

Update information for the PTC-II/e/ex/pro-Firmware Version 3.6

1. General

The version 3.6 firmware considerably increases the functionality: For the first time the PTC Firmware supports “Automatic Position Reporting System” as “stand alone” Service. A PTC can be used as a position “Tracker”. The generated datagram is APRS compatible. Version 3.6 offers a further important new feature, an innovative, robust modulation mode for HF-Packet-Radio (HF-PR). This is also the ideal method to transfer position data with high reliability via shortwave. The new modulation method (Robust Packet-Radio) is available for free for the PTC-IIex. For the PTC-II and PTC-IIpro a new inexpensive **DSP-Modem-II** (plug in module) will be available from SCS as of June 2005. The new DSP-Modem naturally offers all the past PR-modulation modes (300-19200 Bd). Only the PTC-IIe is unfortunately not upgradeable for “Robust-PR”. A few small error corrections round up the update.

IMPORTANT: The firmware (firmware file **profi36.pt2**) will only be started by the PTC-II when the PTC-II is equipped with 2 MB of RAM. The PTC-II is upgradeable to 2 MB of RAM, refer to the manual to see how.

The DSP-Modem-II is only recognized by the PTC-II when the DIP-switch 1 for port 1 or switch 2 for port 2 is set to “ON”. The DIP-switches are on the bottom side of the unit.

2. New Features

2.1 APRS¹-Commands/Configuration (for “Stand-Alone” Position Tracking)

“Stand alone” means position tracking that works without a PC being connected. The actual position data is sent in regular intervals in APRS format. The position can be entered either manually (“Fix-operation”) or collected from a connected GPS receiver (“GPS-operation”).

For setting up the tracker functions a new command `Aprs` is available in the **pac:** -menu (only the letters in capital are necessary for the command to be accepted). The first argument that follows the `Aprs` command selects one of the available functions and thus can be considered as “sub-command”. If the “sub-command” is missing, i.e. a direct numerical parameter follows the `Aprs` command, this parameter defines the APRS main operation mode.

With multiport units (PTC-II, PTC-IIpro) a few commands can be set referring to the port. The corresponding commands are marked as “port dependent.”

APRS-digipeating is not directly supported by the firmware 3.6. However, the normal digipeating functions can be used for simple APRS-digipeating. A universal APRS digipeater can easily be established using free PC programs (e.g. UI-View).

¹ APRS is a registered trademark of APRS Engineering LCC, USA

APRS datagrams are always sent with the modulation mode previously set with the Baud command (%B in hostmode) .

The following functions are available.

2.1.1 Aprs (without “sub command”) (Port dependent)

Default setting: 0

Possible parameters: 0, 1, 2

This “APRS main switch” defines the APRS mode:

0: OFF, APRS-beacon is switched off.

1: GPS, APRS-beacon sends the GPS position data if available.

2: FIX, APRS-beacon sends the fixed position data (adjustable with Aprs POsition) if available.

In GPS mode the beacon only transmits if the position data is not older than 20 minutes. If the GPS receiver fails, the beacon terminates its transmission after 20 minutes.

Important

The APRS beacon uses as sender callsign the MYcall of the virtual channel 0. As long as this callsign is not set, the APRS-beacon cannot be activated. The MYcall of the virtual channel 0 is automatically taken over from the PACTOR MYcall (after a REStart), so that normally only a single MYcall entry is necessary to set all PACTOR as well as Packet-Radio/APRS MYcalls to the own callsign.

2.1.2 Aprs Timer (alternative Aprs BEacon) (Port dependent)

Default setting 900

Possible parameters: 0, 10-7200

Sets the beacon interval in seconds. With the default setting 900, the beacon sends every 15 minutes, if position data is available and the “global MYcall” is set on the virtual channel 0.

Parameter 0 activates the speed dependent automatic mode: The interval is then calculated by the formula: Interval [sec] = 1800/GPS speed (knots).

Above 180 knots the interval is limited to 10 seconds.

This automatic can only function when the speed is contained in the GPS-data; when RMC data from the connected GPS-Receiver is available. If no speed data is available, the interval in automatic mode is set to 900 seconds. With “FIX-Position” (Aprs 2, see above) and automatic timer, the firmware sets the interval independent from the speed data of any connected GPS-receiver to 1800 seconds.

2.1.3. Aprs COmment

Default setting: NONE

Possible parameters: - or maximum 40 characters comment text.

Defines the comment text that is added to every APRS-datagram. For example, a main points description of the system can be included here: “{PTC-II} 20 W, Dipole”. The comments maximum length is 40 characters. Longer comments will be rejected with an error message. A minus character (-) as first comment character sets the comment to “NONE” , respectively deletes the comment.

APRS comments should be as short as possible, since longer APRS-datagrams lead to a (unnecessary) high channel occupation.

2.1.4 Aprs SYmbol

Default setting: 15 [Dot]

Possible parameters: 1 – 94, a1 – a94

Sets the graphic APRS symbol that an APRS-receiving station should display: e.g. a symbolic car in mobile service (Symbol 30). The symbol numbers follow exactly the table in the APRS-protocol version 1.0. The complete protocol information is available on the Internet. Symbols from the alternative table (“alternate table”) can be selected by prefixing an “a” before the symbol number. E.g. “A SY a13” for “House(HF)”.

If no symbol number is given as an argument, the “A SY” command (normal way) displays the actual parameter settings with the current symbol and additionally a short description in square brackets, e.g. “a13 [House (HF)]”.

Here is a selection of current symbols with their numbers:

- 6: HF Gateway
- 7: Small Aircraft
- 13: House QTH (VHF)
- A13: House (HF)
- 15: Dot
- 27: Campground
- 28: Motorcycle
- 30: Car
- 47: Balloon
- 50: Recreational Vehicle
- 53: Bus
- 56: Helicopter
- 57: Yacht (Sail boat)
- 65: Ambulance
- 66: Bicycle
- 70: Jeep

75: Truck
83: Ship (Power boat)
86: Van

2.1.5 Aprs PPosition

Default setting: NONE

Possible parameters: XXXX.XXS/N YYYYYY.YYW/E

Allows the entry of position for “Fix”-operation (Aprs 2, see above). The position must be entered exactly in the correct format for “Latitude Longitude”, which means degrees including leading zeros followed directly by the minutes expression and finally the direction. Any other format will be rejected with an error message.

Example: A PO 4810.30N 01030.25W <Enter>

A “FIX”-position can only be replaced by another “FIX”-position but cannot be deleted.

2.1.6. Aprs SHort

Default setting: 1

Possible parameters: 0, 1

Activates (1) or deactivates (0) the compression of the position Data in the APRS datagram. The compressed format has only advantages: Shorter datagram’s, higher accuracy, speed and direction can be included in the transfer. However because some APRS-programs cannot correctly interpret the compressed format, the SCS firmware allows the compression to be switched off. Uncompressed position data can be directly monitored as usual in “Latitude Longitude-format”, as they are sent in clear text format.

2.1.7 Aprs PPath (Port dependent)

Default setting: APRS via RELAY WIDE

Possible parameters: APRS- target callsign and maximum 8 digipeater callsigns.

Defines the AX.25 transmit path including target callsign and maximum 8 digitpeater callsigns, also with their respective SSID if necessary.

Example: A PA CQ via RELAY <Enter>
 A PA APRS RELAY WIDE GATE <Enter>

Between the target callsign and (optionally) the digipeater list, a “v” or “via” can be inserted to increase readability.

A description of the function of current APRS-digipeater callsigns exceeds the boundaries of this user manual. Appropriate information can be found in relevant literature e.g. Internet. If there is no

exact information of available digipeaters on hand, it is recommended to set “RELAY” as the first digipeater.

2.2 Robust Modulation method for HF-PR (“Robust PR”)

Up to now Packet-Radio over shortwave has been basically a non-starter, it has even been heavily criticized because of the low effective throughput and repeats. AX.25 is for shortwave not an ideal protocol, but with automatic FRack- setting and a small MAXFrame values the protocol should, however, function much better on a shortwave channel than has previously been the case generally. One cannot of course expect an asynchrone protocol to reach the same efficiency as a small synchrone ARQ protocol (e.g. PACTOR), but for some applications a multi-user service, with very uncritical transmit/receive switching, as well as almost zero power holding up a connection when no data passing, brings a real advantage that outweighs the lower data throughput.

What finally are the reasons that up to now HF-PR works so poorly, and apart from “forwarding” is hardly ever used? One finds a simple answer: The current modulation type for HF-PR namely uncoded 300 Bd FSK is really unsuitable for normal HF channels. The symbols are much too short even with moderate “Multi-Path effect” (“delay spread”) to work. Additionally, because no sort of error correction code is used, even short troughs or “static” will destroy a many seconds long Packet. Just one missing bit leads to a repeat of the whole packet.

To help cure this problem, SCS has developed a new class of robust modulations types especially for Packet-Radio. As a special feature for all the variants of this “Robust PR”, a completely new synchronizations algorithm with “catch” properties that were not possible before has been realized. **Frequency deviations of ± 250 Hz are immediately recognized and without any loss of sensitivity compensated**, and this with signals that are buried deep in the noise. Because of this it’s possible to remove a tuning display. One can say with good conscience that this is “Plug and Play” for shortwave.

The 3.6 firmware makes available a small band (500 Hz) version of the “Robust PR”. A wide band variant (2 kHz) with similar characteristics and 4 times the speed is generally possible.

The currently available “Robust PR” modulations types have the following properties:

Bandwidth:	500 Hz @ -30dB.
Modulation:	Pulse-Shaped OFDM (BPSK, QPSK); similar to Pactor-III
Average throughput:	200 or 600 Bits/s (Increase to 1200 Bit/s possible)
Crestfactor:	3.0 or 4.2 dB
Delay-Spread:	to ± 8 msec can be coped with
Coding:	High performance convolutional code, “full-frame interleaved”, rate/2 or rate 3/4

2.2.1 Configuration of the “Robust PR”

For the selection / configuration of the robust modulation for HF-PR no special commands are necessary. The selection of the modulation type follows the usual way with the Baud command in the pac: menu or %B command in hostmode. The transmit level is taken from the `PSKAmp1` (PACTOR PSK-Amplitude).

The center frequency of the audio signal is fixed to 1500 Hz. On the receive side the same side band as on the transmit side must be used. We generally recommend **USB**.

With “Robust PR”-modulation selected, the PTC assumes that a connection will be via a HF channel and adjusts a few parameters automatically.

MAXFrame is automatically administrated; the value given by the user does not matter.

RETries is automatically doubled, but cannot exceed 255.

TXDelay is automatically divided by 4, with the default setting of 100 resulting in the usual 25 msec for shortwave.

RESptime is automatically halved.

Following additional parameters of the Baud command are available:

Baud R300: During an X.25 connection automatic / self adaptive selection between 200 bit/sec and 600 bit/sec. UI-Packets (e.g. APRS) are transmitted in 200 bit/sec.

Baud R600: During an X.25 connection automatic / self adaptive selection between 200 bit/sec and 600 bit/sec. UI-Packets (e.g. APRS) are transmitted in 600 bit/sec

The arguments valid for Baud are also available in the same form for the Hostmode command %B.

3. Improvements / Error corrections.

- Auto GLL/RMC when GPS receiver is connected.
Firmware now accepts parallel \$XXRMC as well as \$XXGLL (XX=GP or II). RMC has priority. As soon as RMC is received the firmware does not look for GLL any more for 15 seconds (retriggered).
- On hostmode channel 249 the PTC-IIex provides all NMEA sentences of a connected GPS receiver. Except the terminating <CR> (ASCII13) the data is exactly matching with the one the GPS receiver sends. The PTC-IIex buffers 32 sets of NMEA data internally. This NMEA channel is also included in the extended hostmode channel 255, which means that the usual poll on channel 255 is sufficient to determine if there is new NMEA data available on channel 249

- Dynamic FRack with Packet-Radio connection.
FRack start value as in the past, otherwise $2 \cdot \text{SRTT} \cdot X$ ($X = \text{RETRY}/2$, if $\text{RETRY} > 2$, otherwise $X = 1$; $\text{SRTT} = \text{Smoothed Round Trip Time}$). X is generally 1 in linkstate “Link Setup” (Connection setup)
- Several small weaknesses in the AX.25 protocol implementation cleared.