

## LMUs & Accessories



### Coupling devices for Power Line Carrier systems

- Line Matching Units
- Differential Hybrid circuits



## LMUs & Accessories



## Description

### Introduction

Power-Line Carrier (PLC) systems form part of the power utilities' communication networks using high-voltage electrical power lines to transmit information related to the operation of the power system.

The line trap and line-trap tuner are devices installed in series with the conductor used for signal transmission. The set has a higher impedance at the PLC link transmission frequencies and a lower impedance at the power system frequency (50 or 60 Hz). Installing line trap and liner-trap tuners at the ends and tie points of HV lines, allows using them as communication lines since the PLC link is separated from the energy transmission at the power frequency.

The line matching units, together with the coupling capacitors, make up filters which adapts the impedances between the high voltage line, used as a signal transmission line, and the PLC equipment. Line matching units are also the elements in charge of isolating the PLC terminal and personnel from the HV line.

A line matching unit contains tuning elements, an isolating transformer and protection devices.

ZIV COMMUNICATIONS wide range offering includes adaptable line-tuning units with different tuning circuits, allowing optimal settings according to the bandwidth and the line parameter requirements of each application. Also available, are line matching units with integrated hybrid circuit, reducing the number of devices required for phase-to-phase and three-phase couplings.

### Quality Control You Can Rely On

Quality is built into our products in every step.

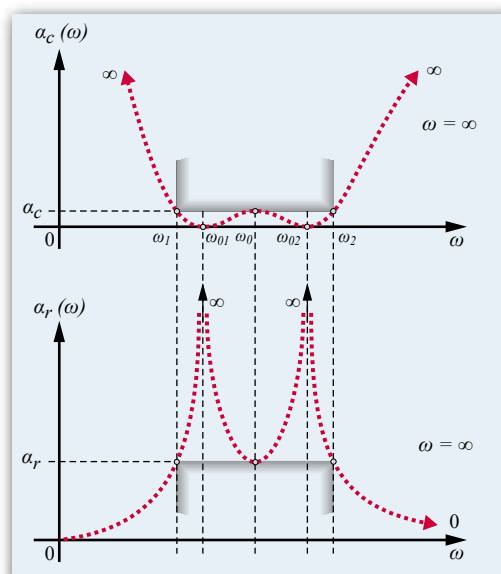
ZIV COMMUNICATIONS has its own test laboratory for type testing of line matching units in order to verify IEC 60481 compliance.

### Special models on request

Line matching units with different specifications and models for underground cables can be developed on request. Please contact ZIV COMMUNICATIONS with your special application details.

### Key features:

- Designed according to IEC 60481 standard (composite loss  $\leq 2\text{dB}$  and return loss  $\geq 12\text{dB}$  in the selected bandwidth)
- Distortion and intermodulation: 80 dB below the level corresponding to the nominal power (P.E.P.)



$P_{max}$ : Maximum theoretical power  
 $P_t$ : Actual transmitted power; frequency dependent  
 $P_{ref}$ : Reflected power; frequency dependent

IF  $P_t(\omega) = P_{max}$   $\begin{cases} \alpha_c(\omega) = 0 \\ \alpha_r(\omega) = -\infty \end{cases}$   
 $(P_{ref}(\omega) = 0)$   
**(PERFECT MATCHING FREQUENCIES)**  
 $\omega = \omega_{01}, \omega = \omega_{02}$

#### USEFUL BANDWIDTH (MATCHING BANDWIDTH)

The frequency range where  $\alpha_c(\omega) \leq \alpha_c$ ,  $\alpha_r(\omega) \leq \alpha_r$

Being  $\alpha_c$  and  $\alpha_r$  a specified values

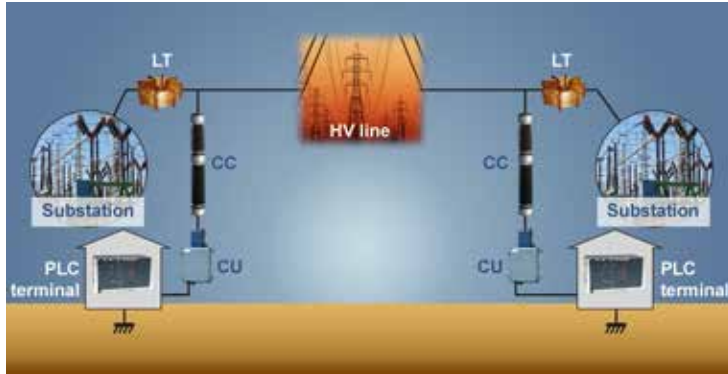
$R/R_0$	$R_0/R$	$P_{ref}/P_{max}$ (%)	$P_t/P_{max}$ (%)	$\alpha_r$ (dB)	$\alpha_c$ (dB)
1,000	1,000	0,00	100,00	infinite	zero
0,952	1,050	0,06	99,94	32,2557	0,0026
0,606	1,650	6,02	93,98	12,2067	0,2695
0,598	1,671	6,31	93,69	12,0003	0,2830
0,588	1,700	6,72	93,28	11,7253	0,3022
0,571	1,750	7,44	92,56	11,2854	0,3357
0,560	1,785	7,94	92,06	11,0001	0,3594
0,556	1,800	8,16	91,84	10,8814	0,3698
0,541	1,850	8,90	91,10	10,5085	0,4046
0,526	1,900	9,63	90,37	10,1631	0,4398
0,519	1,925	10,00	90,00	10,0000	0,4576
0,513	1,950	10,37	89,63	9,8420	0,4755
0,174	5,750	49,52	50,48	3,0522	2,9688
0,172	5,800	49,83	50,17	3,0254	2,9953
0,171	5,850	50,13	49,87	2,9990	3,0217
0,169	5,900	50,43	49,57	2,9731	3,0479
0,168	5,950	50,73	49,27	2,9476	3,0739
0,167	6,000	51,02	48,98	2,9226	3,0998

## Applications

These are the most common types of line coupling applications:

### Phase-to-earth coupling

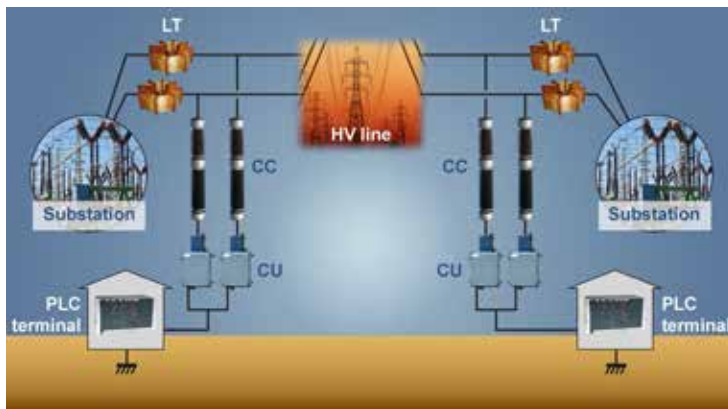
The PLC terminal is connected between one of the line's phases and earth.



### Phase-to-phase coupling

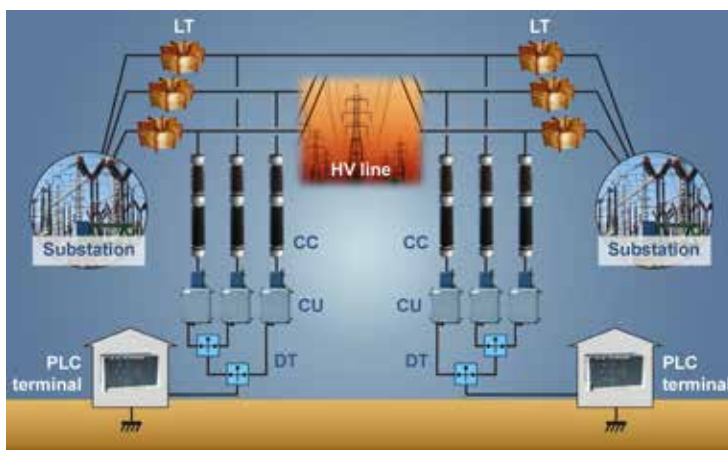
The signals are injected equally in two phases of a line. The phases can be in the same or in different arms.

It is possible to use a differential transformer acting as a hybrid circuit to separate the phases and increase the reliability of the link.



### Three-phase coupling

The signals are injected in the three conductors of the line, half of the power in the central conductor and the other half distributed equally between the external conductors.



### Key features:

- Easy to install
- Highest safety and protection for personnel and communication equipment
- Frequency range from 40 to 500 kHz

## Technical specifications

### UAPA-1 High-pass/Band-pass unit

#### Electrical characteristics

Frequency range	40 to 500 kHz
Coupling capacitor	2 to 10 nF. Specific model for 2 to 12.5 nF
Nominal power (p.e.p.)	400 W for two tones
Equipment-side nominal impedance	50 and 75 $\Omega$ . Others on request
Line-side nominal impedance	100 to 600 $\Omega$ , selected by tap connection
Resonant circuit	Configurable as: <ul style="list-style-type: none"><li>- Third-order high-pass filter</li><li>- Second-order band-pass filter</li></ul>
Power frequency insulation	>10 kVrms
Impulse voltage insulation	>5 kV (1.2/50 $\mu$ s)
Protection elements	Line side: drain coil (optional), earthing switch, air-gap surge arrester and an optional solid-state surge arrester Equipment side: gas surge arrester

#### Versions

- Drain coil and earthing switch outside the chassis (option)
- Solid-state surge arrester (option)
- Hybrid circuit (option)
- Band-pass or High-pass configuration
- Line connection at the bottom of the chassis (option)

#### Mechanical characteristics

Dimensions	Height: 400 mm; Width: 344 mm; Depth: 200 mm
Weight	11.5 kg (25 lb)
Mounting	Four $\varnothing$ 8.5 mm holes
Connection to line	M12 rod or M8 terminal
PLC equipment side connection	By means of cable glands type PG-21, suitable for cables of between 9 and 18 mm diameter
Connection to earth	M10 rod
Material	Glass-fibre reinforced polyester and specific model in stainless steel

### UAMC Compact Band-pass unit

#### Electrical characteristics

Frequency range	40 to 500 kHz
Coupling capacitor	2 to 10 nF
Nominal power (p.e.p.)	400 W for two tones
Equipment-side nominal impedance	75 and 150 $\Omega$ , selected by jumpers. Others on request
Line-side nominal impedance	25 to 750 $\Omega$ , selected by tap connection
Power frequency insulation	>5 kVrms
Impulse voltage insulation	>2 kVrms
Protection elements	Line side: drain coil, earthing switch, air-gap surge arrester and an optional solid-state surge arrester Equipment side: gas surge arrester

#### Mechanical characteristics

Dimensions	Height: 429 mm; Width: 304 mm; Depth: 176 mm
Weight	7 kg approx. (15 lb)
Mounting	Four $\varnothing$ 7 mm holes
Connection to line	M8 screw
PLC equipment side connection	By means of cable glands type PG-21, suitable for cables of between 9 and 18 mm diameter
Material	Glass-fibre reinforced polyester and polycarbonate (cover)



UAPA-1

#### Key features:

- Band-pass or high-pass filter configurations available.
- Differential transformer acting as a hybrid circuit available in specific models.



UAMC

#### Key features:

- Band-pass filter.
- Can include a built-in differential hybrid circuit.



## Technical specifications

### UAM-4 Band-pass Line Matching Unit

#### Electrical characteristics

Frequency range	40 to 500 kHz
Coupling capacitor	2 to 10 nF
Nominal power (p.e.p.)	400 W for two tones
Equipment-side nominal impedance	75, 125, 150 and 250 $\Omega$ , selected by jumpers. Others on request
Line-side nominal impedance	25 to 750 $\Omega$ , selected by tap connection
Power frequency insulation	>5 kVrms
Impulse voltage insulation	>2 kVrms
Protection elements	Line side: drain coil, earthing switch, air-gap surge arrester and an optional solid-state surge arrester Equipment side: gas surge arrester

#### Available models

##### UAM-4

Drain coil and earthing switch outside the chassis

##### UAM-4/D

Same as above with additional solid-state surge arrester

#### Mechanical characteristics

Dimensions	Height: 264 mm; Width: 214 mm; Depth: 132 mm
Weight	6.5 kg (14 lb)
Mounting	Four $\varnothing 8.5$ mm holes
Connection to line	M8 rod
PLC equipment side connection	By means of cable glands type PG-21, suitable for cables of between 9 and 18 mm diameter
Earthing	M10 rod
Material	Die-cast aluminium with outdoor polyester powder paint

### CHD-4 Differential Hybrid circuit

#### Electrical characteristics

Application	Phase-to-phase coupling. Two PLC terminals coupling. Three-phase coupling
Nominal impedance	75 $\Omega$ . Others on request
Bandwidth	40 to 500 kHz
Nominal power (p.e.p.)	400 W
Insulation between primary and secondary	>2.5 krms / 50 Hz
Protection elements	Gas surge arrester

#### Mechanical characteristics

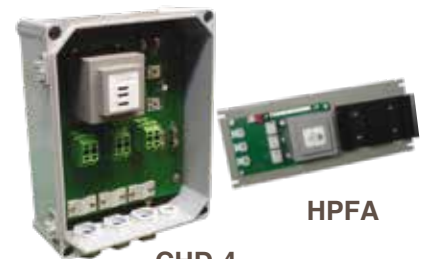
Dimensions	Height: 264 mm; Width: 214 mm; Depth: 132 mm
Weight	5 kg (11 lb)
Mounting	Four $\varnothing 8.5$ mm holes
Connections	By means of cable glands type PG-21, suitable for cables of between 9 and 18 mm diameter
Earthing	M10 rod
Material	Die-cast aluminium with outdoor polyester powder paint



UAM-4

#### Key features:

- Low impedance matching for underground cables.



CHD-4

HPFA

#### Key features:

- Allows connection of a PLC terminal to two or three phases of a power line to improve signal transmission reliability.
- Enables coupling of two PLC terminals using adjacent frequency bands to avoid interferences.
- HPFA is the model for cabinet mounting



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