



# Analogue Power Line Carrier

## APLC-3



APLC3 uses the high-voltage line between transformer substations as a communication path for the telephony, tele-control, teleprotection signals. This technology, which has been tried and tested over decades and adapted to the latest standards, has two main application areas: as a communications link between substations where a fiber-optic connection does not exist or would not be economically viable, and as a backup system for transmitting protection signals parallel to an installed fiber-optic link.

APLC3 supports 5 voice frequency channels. The bandwidth can be programmable in 4 or 8KHz and does not require the exchanging of hardware components. During teleprotection operation, broad band data transmission is briefly interrupted (alternate purpose).

Different from the traditional PLC, APCLC3 gives independent frequency converter and BPF for the pilot and each of voice and RTU data channels. Therefore, it gives up the conception of “upper” & “low” frequency channels for traditional PLC. The frequency band for each of RTU channels can be configured independently as necessary as the user’s RTU modem. In addition, FIR BPFs are employed for data channels in APCLC3, which is propitious to FSK transmission.

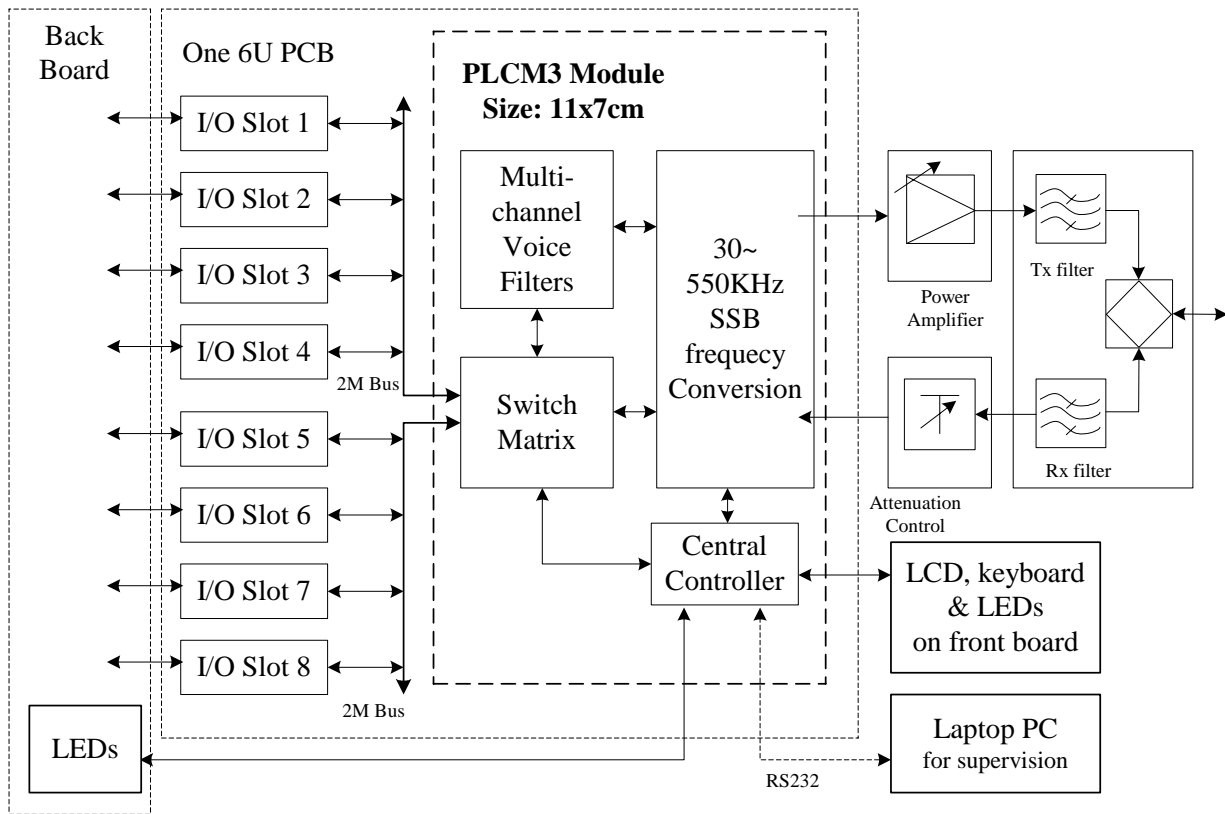
### Features

- Single side-band (SSB) modulation, single stage frequency conversion.
- Frequency range From 40 kHz to 550 kHz. Carrier Frequency:  $(42+4n)$  KHz,  $n = 0..114$ .  
Carrier Band: 4KHz or 8KHz
  - 4KHz: supports one voice channel and two 600bps RTU data channels
  - 8KHz: supports five voice and RTU data channels.
- Teleprotection: supports standard PTT, DTT, Blocking teleprotection in accordance with IEC-60834-1. Boosting control by means of optocoupler. Input voltage: between 30 V and 75V.
- Pilot tone Functions:
  - Automatic Gain Control.
  - Link synchronization
  - Data transmission for the maintenance service
  - Telephone signaling
  - Modulation By frequency-shift keying of  $\pm 30$  Hz. Maximum rate 50 bit/s

- Automatic Gain Control (AGC)
- Wide receiver AGC range > 60dB. Dynamics 55 dB with 1dB pilot modulation
- Efficiency  $\pm 20$  dB input level variations provoke variations of less than  $\pm 0.2$  dB at the output
- Small keyboard and LCD: easily check the system parameters and status.
- Support transparent transmission of voice-frequency signals, such as band limited speech with superimposed teleoperation.
- Integrate a 16x16 voice switch matrix without blocking.
- VF telephone user interfaces: 4-wire EM, FXS and FXO.

### The structure for high integration, flexibility, and anti-interference.

APLC3 integrates all functions except interface on a central module, PLCM3, which size is only 7x11cm. Therefore, the structure of APLC3 is much more simple and reliable than the traditional PLCs. The connections between PLCM3 and outer interface slots are two serial buses only. Each slot is in common use for all types of VF and data interfaces (all interface modules are same size), which offers a high degree of flexibility for user's requirement.



Each I/O slot is in common use for the following interface modules. The more I/O slots can be extended through E1 interface in another chassis.

- 4EM: Voice Frequency 4 wire/EM. 1 channel per slot
- FXS: Voice Frequency FXS interface. 2 channels per slot
- FXO: Voice Frequency FXO interface. 2 channel per slot
- FSK: Narrow band FSK modem or RS232 interface. 1 channel per slot
- Alarm: System alarm module. 1 channel.

APLC3 incorporates extra measures to provide high availability and protection against electromagnetic interference and damage due to over voltage stress. All of VF and data interfaces are electrically isolated, hence providing additional protection against over-voltages, ground potential rise and ground loops beyond standard requirements in the harsh substation environment.

### Easy to operate – the APLC3 management system

APLC3 supports two Human Machine Interfaces for supervision and equipment settings. One is a LCD and a small key board on the front panel. Another is graphical user interface (GUI) based on Microsoft PC.

The APLC3 module features a very user-friendly Human Machine Interface software utility. It provides the following extended facilities and characteristics:

- Collection of operational status information from the statuses of all terminals in a network.
- Setting of the operating frequencies and transmission bandwidth of the link.
- Setting of the included switch & user ports for voice.
- Setting of teleprotection with respect to input/output levels.
- Generation of signals for tuning and testing of the transmit and receive filters

## Technical data

### System

<b>HF transmission</b>	
Modulation	Single-sideband transmission, single stage frequency conversion
HF frequency range	40 – 550 kHz
HF bandwidth	4 or 8kHz
Output power	40-W amplifier: max. + 46 dBm PEP 80-W amplifier: max. + 49 dBm PEP
Output impedance	75 ohms unbalanced
Spurious emission	≥ 60 dB/≥ 70 dB @ 1BN /2BN from the transmit frequency band
Receiver sensitivity for pilot tone	– 40 dBm (minimum receive level can differ according to the operating mode)
Receiver selectivity	≥ 65 dB/≥ 75 dB @1BN /2BN from the frequency band limits
Automatic gain control	45 dB dynamic range (AGC range can vary according to mode) Stabilization of the VF output level: < ± 0.5 dB
<b>Alarm output</b>	
Number of alarm outputs	6
Contact type	Relay changeover contacts
Switching voltage	max. 220 V DC
Switched current	max. 2 A DC
<b>Maintenance interfaces</b>	
Element Manager	RS232 115.2 kbps
<b>Ambient conditions</b>	
Operation	0 °C to + 55 °C
Storage and transport	– 40 °C to + 70 °C

Relative humidity	5 to 95 %
Power supply	Input voltage 48 V DC Power consumption: max. 25 W(Not include PowerAmp.)

## Voice & Data interfaces

Audio frequency analog channels	
Number of channels	up to 5
Frequency range for voice	Speech-filter cut-off frequency Programmable between 1700 Hz and 3400 Hz (in steps of 7.8 Hz)
Compander Compression-expansion ratio k	2, (Dynamically enable or disable)
Frequency range for RTU data communications	From 300~3000Hz (programmable in steps of 7.8 Hz) To 600~3400Hz (programmable in steps of 7.8 Hz) Each channel can be programmable in dependently.

Voice switch between PLC VF channels & phone interface	
switching matrix	16x16 without blocking or concentration.
Signaling	DTMF
Line echo canceller	Selectable

Telephone interface, 4-wire, EM module	
Number of channels	up to 8 (1 channel per module)
Impedance input / output	600 ohms balanced
Input level	- 17 dBm to + 1 dBm
Output level	- 7 dBm to + 14 dBm
“M” wire in	Optocoupler (24 V DC < Vin < 72 V DC, I <sub>max</sub> = 20 mA)
“E” wire out	Optocoupler ( 48V/max. 50 mA)

Telephone interface FXS (2-wire)	
Number of channels	up to 16 (2 channels per module)
Impedance	600 ohms
Feeding current	48 V / max. 40 mA
Loop resistance	≤ 1500 ohms
Ringing current	90 V <sub>pp</sub> / 20, 25, 50, 60 Hz selectable
Input level	- 17 dBm to + 4 dBm
Output level	- 17 dBm to + 1 dBm

Telephone interface FXO (2-wire)	
Number of channels	up to 16 (2 channels per module)
Impedance	600 ohms
Ringing detection	20~130V <sub>rms</sub> , 17~60 Hz
Loop resistance	< 560 ohms
Loop current max	70 mA
Input level	- 17 dBm to 3 dBm

Output level	- 17 dBm to 0 dB
<b>AF data channel for RTU(4-wire)</b>	
Number of channels	up to 8 (1 channel per module)
Impedance input / output	600 ohms balanced
Input level	- 43 dBm to 0 dBm
Output level	- 20 dBm to 0 dBm

## Teleprotection system

### Transmission channels

<b>AF distance protection channel (4-wire)</b>	
Number of channels	1
Impedance input / output	600 ohms balanced
Input level	- 30 dBm to + 3 dBm
Output level	- 30 dBm to + 3 dBm
Transmission time	$\leq$ 4 ms