

TECHNICAL SPECIFICATION T-2040 I

TECHNICAL SPECIFICATIONS OF PLC (POWER LINE CARRIER) DEVICES TRANSMITTING VIA POWER TRANSMISSION LINES OF 150/400KV SINGLE SIDE BAND AMPLITUDE MODULATION WITHOUT FREQUENCY INTERCHANGE WITH B.W. OF 4KHZ PER DIRECTION OF TRANSMISSION

I. GENERAL CHARACTERISTICS

1. APPLICATION - INSTALLATION

- 1.1 The specified PLC devices will be integrated in the existing PLC network of IPTO.
- 1.2 The devices will be installed by IPTO personnel.

2. REQUIRED CAPABILITIES

2.1. Each offered PLC device should be able to perform the following functions:

- 2.1.1. Simultaneous bi-directional telephone communication (Full duplex).
- 2.1.2. Simultaneous bi-directional transfer of call signaling.
- 2.1.3. Simultaneous bi-directional transfer of superimposed signals (data or telecontrol signaling).
- 2.1.4. Data transfer with built-in asynchronous MODEM at speeds of 50 to 1200 baud with FSK modulation.
- 2.1.5. Simultaneous bi-directional operation of teleprotection device type: Alternate multipurpose F6 teleprotection systems according to T-2032 E specification.
- 2.1.6. It should be certified that the offered PLC and the offered teleprotection device as described in 2.1.5 are fully compatible.

3. TECHNOLOGY

- 3.1 The offered devices must be of latest technology and excellent design and manufacturing.
- 3.2 The offered device should comply fully with the latest regulations and IEC-495 recommendations.
- 3.3 In the case the requirements of this specification differ from the regulations and recommendations of IEC-495, the requirements of this specifications should prevail.
- 3.4 The certificates of compliance to paragraph 3.2. must be submitted.
- 3.5 The device should operate with the suppressed carrier or reduced carrier transmission system.
- 3.6 When the PLC is of suppressed carrier transmission type the receiver sensitivity (A.G.C.) should be adjusted by means of a control channel (pilot channel) of 50 Baud, the same channel should also be used as call channel.
The above channel should not be in the frequency band assigned to VF telegraph channels.

- 3.7 When the PLC is of reduced carrier transmission type the receiver sensitivity (A.G.C.) should be adjusted automatically by means of the reduced carrier. The calls will be transferred by means of a 50 Baud channel.
The above channel should not be in the frequency band assigned to VF telegraph channels.
- 3.8 The carrier frequency should be produced by synthesizer. The synthesizer reference frequency must be produced by a crystal of high stability. The selection of the receiver carrier frequency or the transmitter should be selected through micro – switches or jumpers.
- 3.9 The offered PLC devices should be suitably equipped to support adjacent HF frequency reception and transmission bands.
- 3.10 The operation frequency for the receiver and the transmitter should be selectable in steps of 4 KHz. The complete frequency allocation scheme is required to be submitted extending over the frequency range of 40 KHz to 490 KHz.
- 3.11 The frequency selection of the line filters at transmitter or receiver side should be implemented through appropriate micro-switches and/or the replacement of a small number of capacitors .
It is pointed out that each offered PLC should be suitable to operate in any frequency included in the range from 40 KHz-490KHz without any intervention from the manufacturer.
Full details about the frequency setting of each filter, at transmitter or receiver side, for the entire frequency range are required. The procedure that should be followed for the operation frequency changes should be provided.
- 3.12 The device should be equipped with a high frequency power amplifier housed together with the line filters preferably in a separate module.
- 3.13 Each offered device should have in the front panel a gauge for the indication of the received high frequency signal level at the A.G.C. input or a configuration of LEDs indicating the point of operation of the receiver relating to the introduced power line attenuation or any suitable indicator of successful operation.
- 3.14 Each offered PLC device should be equipped with all the required interfaces to operate with:
- 3.14.1. A telephone hand set with a dialing disc (providing pulses, ring tone, as well as a response – return tone).
 - 3.14.2. Another PLC device with a 2 or 4 wire connection capability.
 - 3.14.3. A telephone exchange (PAX) with 2 - 8 wire connection.
 - 3.14.4. A local service telephone unit.
 - 3.14.5. Technical details regarding their connections to PLC should be provided for all the above mentioned interface units.
- 3.15 Each offered PLC should be provided with:
- 3.15.1. A telephone hand set with a dialing disc or keyboards as mentioned in 3.14.1.
 - 3.15.2. A service hand set as mentioned in 3.14.4 if required.
- 3.16 The device should be offered with a DC power supply module operating at a nominal voltage of 48VDC.

3.16.1 All the relevant information regarding the operation of the DC power supply such as drawings and descriptions of all constituting sub-units must be submitted.

3.16.2 The offered power supply as mentioned in 3.16 should be equipped with :

3.16.2.1 Protection against over voltages at its inputs.

3.16.2.2 Electronic protection against short circuits at the subsidiary output voltage.

3.17 The HF output at the transmitter and receiver side should be connected with :

3.17.1 An asymmetric high frequency coaxial cable of nominal impedance of 75 OHMS.

3.17.2 A Symmetric high frequency cable with a nominal impedance of 150 OHMS
Balanced.

3.18 In the case of use a specific HF transformer, for the implementation of the requirements mentioned in 3.17.1 and 3.17.2, the specifications of the transformer should be provided including all the details of attenuation, return loss, reflection, etc for the entire range of PLC operation. Connection instructions with the PLC should be provided .

3.19 Each device should be offered with a dummy load of 75 or 150 OHM fit to be connected with the HF output of the device through jumpers.

3.20 The superimposed (data signals) section of each offered PLC should have :

3.20.1 At least two separate input transformers of characteristic input impedance of 600 OHM, with corresponding adjustable amplifiers or attenuators in 1dB step at the transmitter side, in addition to the built-in digital modem and the teleprotection inputs.

3.20.2 At least two separate output transformers of characteristic output impedance of 600 OHM, with corresponding adjustable amplifiers or attenuators in 1db step at the receiver side, in addition to the built-in digital modem and the teleprotection outputs.

3.20.3 Band pass filters for the superimposed signals at the transmitter and receiver side with a rejection of at least 20db for any undesirable signal.

3.21 Each PLC device should be fully compatible with the teleprotection devices as mentioned in 2.1.5, providing the followings:

3.21.1 Dedicated input/output of audio range protection signals with characteristic impedance of 600 OHM.

3.21.2 The required circuits for connecting/disconnecting the voice, calling and superimposed signals.

3.22 Each device should be equipped with monitoring circuits (ALARMS) to signal (via free contacts) the failure of the power supply and/or the malfunction of the power amplifier and/or the loss of HF input.

3.23 Each device should be provided with a supervision circuit of the calling channel at the receiver, such as in the case of malfunction to proceed the following:

3.23.1 To signal locally through free voltage relay contacts.

3.23.2 To transfer the signal through the transmitter to the other side PLC receiver in order to activate a free voltage relay contacts at the receiving side.

3.24 Each device should be offered with:

3.24.1 A dynamic limiter in the voice input.

3.24.2 A line equalizer in the IF stage at the receiver side.

3.24.3 A spark gap to protect against surge voltages in the H.F. connection circuit.

4. **CONSTRUCTION**

4.1 Each device must be constituted of one or more sub-racks fit to be accommodated in 19" cabinets excluding the offer of any other type.

4.2 Each rack must be modular constructed by means of plug in cards/boards in a main backplane board.

4.3. The wiring among the different sub-racks should be implemented through pre-constructed boards or permanent wiring such as no extra wiring work is required during installation.

4.4 All other external connections (power supply, HF connections, LF connections) should be implemented via connectors or screw type terminals excluding any other type.

4.5 At the front of the PLC or on a separate rack there should be short circuit jacks of U type or knife connectors for the disconnection of the VF input/output signals such as voice, calls, superimposed, protection signals.

4.6 Each plug-in card should be of excellent quality well-constructed (epoxy-glass board) and satisfy the following :

4.6.1 To have golden plated ends on the side of connection with the main board.

4.6.2 To have a layer of epoxy resin to be protected against humidity and corrosion.

4.6.3 The front panel must have the required testing point jacks (for measuring purposes) and LEDs indicators for different state of operation conditions.

4.7. The materials used in the device construction and its accessories should be of excellent quality. The used integrated circuits I.C. on the board must be appropriate category type for industrial use.

4.8. The cooling of the device should be implemented through natural air ventilation.

4.9. The offered PLC should have dimensions not exceeding the 70cm in height. The exact dimensions of the device should be stated in the offer.

4.10 The PLC device should be well designed so all its parts to be easily accessible facilitating the maintenance requirements.

4.11 Each PLC should be accompanied by an extension card.

4.12 Special measuring cables must be provided if required.

- 4.13 If the use of PC is required for the configuration of the device or other maintenance works, the necessary software must be offered suitable for Windows operating system (new and old) accompanied by the appropriate interconnection cables. (at least 20 sets).

5. **DOCUMENTS AND DRAWINGS**

- 5.1 Each PLC device must be provided by a complete set of technical documentation.
- 5.2 The provided technical documentation must be in Greek or in English. Any other language of technical documentation will not be accepted.
- 5.3 The technical documentation must include the following :
- 5.3.1 Detailed operational diagrams for each module/unit and block diagrams showing the interconnection among all the modules/units that consist the PLC device.
 - 5.3.2 Initial installation procedures and configuration parameters.
 - 5.3.3 Detailed description of the operation of the device.
 - 5.3.4 Technical information, diagrams-curves, graphical representations of the variables of the operational characteristics of the PLC device.
 - 5.3.5 Detailed circuit diagrams and topological drawings for each unit and sub-units.
 - 5.3.6 Detailed list of all used parts, and elements/components used in each unit and sub unit (electrical or electronic elements) constituting each PLC device stating the exact serial production number and the corresponding commercial number.

6. **SPARE PARTS**

- 6.1. The complete spare part list should be provided including the relevant serial numbers.

7. **WARRANTY**

The supplier must provide a warranty of at least two (2) years, starting from the date of equipment delivery.

8. **TRAINING**

Training of ten (10) technicians for a week must be included in the offer. The training will take place at the IPTO premises.

9. **PLC PACKING REQUIREMENTS**

- 9.1 Each PLC device should be delivered packed in a robust paper box suitable to withstand transfer hazards, accompanied by its accessories.
- 9.2 It should be written on each box the type of the device, its serial production number and the number of contract.

10. **SAMPLE FOR EVALUATION**

The submitted sample should be of the exact type with the offered and should be accompanied with all the relevant type tests and certificates.

II TECHNICAL SPECIFICATIONS

1. Transmission type : Single side band with suppressed or reduced carrier transmission with I.F. stage.
2. Modulation type : Amplitude modulation
3. H.F. range of operation : From 40 KHz to 490KHz continuous band working with no frequency gaps.
4. H.F frequency Bandwidth : 4 KHz for each direction of transmission
5. Output power, measured at the output of the device (antenna), excluding any attenuation inserted by matching transformer :
 - 5.1. $Z=75\Omega$ (Coaxial) : 20W/+43dBm
 - 5.2. $Z=150\Omega$ (Balanced) : 20W/+43dBm (according to IEC)
6. Nominal output impedance (HF side).
 - 6.1. Unbalanced : 75 Ω
 - 6.2. Balanced : 150 Ω
 - 6.3. Return loss : >10dB
7. Attenuation due to PLC parallel operation : <15KHz (with total attenuation <1 dB)
8. Working attenuation in noise free line : > 40dB
9. Maximum usable sensitivity with and without F6 teleprotection system. : Provide operational characteristics for adjacent H.F. bands for carrier or F6 pilots frequencies
10. AGC sensitivity for output variation < 0,5dB : > 35 dB

11. Spurious frequencies : According to IEC 495.
- 12 . Noise level at voice output : < -55 dBmOp.
13. Voice limiter
- 13.1. Method : Level + 0,5dBmO
- 13.2. Output level for input of +15dBmO : ≤ 3dBmO
14. Low frequency B.W.
- 14.1. Voice : 0,3 to 2 KHZ adjustable
- 14.2. Telegraphic channels : 2,3 to 3,4 KHZ adjustable
- 14.3 Asynchronous data MODEM : Transmission speed programmable to:
50 baud (ITU-T R.35)
100 baud (ITU-T R.37)
200 baud (ITU-T R.38B)
200/300 baud (ITU-T R.38A)
600 baud (ITU-T V.23, 601, 602, 603)
1200 baud (ITU-T V.23, 701)
Data interface V.24/V.28, RS232
Programmable RTS/CTS delay
- 14.4. Protection type F6.
15. Signaling frequency : FSK/2.580 ± 30Hz or equivalent
16. Signaling speed : ≥ 10 pulses /Sec (40/60)
17. Destruction : ≤ 5mSec
18. Signaling input : By switching to ground potential
19. Signaling output : Free voltage double pole change over
contact 150 VDC 2A 60 VA
20. Voice levels :
- 20.1. Two wire input : 0db/600Ω
- 20.2. Four wire input : 0dB to - 17dB/600Ω
- 20.3. Two wire output : - 7dB/600Ω
- 20.4. Four wire output : -7dB to +8dB/600Ω adjustable to 1 dB
steps

21. Telegraphic channels levels

21.1. Input : -20dB to -5dB/600Ω adjustable to 1 dB steps

21.2. Output : -20dB to -5dB/600Ω adjustable to 1 dB steps

22. Frequency stability between transmitting and receiving low frequency signals : < ±2HZ

23. Nominal impedance levels.

23.1 Nominal impedance : 600Ω balanced

23.2 Return loss : >14dB

24. Power supply DC

24.1 Nominal Voltage : 48 DC +20% to -15%

25. Power consumption : < 150VA

26. Insulation

26.1 Input to power supply : Each terminal to ground
500Vrms/50HZ/1min

26.2 H.F side : Each terminal to ground
2KVrms/50HZ/1min

26.3. Low frequency side : Each terminal to ground
500Vrms/50HZ/1min

27. Operating conditions

27.1 Operating temperature : 0° to +45° (according to IEC)

27.2 Humidity : 0 to 90%

28 Storage

28.1 Temperature : -25° C to +65° C

28.2 Humidity : 0 to 90%

29. Protection : IP20 according to DIN 40050

III. **INSTRUCTIONS FOR TECHNICAL OFFER FORMAT**

1. The technical offer must be typed in Greek or in English and submitted in two (2) copies.
2. Every offer must be accompanied by the following :
 - 2.1. Complete set of technical manuals of the exact type of equipment offered in accordance with par 5 of technical specification.
 - 2.2. Full compliance list.
In this list must be stated the compliance or non compliance to all relative specification requirements for each paragraph of chapters I and II. Answers must be clear with references to the technical manuals and/ or other documents accompanying the offer.
E.g. : Comply and offered. See technical manual, page, par.....
or : Not comply, but we offer equivalent. See technical manual, page....., par.....
 - 2.3. Equipment composition list stating :
 - 2.3.1. The exact type of the equipment offered.
 - 2.3.2. Complete and analytic composition list of the equipment offered with description and number of units and subunits used, mechanical parts tec. as with their code numbers.
Each set of equipment must be offered complete with all accessories necessary for its independent operation.
 - 2.4. Sample of the equipment offered for technical evaluation.
 - 2.4.1. All bidders within ten (10) working days from the data of their requested department of IPTO with a sample of the exact type of the equipment offered for further technical evaluation, otherwise the offer will be considered as non acceptable.
 - 2.4.2. In case that the offered equipment is identical to previously supplied to IPTO it is not necessary to provide said sample but must state the number of the relevant contract.
 - 2.4.3. The supplied sample will remain with IPTO for at least the duration of the validity of the economic offer.
 - 2.5. List of spare parts offered. In this list all equipment parts (units, subunits etc) and components must be included with description, manufacturers part number and where possible commercial type number.
 - 2.6. Certificates and guaranties as required by specifications.
 - 2.7. The supplier must provide a customer list with company names, addresses, FAX and emails of utility companies where has installed and successful operated.
 - 2.8. If the equipment offered is manufactured under license the relative documents must be supplied.

- 2.9. Exact and complete photocopy of economic offer without prices and discounts.
3. The following clarifications must be seriously noted :
 - 3.1. Every par. Of the specification requirements that has not been answered or has been answered but non clearly will be considered as negative answer.
 - 3.2. Any offer not containing all requirements of par. I.5 of the technical specifications will be rejected as not technically acceptable.
 - 3.3. The required lists III.2.3. and III.2.32.5. above must not include prices otherwise the offer will be rejected. However these lists III.2.32.3. and III.2.32.5. must be included in the economic offer with price break – down. The sum of the break – down prices of the units of the composition list 2.3. must equal the total value of the system offered.
 - 3.4. IPTO reserves the right to decide which spare parts and their quantity that will be included in the final contractual agreement.
The price of the spare parts will not be considered in the economic evaluation of the offers.
 - 3.5. For the award of the contract the following will be seriously considered :
 - 3.5.1. The compliance to the technical and other requirements.
 - 3.5.2. The conduct of the supplier and the quality of the material supplied to IPTO in previous contracts if any.
 - 3.5.3. The delivery time of the requested equipment.