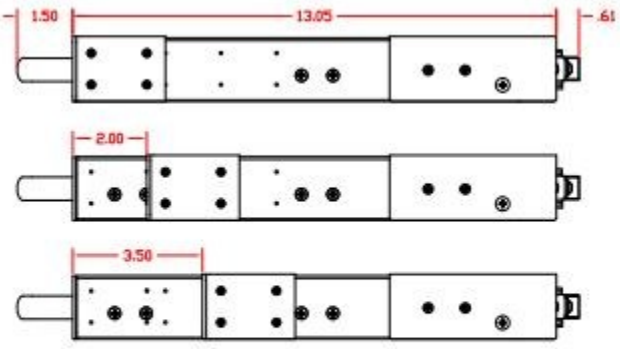
TOP VIEW



FRONT VIEW



REAR VIEW



SIDE VIEW

(MULTIPLE MOUNTING DEPTHS SHOWN)

APP-110 IRIG-B ANALYZER/GENERATOR™

Decode and analyze IRIG-B timing signals with the APP-110 IRIG-B Analyzer.
Validate the integrity of your time sensitive monitoring equipment at every level by using the APP-110 IRIG-B Analyzer by generating an IRIG-B time signal and other signals.

FRONT PANEL

Oscilloscope view of input signal
Hold and run modes
50ms or 100ms window with auto ranging
Decoded IRIG-B information including:
- Time
- Date
- Time code
- Daylight saving
- Time quality

INPUTS

Micro-USB power connector
3/4 inch spaced banana plug connectors
BNC input using BNC to banana plug adapter
Autodetect modulated/unmodulated/1PPS input IRIG-B time signal
Ability to detect if input signal is IEEE 1344 compliant
Accepts general signals <30V for oscilloscope display

ENVIRONMENTAL

Operating temperature range 0°C to 50°C
Humidity 0% to 95% non-condensing

POWER

Power supply: - 5 VDC battery pack
US plug 5VDC micro-USB adapter included

PHYSICAL

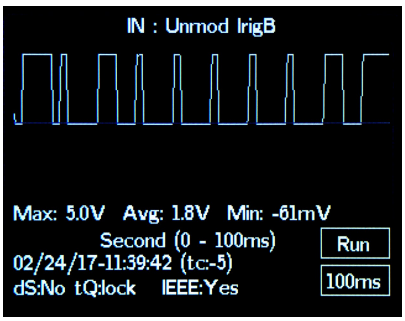
Dimensions: 6.73” (L) × 3.39” (W) × 1.24” (H)
Weight: 200 grams / 7.1 oz (without battery)

OUTPUTS

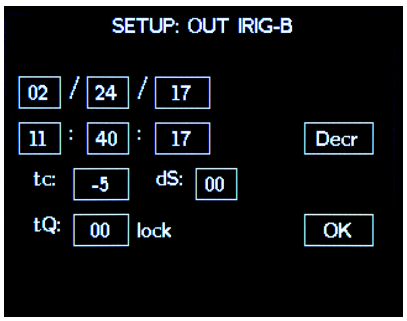
2 BNC outputs: 1 sine wave / 1 square wave
Sine wave output modes:
- Modulated IRIG-B time signal
- 1 pulse per second
- 60Hz sine wave
- 50Hz sine wave

Square wave output modes:
- Unmodulated IRIG-B time signal
- 1 pulse per second

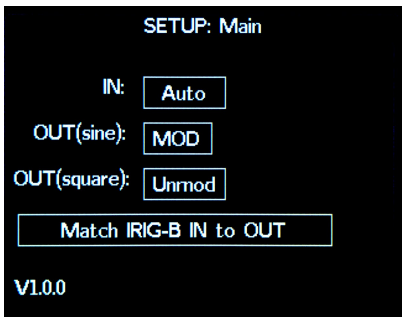
Ability to sync input IRIG-B time signal to output IRIG-B time signal
Output custom IRIG-B time signal set by user



Oscilloscope view and decoded



Output custom IRIG-B time



Generate IRIG-B time signals

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.

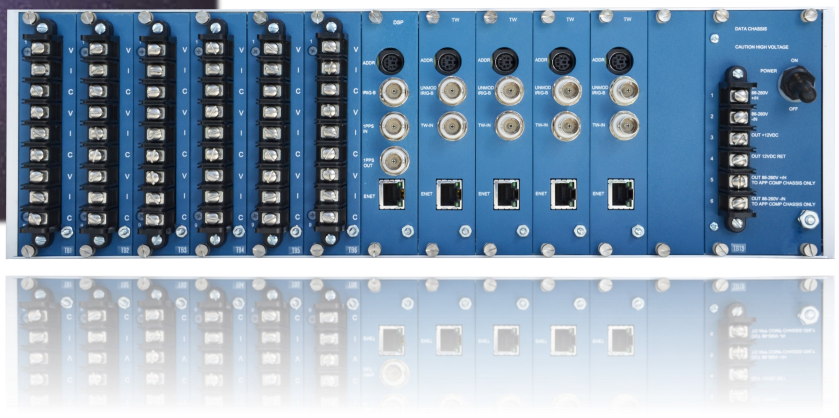
Add to any existing APP-601 system. Can create any configuration of analog, digital and travel-ing wave boards in each data chassis (over one million different configurations)

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

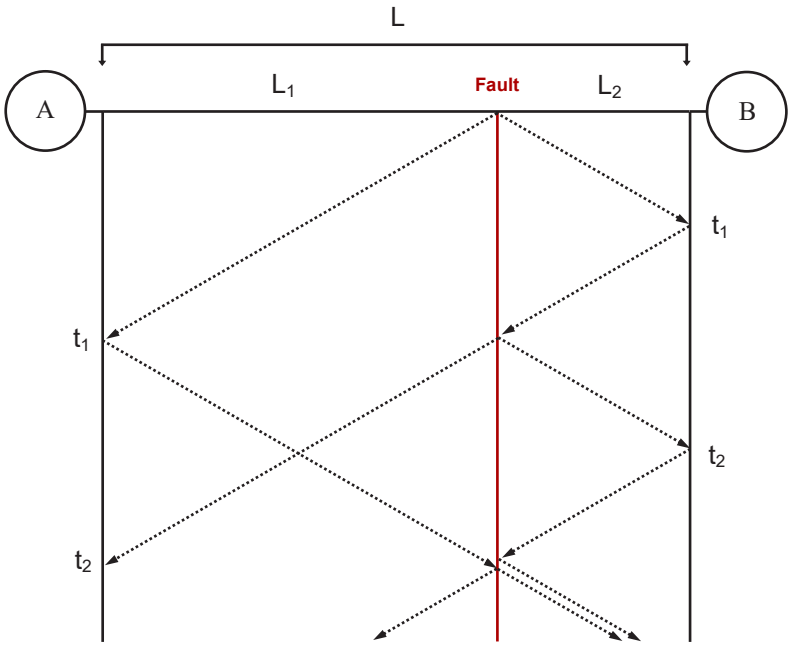


Concept

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

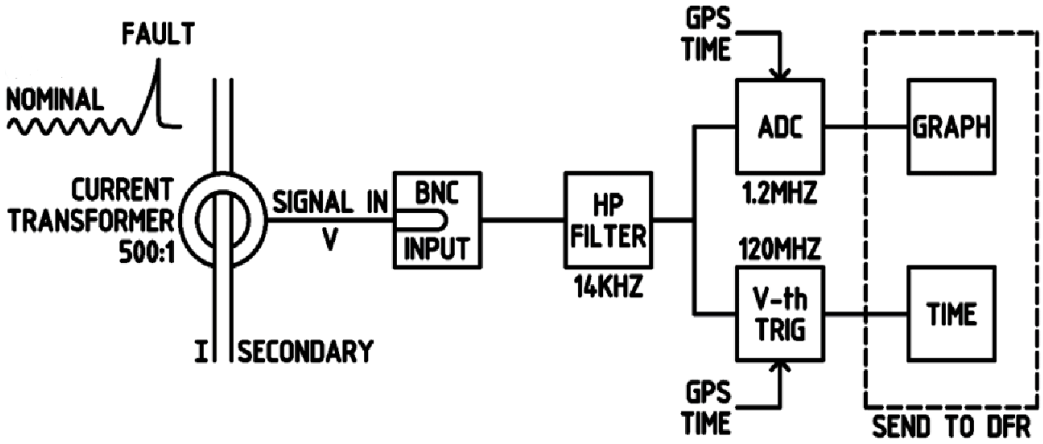
By using the information about the length of the line, the time of when the fault was recorded, and the velocity at which the fault moves along the line (information which is known at the time of setup), the Recorder's TWFL feature can determine the location of the fault along the line.

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 timemark 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

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

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)

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 (1 board and 1 CT's per line).

Specifications

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

APP-00155 Split Core Trip Indicating Relay ™

Applications

√ Lock Out Relay Circuits
√ Trip Coil Circuits
√ Control System Operations

Ordering Information

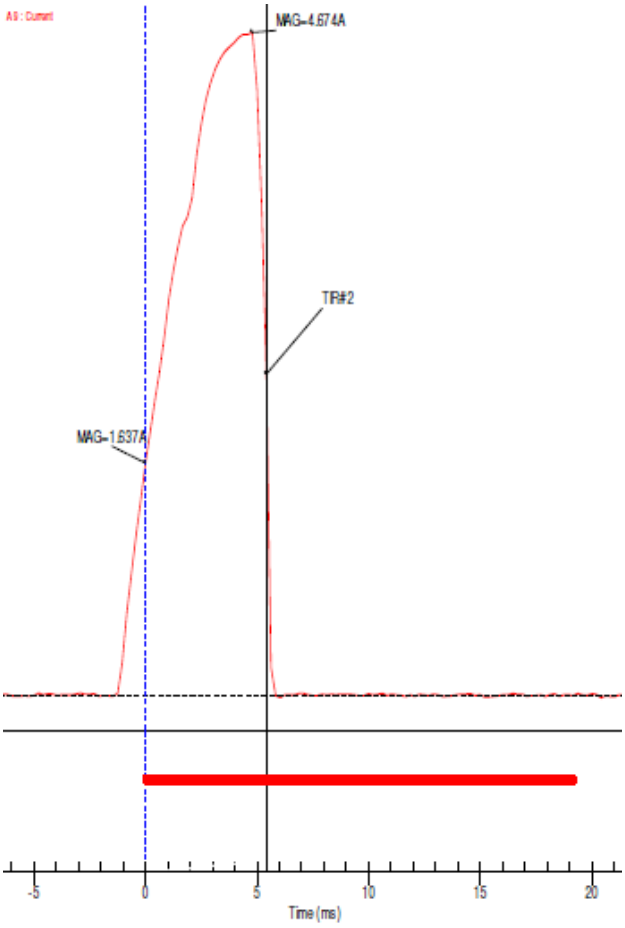
Part Number = APP-00155
Mounting Brackets Available

Features

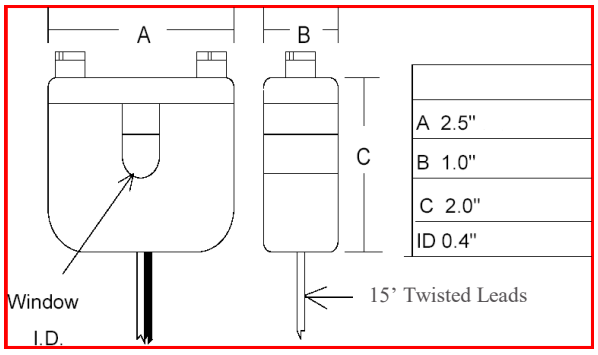
√ Easy Installation
√ Small Size
√ Isolation

Specifications

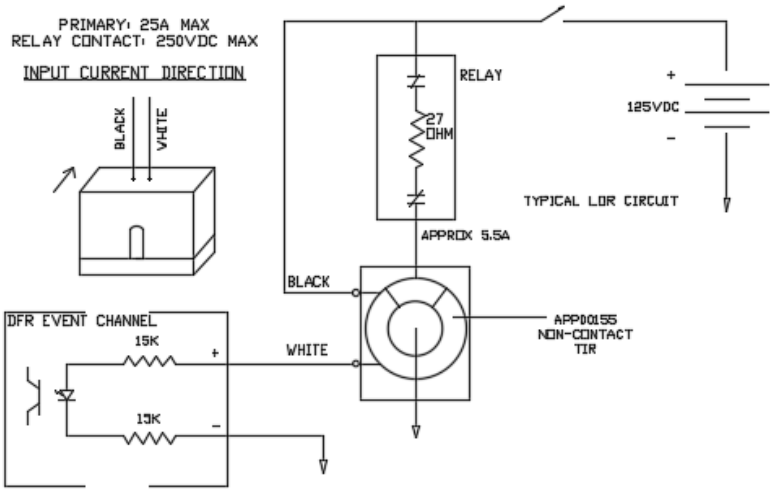
Current thru primary 25A Max.
Output Contact 250VDC Max.
Output Response Time Approx. 2ms
Operating Temperature: -20ºC to 50ºC
Operation: Indoor
Case Material: ABS Thermoplastic
Removable Leg Screws: Knurled Nylon
Overallsize: 2”H x 2.5”W x 1”D
Weight: Approx. 8oz with 15’ Leads
Conductor Thru Hole Diameter: 0.4”
Standard Lead Length 50’
Twisted Leads, 22AWG
Black Wire Positive
Arrow Towards Current Load
Primary current needs to rise to approx. 1.6A to switch output (see graph).
Momentary Contact Closure
Mounting Brackets Available



DFR Trigger Via Event Channel at t_0



Removable leg contains a lapped spring loaded core that mates with the precision core in the main housing.



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

A ten year warranty applies to most items. Contact the factory for specific details. Items such has satellite controlled clocks and antennas carry the OEM warranty.

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