

# UPLC<sup>™</sup>

The Universal Power-Line Carrier  
is the **NEXT GENERATION**  
of Power Line Carrier.



**Pulsar**

Narrowband Power-Line Carrier for Protective Relay Applications

## History of Power-Line Carrier

Power-line carrier has been used since the beginning of the 20th century. In New York City, a 500 Hz signal on the power line was used to control the streetlights. As technology progressed, so did the power-line carrier equipment. There are still many transmitter and receiver sets in use today that utilize vacuum tubes, or discrete transistor logic. These are being replaced with state-of-the-art components such as digital signal processors and other VLSI (very large scale integration) components. The UPLC incorporates these technologies to provide some important features that were previously not available.

## Today's Usage

For over 100 years, the power industry has relied on power-line carrier for many critical circuits. The major application for single function narrowband power-line carrier is on transmission lines for protective relaying channels. A channel is used in line relaying so that both ends of a circuit are cleared at high speed for all faults. A power-line carrier channel can also be used to provide remote tripping functions for transformer protection, shunt reactor protection and remote breaker-failure relaying.

With AMETEK's commitment to improved ease of use and flexibility, the UPLC is clearly the most versatile power-line carrier available. It incorporates the latest technologies to assist you in application, installation, and maintenance of your power-line carrier systems.

The UPLC is fully microprocessor controlled to provide automatic setting of the transmit output level and receiver sensitivity as well as continuous monitoring of the AM channel and sequence of events recording. Programming is accomplished either via the front panel keypad, or with a personal computer and standard web browser.

## New Power-Line Carrier Concepts

The UPLC platform is built upon digital signal processing and technology using proven hardware and firmware from the TC-10B/TCF-10B family. Combining modern technology with AMETEK's years of experience in design and application has resulted in the most advanced power-line carrier available anywhere.

As with our previous power-line carrier designs, UPLC requires no hardware modifications for most required configurations. UPLC is frequency programmable across the entire power-line carrier spectrum (30 to 500 kHz) without changing any hardware components. UPLC can be software configured either as an ON/OFF or frequency-shift keyed (FSK) power-line carrier unit without return to the factory or changing any hardware components. This flexibility makes each UPLC universally suited for any directional comparison blocking, permissive, phase comparison or transfer trip protective relay application.



In addition, UPLC is fully programmable using a simple-to-use web browser interface, which offers many benefits for the user. First, a web browser often is installed on a personal computer when the operating system is installed. This removes the need to have administrative rights to install proprietary interface software. Secondly, since the web browser is used for other applications, the user is familiar with browser functionality. Lastly, the web browser screens are dynamically updated to reflect status of the unit.

Since UPLC is fully programmable, the settings can be uploaded via any of the communication ports. Setting files are in the Extensible Markup Language (XML) format, which can be easily modified if desired. With the XML format, the unit will be compatible with future intelligent electronic devices (IEDs). Settings may also be applied from the factory defaults which are stored in the unit. The user has choices for the most commonly used types of protection systems.

In the AM mode, there is Directional Comparison Blocking or Phase Comparison Blocking for line relaying. In the FSK mode, there is Directional Comparison Unblocking (DCU)/Permissive Overreaching Transfer Trip (POTT) for line relaying. Direct Transfer Trip is also offered for equipment protection in the FSK mode. A combination of DTT and DCU/POTT is available with the 3 frequency setting in the FSK mode.

## Applications:

The UPLC can be applied on HV and EHV transmission lines of lengths over 300 kilometers (180 miles). Dedicated or sometimes called Narrowband Power line carrier technology can be used as the pilot channel equipment for transmission line relay as a primary channel, backup to other channels such as fiber or digital PLC, as well as being used as primary and secondary channels. The UPLC easily replaces older single side band technology, to allow the relay engineer control over the pilot channel.

A new feature of the UPLC is the 4-Frequency Logic. Similar to the 3-Frequency option, this provides for 2 functions over one channel. This new feature allows two independent inputs to key independently or simultaneously to produce received outputs for a command A trip, a command B trip or a command A & B trip. Four frequencies are transmitted within the one channel, a guard frequency, a command A frequency, a command B frequency and a fourth frequency that represents command A & B.

Self-calibration provides for ease of installation and maintenance. Pulsar was the first to introduce a self-calibrating receiver. Now the UPLC incorporates this plus a self-calibrating transmitter. No longer are instruments needed to calibrate an individual transmitter/receiver. Accurate measurements for the transmitter output and the received signal level are displayed on the front of the UPLC and on the web page.

Reflected power measurement is included on the UPLC. While this cannot take the place of a reflected power meter when tuning the high voltage equipment, it will provide information for the user to track changes in the tuning efficiency of the line. Reflected power readings are available on the front of the unit, through the test function or on the home web page of the UPLC.

## Redundancy:

Increase the overall reliability of the protection system with the UPLC. With the addition of the redundant power supply, hot standby is possible, a (1 + 1) protection, using either the same battery or a different battery. Increase the RF power output with the redundant power amplifier and get a total of 20 watts out. If one power amp fails, only 3 dB of RF power is lost. This greatly improves the reliability of the overall protection system.

Even if not using PLC communications as the primary channel, the UPLC is great as a redundant channel as backup to your other protection channels and cost effective too!

## UPLC Features:

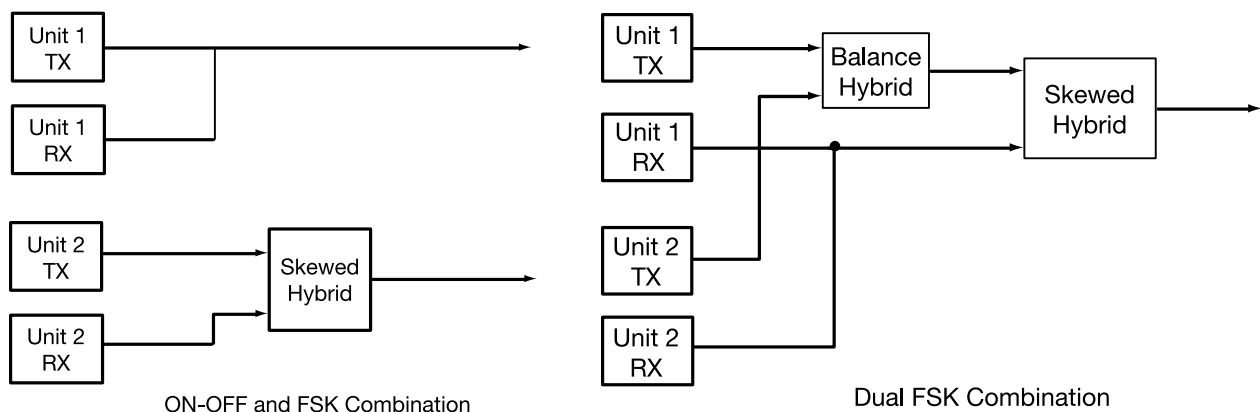
- Programmable for either FSK or ON-OFF Applications
- Fully Frequency Programmable from 30 to 535 kHz in 0.01 kHz Increments
- Bandwidths and Frequency Shifts Selectable
- FSK Units Settable for 2 or 3-Frequency Applications
- All Software Configurable Items are set via Standard Web Browser
- Integrated HMI with Front Keypad and 4x20 Character Vacuum Fluorescent Display
- Front Ports: RS232 or USB (USB to be Replaced by Ethernet RJ45 in Future)
- Unit can be Programmed to Match any Narrowband PLC at Remote End, Excluding Voice or Checkback Functions.
- Front Panel Transmit and Receive Level Readouts
- Continuous Monitoring of AM Receiver Background Noise
- Automatic Receiver Sensitivity Settings
- Transmitter Reflected Power Monitor
- Sequence of Events, Time-Tagged with 1-ms Accuracy for most Events
- IRIG-B Input (Both Modulated and TTL)
- 48/60 Vdc or 110/250 Vdc Powered
- 5 Keying Inputs, High Threshold and Optically Isolated Design
- Outputs: 7 Programmable Solid State, 3 Programmable Contacts
- Standard 19 Inch Chassis Mounting, 3 Rack Units
- Meets or Exceeds All Applicable IEC and ANSI Standards

## Options:

- Trip Duty Contact Outputs (4)
- Testing facilities -automatic checkback for AM and trip testing for 2 or 3-frequency applications
- 4-Frequency Logic (2 independent trips)
- Auxiliary Power Supply for Driving 20/200mA Loads
- Redundant Power Supply
- Redundant Power Amplifier
- Rear Ethernet Ports: Redundant 10/100 BaseT or 100 BaseFX (SC, ST, or MTRJ Connectors)
- Freq. Selectivity for Reflected Power Measurement (in future)

## New Development in Progress: Dual UPLC

Utilizing one 4 RU chassis, the Dual UPLC will have two transceivers (2 channels) in one chassis. This will allow the user to program one as an ON-OFF and one as an FSK or both to the FSK or both to ON-OFF. The combinations are almost endless. In the Dual UPLC, the RF hybrids are included, further reducing the required mounting space for the RF equipment. Each transceiver has independent functionality with its own dedicated power supply and power amplifier and only shares the inputs and outputs. The Dual UPLC provides the user with a rack space savings of 50% and a cost savings of about 25%.





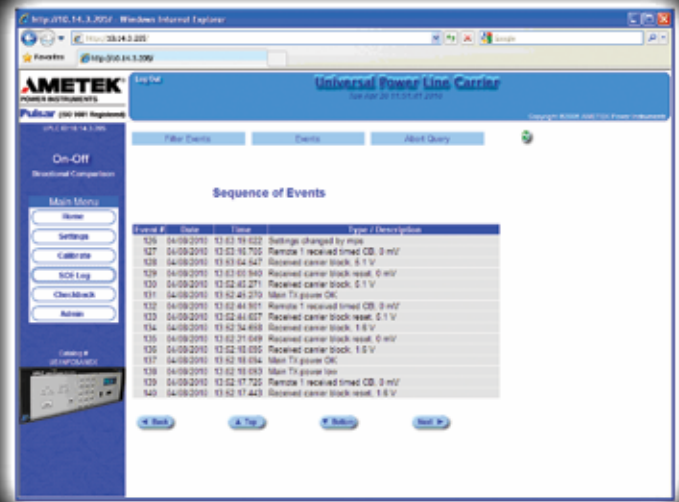
Home Page – See the current settings, status and basic alarms of the unit.



General Settings Page – Set the frequencies, transmit power, receiver margin, etc. A red “Changes Pending” bar appears at the top of the screen when changes are made.



Inputs and outputs are user programmable.



SOEs – View and download the up to 4096 SOEs available in the unit.

## Protocols Available

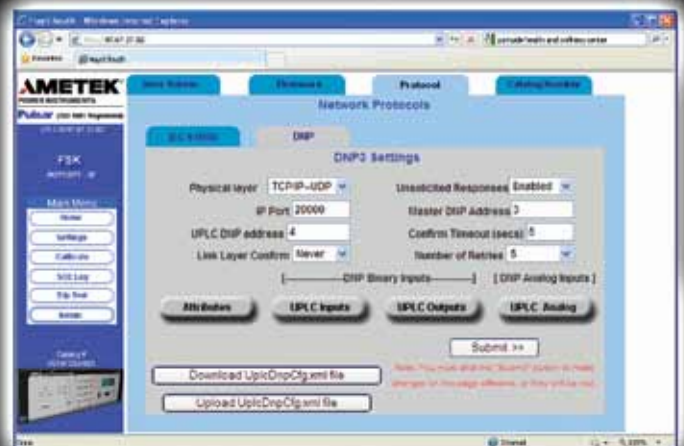
Allow remote communications and control of the UPLC through the use of either of two protocols. DNP3 is the workhorse of the RTU sector of the industry and allows binary and analog quantities to be remotely accessed. IEC61850 is the all inclusive protocol that allows high-speed interface over Ethernet-based local area networks for data transfer via a peer-to-peer communication network.

### DNP3

With the use of DNP3 the user can eliminate alarm wiring by utilizing the RS232, RS485 or Ethernet communications for data retrieval.

### IEC61850

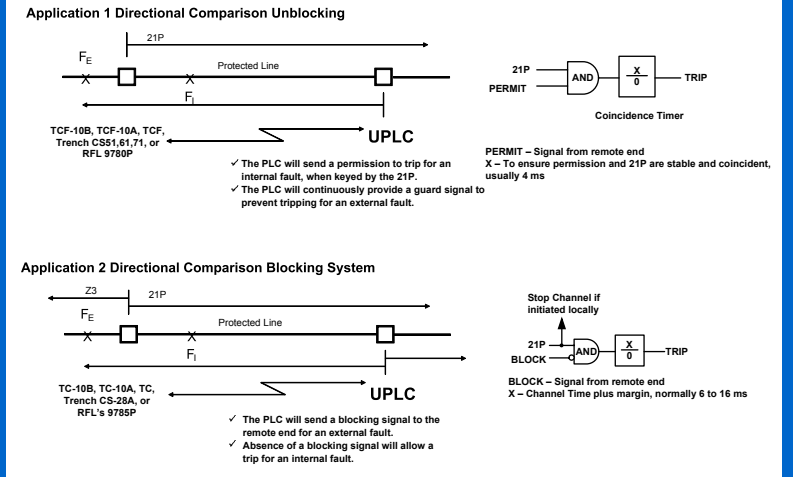
The user can eliminate copper wiring altogether with the use of IEC61850. All inputs and outputs can be implemented with the use of the Generic Object Oriented Substation Event messages (GOOSE). Digital and Analog events are available at speeds consistent with protection functions.



## Compatibility

The UPLC may be used in any application in which our legacy TC-10B or TCF-10B were applied. Other compatible PLC equipment may be used at the opposite end of the line just as with the TC-10B/TCF-10B units.

The UPLC checkback is compatible with the TC-10B checkback and the UCBS Standalone checkback system. Two typical line-relaying applications are illustrated here.



## System Specifications:

- Meets or exceeds the requirements of C93.5, ANSI Requirements for Single Function Power-Line Carrier Transmitter/Receiver Equipment
- Modulation Type: On-Off (Amplitude Modulation) or FSK (Frequency Shift Keyed), Field Programmable, 2-wire or 4-wire application
- Frequency Range: 30-535 kHz, in 0.01kHz steps
- 4 wire Receiver Input Impedance greater than 4,000  $\Omega$
- RF Output Impedance – 50  $\Omega$  or 75  $\Omega$  nominal unbalanced
- RF Output Power 10 watts (max), 0.3 watt (min) (20 watts with optional redundant amplifier)
- Frequency Shifts: Programmable from +/-100, 250 and 500 Hz
- Transmit and receive levels are displayed on Front Panel and Web Pages in dB units or W/V units
- Reflected Power Accuracy - +/- 10 %

## Nominal Receiver Bandwidths:

Bandwidth	Nominal
On Off	
Narrow	600
Wide	1200
Extreme Wide Band	4000
FSK	
Narrow	300
Wide	600
Extra Wide	1200

## Receiver Sensitivity:

28 mV (min) to 70 V (max)/ -20 dBm to +50 dBm @ 50  $\Omega$

## Minimum Frequency Spacing:\*

On-Off Applications			
Wide Band	Directional Comparison Relaying		2000 Hz
Narrow Band	Directional Comparison Relaying		1000 Hz
Extreme Wide Band	Phase Comparison Relaying		4000 Hz
<b>FSK Applications</b>			
Narrow Band	Direct. Comp or DTT	1 way	500 Hz
Narrow Band	Direct. Comp or DTT	2 way	1000 Hz*
Wide Band	Direct. Comp or DTT	1 way	1000 Hz
Wide Band	Direct. Comp or DTT	2 way	2000 Hz*
Wide Band	Dual Comparator Phase Comp.	1 way	1500 Hz
Wide Band	(50/60 Hz sq wave keying)	2 way	3000 Hz*
Wide Band	Segregated Phase Comp	1 way	2000 Hz
Wide Band	(50/60 Hz sq wave keying)	2 way	4000 Hz*
Extra Wide Band	Direct. Comp or DTT	1 way	2000 Hz
Extra Wide Band	Direct. Comp or DTT	2 way	4000 Hz*
Extra Wide Band	Dual Comparator Phase Comp.	1 way	1500 Hz
Extra Wide Band	(50/60 Hz sq wave keying)	2 way	3000 Hz*
Extra Wide Band	Segregated Phase Comp	1 way	2000 Hz
Extra Wide Band	(50/60 Hz sq wave keying)	2 way	4000 Hz*

\*An external hybrid or other device offering at least 20 dB rejection of the adjacent channel must be used in the application. 1 way represents transmitter-to-transmitter or receiver-to-receiver 2 way represents transmitter to receiver

## Channel Speed at 15 dB margin:

On-Off	
Narrow Band	2.8 ms
Wide Band	2.1 ms
Extreme Wide Band	1.5 ms
FSK	
Narrow Band	7 ms
Wide Band	6 - 6.5 ms
Extreme Wide Band	4.8 ms

Channel times do not include logic trip delay or relay-operate times

## Environmental Specifications:

Ambient Temperature, range of air	-30°C to +70°C (ANSI C37.90)
Relative Humidity	Up to 95% (non-condensing at 40°C (for 96 hrs cumulative) (ANSI C93.5)
Altitude	Up to 1500m (without de-rating), 6000m with de-rating
Surge Withstanding Capability	Per ANSI C37.90 (500 volt class)
1 Minute Withstand	IEC 255-5 and ANSI 37.90 (500 volt class)
RF Coax Connector, center conductor to ground	3000 Vdc impulse level, 1.2 x 50 ms impulse, per ANSI C93.5
Dielectric	Per ANSI C37.90, 500 V Class, (3000 Vdc dielectric with stand), IEC60255-5
Electrostatic Discharge	Per ANSI C37.90.3, IEC61000-4-2
Radio Frequency Interference	ANSI/IEEE C37.90.2,

### Inputs:

Five programmable inputs, jumper selectable for 15, 48, 125, or 250 Vdc.

### Power Supply Alarm:

One contact, selectable for NO or NC, rated for 0.25A from 15 to 250 Vdc, non-wetted.

### 10 Programmable Outputs:

**7 Solid State outputs:** Rated for 1A from 15 to 250 Vdc at the 1.0 A setting, capable of operating a lock out relay at 5 A for 10 ms.

**3 relay contact outputs:** Rated for 0.25A from 15 to 250 Vdc: Operate 15 ms and Dropout 10 ms maximum. Non-wetted outputs provided.

### Optional 4 Trip Duty Electromechanical Outputs:

**Operate Time:** NO Contact closing: 2.8 ms NC Contact opening: 2.0 ms Release time: NO Contact opening: 2.8 ms

NC Contact closing: 3.9 ms Contact Bounce: 1.9 ms Ratings: Make and carry 30 A for 200 ms with a duty cycle as specified per ANSI C37.90.

### On-Off Optional Output for KA-4 Relays:

45 V or 8 V output to operate 20 or 200 mA holding coils in electromechanical carrier aux relays.

### Reflected Power:

Accuracy to 10%, ratio of reverse power to forward power.

### IRIG-B:

Modulated IRIG-B input impedance = 2.5k ohms min. (3.5k ohms typical)

TTL IRIG-B input current draw = 3.8mA typical at 5Vdc

### Power Requirements: (single unit)

Nominal Battery Voltage	Permissible Voltage Range	Standby	1 Watt Transmit Single	10 Watt Transmit Single	1 Watt Transmit Dual	10 Watt Transmit Dual
48/60 Vdc	38 to 76 Vdc	26 Watts	35 Watts	58 Watts	70 Watts	116 Watts
110/125/250 Vdc	88 to 300 Vdc	20 Watts	30 Watts	66 Watts	60 Watts	132 Watts

### Weights and Dimension Specifications:

Equipment	Weight		Height		Width		Depth		Rack Space
	lbs	kg	In	mm	In	mm	In	mm	
Single Unit	21	9.53	5.218	132.54	17.437	442.90	13.26	336.75	3 RU
Dual Unit	35	15.88	7.00	177.9	17.437	482.6	13.26	336.75	4 RU

# Order one today... *the next generation Power-Line Carrier*

## Learn More – Contact Us **TODAY!**

1 2 3 4 5 6 7 8 9 10 11 – Catalog Number Position

**U S I N S C I A N S X** – Example Catalog Number

<b>1- Base Unit</b> ■	U
<b>2 -Configuration</b> ■	
Single Transceiver Unit (3RU) .....	S
Single Transceiver Unit (3RU) with Dual Power Amplifier <sup>1</sup> .....	A
Single Receiver Unit (3RU).....	R
Dual Transceiver Unit (4RU) <sup>1,2</sup> with Dual Power Amplifier <sup>4</sup> .....	D
Dual Receiver Unit (4RU) <sup>1,2</sup> .....	Q
<b>3-DC/DC Converter Power Supply</b> ■	
48/60 Vdc.....	4
110/125/250 Vdc .....	1
48/60 Vdc with Auxiliary Power Supply for 20/200 mA Output.....	8
110/125/250 Vdc with Auxiliary Power Supply for 20/200 mA Output .....	2
<b>4-Redundant DC/DC Converter Power Supply</b> ■	
48/60 Vdc.....	4
110/125/250 Vdc .....	1
48/60 Vdc with Auxiliary Power Supply for 20/200 mA Output.....	8
110/125/250 Vdc with Auxiliary Power Supply for 20/200 mA Output .....	2
None .....	N
<b>5-Outputs/Logic</b> ■	
Standard Outputs (7 SS, 3 Contacts) only.....	S
Standard Outputs (7SS and 3 Contacts) plus Trip Duty Contact Outputs, (4 per unit) .....	E
Standard Outputs (7 SS, 3 Contacts) only/with 4 Frequency Logic .....	T
Standard Outputs (7SS and 3 Contacts) plus Trip Duty Contact Outputs, (4 per unit)/with 4 Frequency Logic.....	F
<b>6-Ethernet Ports (Rear)</b> ■	
None .....	A
10/100 BaseT, with Stand-by 10/100 BaseT.....	C
100 BaseFX, with Stand-by 100 BaseFX with SC Connectors .....	D
100 BaseFX, with Stand-by 100 BaseFX with ST Connectors (Multi-mode Fiber) .	E
100 BaseFX, with Stand-by 100 BaseFX with MTRJ Connectors (Multi-mode Fiber) ...	G
10/100 BaseT, with Stand-by 100 BaseFX with ST Connectors (Multi-mode Fiber) H	
10/100 BaseT, with Stand-by 100 BaseFX with SC Connectors (Multi-mode Fiber) ..	J
<b>7-Protocols/PC Interface (Front Port)</b> ■	
No Protocol/RS-232 Front Port .....	1
No Protocol/USB Front Port .....	2
IEC 61850 Compliant <sup>3</sup> /RS-232 Front Port .....	3
IEC 61850 Compliant <sup>3</sup> /USB Front Port .....	4
DNP Compliant/RS-232 Front Port.....	5
DNP Compliant/USB Front Port.....	6
No Protocol/RS-232 and 10/100 Base T Ethernet Front Ports <sup>2</sup> .....	7
IEC 61850 Compliant <sup>3</sup> /RS-232 and 10/100 Base T Ethernet Front Ports <sup>2</sup> .....	8
DNP Compliant <sup>3</sup> /RS-232 and 10/100 Base T Ethernet Front Ports <sup>2</sup> .....	9

<b>8-Testing Facilities</b> ■	
Single Transceiver .....	A
Dual Transceiver <sup>2</sup> .....	C
None .....	N
<b>9-Power Amp Features</b> ■	
Standard Power Amp-no features .....	N
Improved Power Amp .....	A
Improved PA with Freq Selectivity for Reflected Power <sup>2</sup> .....	F
<b>10-Back Plate Option</b> ■	
Standard .....	S
<b>11-Future</b> ■	
Reserved for Future Options.....	X

### Notes:

- 1 Any Dual Configuration requires 2nd Power Supply
- 2 Call for availability
- 3 Must also select an Ethernet option
- 4 Includes skewed hybrid and resistive combiner

Continuous product development may make it necessary to change product details without notice.



### POWER INSTRUMENTS

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