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UPLC-II

The **SECOND GENERATION** of Universal Power-Line Carrier



AMETEK

POWER INSTRUMENTS

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-II 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 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-II 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-II is fully microprocessor controlled to provide automatic setting of the transmit output level and receiver sensitivity as well as 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-II 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-II requires no hardware modifications for most required configurations. UPLC-II is frequency programmable across the entire power-line carrier spectrum (30 to 500 kHz) without changing any hardware components. UPLC-II 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-II universally suited for any directional comparison blocking, permissive, phase comparison or transfer trip protective relay application.



In addition, UPLC-II 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-II is fully programmable, the settings can be uploaded/downloaded 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 ON-OFF (AM) mode, there is Directional Comparison Blocking (DCB) 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 (DTT) 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-II 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 relays 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-II easily replaces older single side band technology, to allow the relay engineer control over the pilot channel. The UPLC-II can also be applied in distributed generation anti-islanding applications.

Another FSK feature of the UPLC-II 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 Guard-A, Trip-A, Guard-B and Trip-B. 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-II 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-II and on the web page.

Reflected power measurement is included on the UPLC-II. 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-II.

Redundancy:

Increase the overall reliability of the protection system with the UPLC-II. 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-II is great as a redundant channel for backup to your other protection channels and cost effective too!

UPLC-II Standard Features:

* denotes new feature

- 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 for PC Interface: Ethernet RJ45 * and RS-232
- Unit can be programmed to match any Narrowband PLC at Remote End, Excluding Voice or Checkback Function
- Measured Transmit and Receive Level are displayed on front panel and web pages in dB units or W/V units
- Continuous Monitoring of AM Receiver Background Noise
- Automatic Receiver Sensitivity Settings
- Continuous Transmit Reflected Power Meter with Frequency Selectivity * and settable alarm output
- Sequence of Events, Time-Tagged with 1 ms Accuracy for most Events
- IRIG-B Timing Input (Both Modulated and TTL)

- 5 Keying Inputs, High Threshold, current-limited 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:

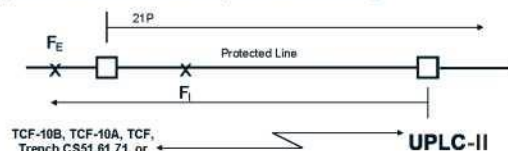
- 48/60 VDC or 110/250 VDC Powered
- Trip Duty Contact Outputs (4)
- Testing facilities-automatic checkback for ON-OFF and trip testing for FSK 2- or 3-frequency applications
- FSK 4-Frequency Logic (2 independent trips)
- Auxiliary Power Supply for Driving 20/200 mA Loads (older EM relays)
- Redundant Power Supply
- Redundant Power Amplifier
- Rear Ethernet Ports: Redundant 10/100 BaseT (RJ-45) or 100 BaseFX (ST Connectors)
- Communication Protocols: DNP3 or IEC61850

Compatibility

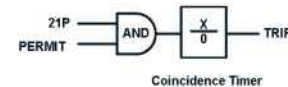
The UPLC-II may be used in any application in which our legacy TC-10B or TCF-10B were applied. Other compatible PLC equipment may be used at the opposite end of the line just as with the TC-10B/TCF-10B units.

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

Application 1 Directional Comparison Unblocking

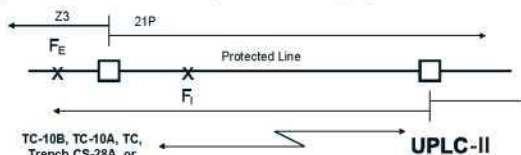


- ✓ The PLC will send a permission to trip for an internal fault, when keyed by the 21P.
- ✓ The PLC will continuously provide a guard signal to prevent tripping for an external fault.

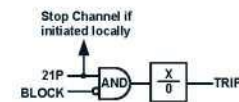


PERMIT – Signal from remote end
X – To ensure permission and 21P are stable and coincident, usually 4 ms

Application 2 Directional Comparison Blocking System



- ✓ The PLC will send a blocking signal to the remote end for an external fault.
- ✓ Absence of a blocking signal will allow a trip for an internal fault.



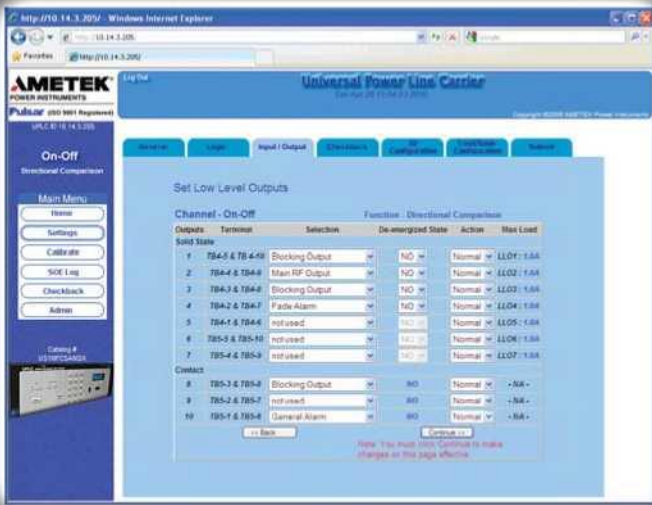
BLOCK – Signal from remote end
X – Channel Time plus margin, normally 6 to 16 ms



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

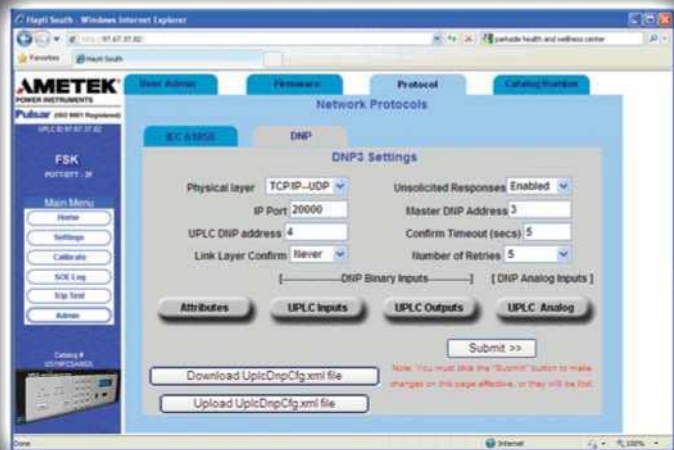
Allow remote communications and control of the UPLC through the use of either of two protocols. DNP3 is the workhorse of the RTU sector of the industry and allows binary and analog quantities to be remotely accessed. IEC61850 is the all inclusive protocol that allows high-speed interface over Ethernet-based 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 via SCADA. Data includes TX/RX levels, percent reflected power, RX margin and I/O status.

IEC61850

The user can eliminate almost all copper wiring 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.



DNP3 Protocol Settings

Basic Transmit/Receive Specifications:

Basic Industry Specification	Meets or exceeds requirements of C93.5, ANSI requirements for single function power line carrier TX/RX equipment
Frequency Range	30-535 kHz
TX/RX Frequency Resolution	10 Hz increments
Frequency Stability	±5 Hz
TX/RX Connections	2-Wire or 4-Wire
TX RF Output Impedance	50 Q, 75 Q nominal unbalanced
TX RF Output Power	10 W max (20 W with optional redundant amp) 0.3 W min
TX Harmonic & Spurious Output	55 dB below TX frequency at rated full power
TX Output Variation	±1 dB over temp/volt range
TX Reflected Power Monitor Accuracy	±10% of reading (with or without interference)
Modulation Type	ON/OFF (Amplitude Modulation) or FSK (Frequency Shift Keyed), field programmable
FSK Frequency Shifts	Programmable ±100, ±250 or ±500 Hz
Minimum In-Band SNR for Good Channel operation	13 dB for FSK, 20 dB for ON/OFF
4-Wire Receiver Input Impedance	>4 k Q
Receiver Sensitivity (min to max)	28 mV (min with 15 dB margin) to 70 V (max), -20 dBm to +50 dBm @50 Q/75 Q
Power Supply & Power Amp Boards only	Hot swappable

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
FSK Applications			
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

Nominal Receiver Bandwidths and Corresponding Channel Delay*:

Mode	Receiver Bandwidth	Channel Delay
ON/OFF		
Narrow Band	600 Hz	2.8 ms
Wide Band	1200 Hz	2.1 ms
Extra Wide Band	4000 Hz	1.5 ms
FSK		
Narrow Band	300 Hz	7 ms
Wide Band	600 Hz	6.5 ms
Extra Wide Band	1200 Hz	4.8 ms

* Channel times are nominal values with a 15 db RX Margin on a back-to-back system. Times are for solid state outputs and do not include logic trip delay or relay output operation times.

Output Ratings (All Outputs Non-Wetted and Non-Polarity Sensitive):

Output (Terminal Block)	Max Current at @ 250 VDC			N.O. / N.C. Selectable	Nominal Voltage Drop	Voltage Range	Max Operate Time	Max Dropout Time
	Make & Carry Continuous	Make & Carry Short Term	Interrupt					
Power Supply (TB1 or 2 - 5 & 6)	8 A	N/A	0.25 A	Hardware Jumper (PS)	0 V	15-250 VDC	15 ms	10 ms
7 Low Level Solid State (TB4 & 5)	0.1/1.0 A Hardware Selectable	6 A/15 ms for 1 A Setting	0.1/1.0 A Hardware Selectable	Software Setting	2.5 V	15-250 VDC	0.5 ms	0.5 ms
3 Low Level EM Contacts (TB5)	8 A	N/A	0.25 A	Hardware Jumper (I/O)	0 V	15-250 VDC	15 ms	10 ms
4 Trip Duty EM Contacts (TB6)	14 A	30 A/200 ms w/duty cycle per ANSI C37.90	0.25 A	Hardware Jumper (I/O)	0.2 V @ <1 A 7 V @ 30 A	15-250 VDC	N.O. Contact Closing = 3 ms N.C. Contact Opening = 2 ms	N.O. Contact Opening = 5 ms N.C. Contact Closing = 4 ms

Keying Input Ratings (Non-Polarity Sensitive):

Nominal Input Voltage	Min Keying Voltage	Max Current Draw
15 VDC	10 VDC	5 mA
48/60 VDC	38 VDC	5 mA
110/125 VDC	70 VDC	5 mA
220/250 VDC	150 VDC	5 mA

IRIG-B Specifications:

Modulated IRIG-B Input Impedance	2.5 K ohm min (3.5 K ohm typical)
TTL IRIG-B Input Current Draw	3.8 mA typical at 5 VDC

Environmental/Surge/Interference 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 1500 m (without de-rating), 6000 m with de-rating
Surge Withstanding Capability	Per ANSI C37.90.1
1 Minute Withstand	IEC 255-5 and 37.90 (500 VDC class)
Coax, center conductor to ground	3000 V impulse level, 1.2 x 50 ps impulse, per ANSI C93.5
Dielectric	Per ANSI C37.90, 500 VDC Class, (3000 VDC dielectric withstand), IEC60255-5
Electrostatic Discharge (ESD)	Per ANSI C37.90.3, IEC61000-4-2
Radiated Electromagnetic Interference from Tranceivers	Per ANSI C37.90.2
Carrier Frequency on DC Input Leads when Transmitting 1 W	20 mV (max)

Power Requirements:

Nominal Battery Voltage	Permissible Voltage Range	Standby	1 Watt Transmit		10 Watt Transmit
48/60 VDC	38 to 76 VDC	25 W	35 W	35 W	60 W
110/125/250 VDC	88 to 300 VDC	20 W	30 W	30 W	66 W

Weights and Dimension Specifications:

Equipment	Net Weight		Height		Width		Depth		Rack
	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

Order one today...the 2nd generation Universal Power-Line Carrier Learn More - Contact Us TODAY!

1 - Base Unit.....	U
2 - Configuration	
Single Transceiver Unit (3RU) w/Single Power Amplifier.....	S
Single Transceiver Unit (3RU) w/Dual Power Amplifier ¹	A
Single Receiver Unit (3RU)	R
3 - Main Power Supply	
48/60 VDC.....	4
110/125/250 VDC	1
48/60 VDC w/ Auxiliary Power Supply for 20/200 mA Output	8
110/125/250 VDC w/ Auxiliary Power Supply for 20/200 mA Output	2
4 - Redundant Power Supply ²	
48/60 VDC.....	4
110/125/250 VDC	1
48/60 VDC w/ Auxiliary Power Supply for 20/200 mA Output	8
110/125/250 VDC w/ Auxiliary Power Supply for 20/200 mA Output	2
None	N
5 - Outputs/4-Freq. Logic	
Std Outputs (7 SS, 3 Contacts)	S
Std Outputs (7 SS, 3 Contacts) + 4 Trip Duty Contact Outputs	E
Std Outputs (7 SS, 3 Contacts) + 4-Freq. Logic.....	T
Std Outputs (7 SS, 3 Contacts) + 4 Trip Duty Contact Outputs + 4-Freq. Logic	F
6 - Ethernet Ports	
None (Front Port Present but Non-Functional)A
Front = 1 RJ-45, Rear = 2 RJ-45 (10/100 BaseT)	M
Front = 1 RJ-45, Rear = 2 Fiber ST (100 BaseFX).....	.P
Front = 1 RJ-45, Rear = 1 RJ-45 & 1 Fiber ST ²R
7 - Protocols	
No Protocol.....	7
IEC 61850 Compliant ³	8
DNP3 Compliant	9
8 - Testing Facilities (ON/OFF Checkback Test/FSK Trip Test)	
Active	A
None	N
9 - Power Amp Features	
Power Amp with Frequency Selectivity for Reflected Power	F
No Power Amp - Receiver Only.....	X
10 - Back Plate Option	
Standard.....	S
11 - Future	
Reserved for Future Options	X

Notes:

1. Dual Power Amps requires 2nd power supply
2. Call for availability
3. Must also select an ethernet option

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