



PLC42-OCH - PGC_9

Programmable universal PLC terminal for providing analogue and/or digital telecommunication channels on HV power lines

PGC_9 Universality

Traditional PLC links offered telecommunication resources in form of 4kHz wide analogue channels (gross). Modern trends in telecommunications have also resulted in field of PLC communications. Increased need for transmission of data, development of quality algorithms for compressing of digitalized speech and need to include PLC links into unified digital communication transmission network have resulted in emerging of digital PLC terminals or more precisely digital PLC channels. With emerging of digital PLC links analogue PLC links however did not lose their meaning. Analogue PLC channels are much more robust due to its high resistance to adverse operational conditions and are therefore suitable for realisation of most important communication services (such as point-to-point dispatcher speech link, transmission of protection commands, redundant transmission of critical information using two different transmission media etc.). Less resistant digital PLC channels on the other hand offer relatively high transmission capacity with regard to the frequency bandwidth used ($n \times 4\text{kHz}$; $n = 1, 2, 3, 4, \dots$).

Major part of PLC terminal is same regardless of the channel type (analogue or digital). It is therefore sensible that the design of the PLC terminal is universal. Universal PLC terminal provides realization of analogue (aPLC) or digital (dPLC) channels or even combination of both.

PLC terminal **PGC_9** is *typical universal PLC terminal*.

PGC_9 Main characteristics and features

- **Universal design** provides realization of analogue (aPLC) and/or digital (dPLC) channels.



- **Full programmability** without changing any hardware (modules). Value of most parameters is settable by PC locally or remotely.
- **One-step modulation scheme** enables simple production of PLC terminals with different number and type of channels:
 - up to 6 aPLC channels or
 - 1 dPLC channel or
 - aPLC channel(s) and 1 dPLC channel
- **Modular design** enables optimal adjusting of the PLC terminal hardware structure to specific needs of particular application. User always buys only necessary hardware (modules). With adding (or removal) of modules structure of PLC terminal can be adjusted to new requirements: changing of number and type of channels, aPLC channels version («standard» or «speech-plus»), output power (PEP), power supply source and possibility of later integration or removal of TPS function.
- **Wide RF range** of operation from 20kHz to 1.000kHz; programmability without changing of hardware.
- **Compact design:** Regardless of output power (10W, 20W, 40W or 80W) and of number of channels, PLC terminal PGC_9 occupies standard 19 inch rack of 6U (266mm) height and 295mm depth.

- **Powerful diagnostic system** generates lists of diagnostic data (alarms, operational parameters, events) which enable supervision of a device condition locally or remotely.
- **Modern technology:** Intensive use of **DSP** (Digital Signal Processing) and **CPLD** (Complex Programmable Logic Device).
- **Compliance with the relevant standards and recommendations:** IEC 60495 (1993-09), document »Report on Digital Power Line Carrier« (CIGRE WG 35.09, April 2000) and relevant standards on EMC (IEC 61000-4-xx; ElectroMagnetic Compatibility) and safety.

terminal. »Speech-plus« aPLC channel **additionally** includes universal (programmable) telephone interface providing possibility for different telephone applications such as remote subscriber (interface on subscriber side (FXS) or telephone exchange side (FXO)) or TRUNK connection between telephone exchanges (2-w/4-w, E&M interface).

Each aPLC channel can have integrated function for transmission of protection commands (TPS function) which characteristics are the same as of **PST 9-A** TPS terminal. In such case suitable number of interface modules for connection to protection relay is built into the rack; PRIA, PRIB and/or PRIC module(s).

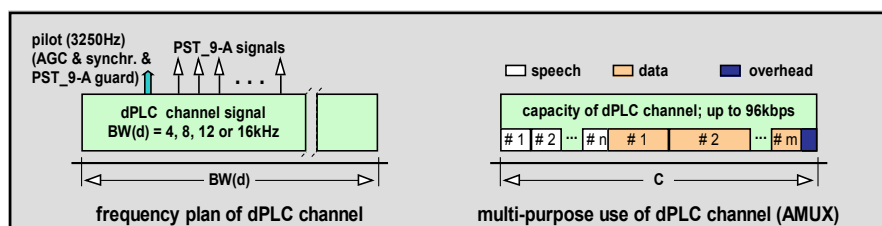
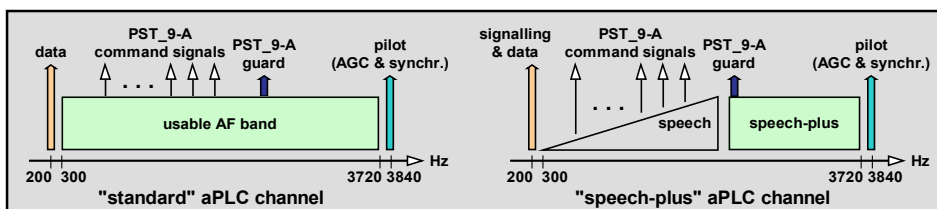
PGC_9 aPLC channel

Each aPLC channel is a telecommunication resource in a form of usable AF band from 300Hz to 3.720kHz (4kHz gross) intended for a transmission of analogue signals, carrying information. aPLC channels are very robust. They operate with sufficient dependability even at adverse operational conditions (e.g. bad weather) represented by high attenuation of transmission path and high level of noise and interferences which result in low Signal-to-Noise ratio (SNR) at the receiver input.

Two versions of aPLC channel are available: »standard« and »speech-plus«. Interface of each »standard« aPLC channel includes three (3) 4-wire analogue channel ports and input for control signal »BOOST«. AF channel port #1 can perform transit function for analogue signals (activation of transmit and/or receive transit filter), AF channel port #2 can serve for connection of external TeleProtection Signalling

PGC_9 dPLC channel

Each dPLC channel is a telecommunication resource in a form of transmission capacity expressed in kilobites-per-second (kbps). Transmission capacity of dPLC channel of universal PLC terminal PGC_9 is programmable in the range from 9.6kbps to 96kbps. Frequency bandwidth occupied by dPLC channel is also programmable in the range $n \times 4\text{kHz}$; $n = 1, 2, 3$ or 4. dPLC channel enables transmission of information in digital form. dPLC channel is more sensitive to adverse operational conditions but it provides more efficient use of frequency band intended for PLC communications. Whole transmission capacity of dPLC channel may be used for transmission of only one digital signal and this is called **single-purpose use** of dPLC channel. In that case source/sink of digital signal is connected directly to digital channel interface of dPLC channel. dPLC channel may be equipped with digital interfaces of different type.

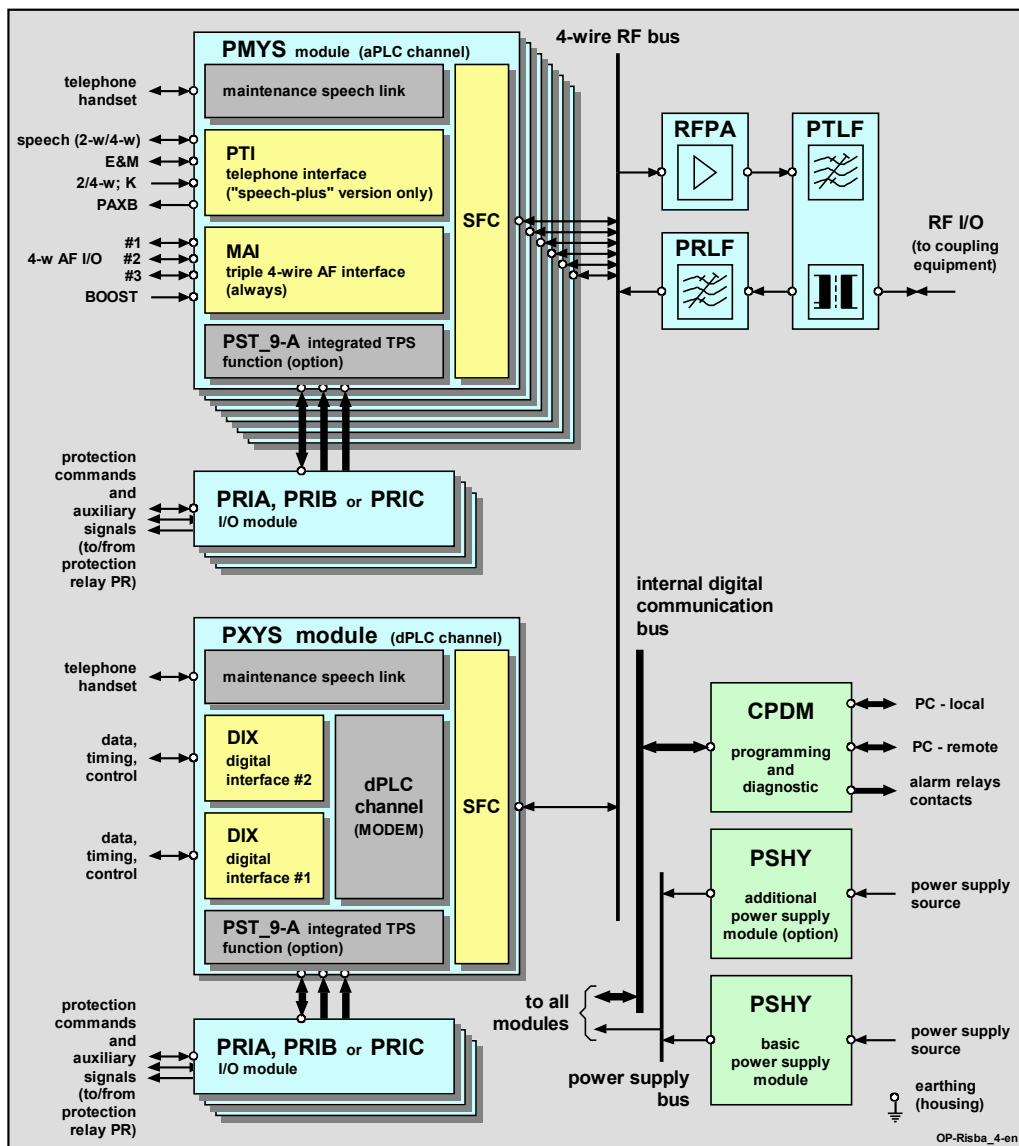


Several applications require transmission of many individual digital signals over single dPLC channel (data and/or speech) and this is called **multi-purpose use** of dPLC channel. In this case external digital access multiplexer (AMUX) is connected to the digital channel interface of dPLC channel. Basic function of AMUX is digitisation and compression of analogue speech signals and time division multiplexing of data and digitised speech signals to single digital signal suitable for transmission over dPLC channel. AMUX structure is modular which enables insertion of different data and speech (telephone) interfaces and with that coverage of many different applications requirements.

PLC terminal PGC_9 does not include AMUX. TTC Marconi offers AMUX of third party supplier which is modular, has quality algorithms for speech compression and high efficiency of multiplexing (low »overhead«) and is on very high technological level.

dPLC channel may have integrated function for transmission of protection commands (TPS function) which characteristics are the same as of **PST_9-A** TPS terminal. In such case suitable number of interface modules for connection to protection relay is inserted into the rack; PRIA, PRIB and/or PRIC module(s).

PGC_9 Principal block diagram



PGC_9 Main technical data

type of modulation	single-step AM
transmission method	SSB with suppressed carrier
operating mode	duplex
RF range (kHz)	20 – 1.000
channel type:	analogue (aPLC) or digital (dPLC)
number of channels:	1 to 6 aPLC channels or 1dPLC channel or aPLC channels & 1 dPLC ch.

General

channels polarization	always normal
Tx/Rx channel allocation	adjacent or non-adjacent
RF output power PEP (W)	10, 20, 40 or 80
RF IN/OUT impedance (Ω):	50, 75, 125 or 150; balanced or unbalanced or 2 x 75 unbal. (RF hybrid)
power supply - mains:	115 / 230 V AC
power supply – battery:	24, 48, 60, 110, 220 V DC
temperature range (°C)	0 – 45 (55)
compliance	IEC 60495 (1993-09)

Analogue channel (aPLC channel)

bandwidth (kHz)	4 (gross)
usable AF band (Hz)	300 – 3.720
channel versions:	»standard« or »speech-plus«
AF channel interface	3 x 4-wire port & BOOST
transit filter	YES (in Tx and Rx direction)
telephony interface	universal; FXS, FXO, 2-/4-wire, E&M (TRUNK)

receiver sensitivity	pilot level ≥ -30dB (PEP/channel = 10W: line attenuation ≤ 51dB)
AGC range	≥ 40dB
synchronization	YES; »master – slave«
integrated functions:	maintenance speech ch. TPS function PST_9-A (option)

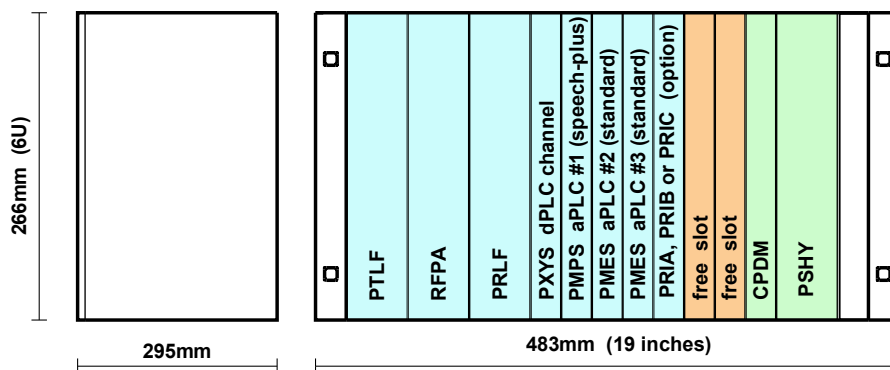
Digital channel (dPLC channel)

digital modulation	MC OFDM QAM
adaptive equalizer	YES
nominal channel capacity (kbps):	9.6, 14.4, 19.2, 24, 28.8, 32, 48, 56, 64, 72 or 96
bandwidth used (kHz):	4, 8, 12 or 16
utilisation methods:	single-purpose use or multi-purpose use (AMUX)

(see also AMUX data)

digital channel interface	two interfaces; RS-232 (V.24/V.28), V.35, X.21 or G.703 (co- or contra-direct.)
integrated functions:	maintenance speech ch. TPS function PST_9-A (option)

PGC_9 Mechanical design (rack R1P)



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