1 Introduction

1.1   SCS P4dragon, the next Generation

Thank you for purchasing the **SCS P4**dragon DR7800 high performance HF radio modem. **SCS** modems are the original PACTOR mode modems developed by the people who have created all PACTOR modes. From **SCS** and **SCS** representatives, you will receive the best possible support and benefit from the concentrated knowledge of the PACTOR engineers who invented PACTOR.

With the introduction of the **P4**dragon DR7800 modem, **SCS** also announces PACTOR-4 as a new mode of high performance data transmission over HF frequencies. **P4**dragon stands for high sophisticated algorithms of communication engineering and high computation power of the PACTOR modems of the fourth generation.

1.2   Packaging list

This is a complete list of hardware and software supplied with the **SCS P4**dragon:

- 1 x **P4**dragon DR7800 High Performance HF-Radio Modem
- 1 x Installation Guide
- 1 x **SCS** CD-ROM
- 1 x 8 pole DIN cable
- 1 x 13 pole DIN cable
- 1 x USB cable
- 1 x RJ45 Patch cable (with installed "network option")

1.3   Requirements to operate a PACTOR Modem

A transceiver capable of switching between transmit and receive within 20 ms. Most modern transceivers fulfill this requirement.

A computer that provides an USB interface or Bluetooth capability.

An appropriate terminal program to operate with a USB or Bluetooth virtual COM port.

1.4   About this installation guide

This installation manual contains only relevant information about the installation of your **SCS P4**dragon modem and popular applications like HF email. You can find complete documentation and detailed descriptions of the command set of the **P4**dragon in the electronic version of the complete manual (PDF format) on the **SCS** CD-ROM supplied with your modem.

1.5   HF E-mail

For HF email you will need a service provider to process your mail and email and "client software" to run on your PC. Your service provider typically distributes the email client software. The client software performs most of the configurations and modem settings to get

you on the air. You will find many popular software packages on the **SCS** CD-ROM supplied with your **P4**dragon modem.

1.6 The **SCS** CD-ROM

The **SCS** CD-ROM contains software to operate the **P4**dragon in various modes and important hints and information about the operation. Additionally the CD contains the USB driver and a PDF manual for all **SCS** modems.

2 The Programs

The **P4**dragon modem offers several modes of operation of which most are related to the exchange of text or data. To access and operate your modem you must run a software program on your computer (PC). Although very simple terminal software (i.e. Windows HyperTerminal) will control a **P4**dragon, it is much more convenient to use a program which has been specially created to operate the **SCS P4**dragon modem.

Many of the programs have been written on a voluntary base and are available free of charge to all users and distributed via the Internet. With the permission of the authors we have included the programs on our **SCS** CD-ROM. Third party programs are **not** developed by **SCS** and **SCS** cannot provide support for them. If you have problems or questions concerning the programs, please contact the author directly.

- If **HF email** is your application, in most cases, your HF email service provider supplies or recommends the appropriate software for their particular service (e.g. **Airmail** for Sailmail and Winlink operation).

- Transceiver control is possible with the **P4**dragon modem.

- Windows programs usually need Windows XP or higher.

- EasyTransfer, **SCS**mail and **SCS**update are programs that have been developed by **SCS**.

- **SCS**update is the recommended program to perform a firmware update with your **P4**dragon

- The **SCS** CD-ROM is usually updated once the year. Always check if there is a newer version of your selected program available from the Internet.

2.1   SCSmail

SCSmail has been developed to enable users of **SCS** PACTOR modems to easily establish an own email system without additional costs. **SCSmail** is freeware and will be distributed via the **SCS** CD and the **SCS** website. It runs in an MS Windows (XP or later) environment and can be used as server and as client, which is decided simply with one mouse click in the setup. The main goal with the development of **SCSmail** was to make it easy to use. To achieve that, it uses a normal email client program (e.g. MS Outlook) the user is accustomed to as frontend and interfaces it to the data transmission system. With **SCSmail** any existent email account can be accessed over the air for sending and receiving emails. **SCSmail** is also capable of administrating several host stations being available for email exchange and is able to control the HF transceiver to automatically hit the correct frequency.

It is not the intention of **SCSmail** to replace or to interfere with existing professional HF email providers with their highly sophisticated solutions and services. Its purpose is just to give private users and small organizations the chance to quickly install an own, private email service without additional costs and without the need to subscribe to an existing provider and with this being dependent from an external service.

2.2   EasyTransfer

EasyTransfer is a program developed for binary transparent file-transfers between two computers connected via PACTOR. The graphical user interface is similar to some well known FTP clients, which are used for file –transfers via the Internet. When viewing the software user

interface, the left side shows the contents of the local hard disk, on the right are the contents of the enabled REMOTE directory of the PACTOR connected server. Files can easily be moved between the two sides using standard drag-and-drop actions. In addition to FTP, EasyTransfer has a "chat" mode to exchange hand typed messages. With that, EasyTransfer is the ideal tool to exchange computer data via HF and over unlimited distances.

With the verson 3.0 EasyTransfer also supports autoforwarding of files. Autoforwarding means, that maximum 16 user definable sub-directories can be automatically observed for new files appearing. These sub-directories are each associated with a destination callsign and a frequency. If a new file appears in one of these sub-directories (because another application has created it or copied it there), EasyTransfer automatically establishes a connection to the station associated and transfers the file(s) to the destination. After the task is done, the connection is terminated again. With this, EasyTransfer also controls the frequency of the HF-transceiver. This feature is used to automatically transfer and distribute data without user access being necessary.

2.3   SCSupdate

Although some third party software is capable to perform a firmware update of the modem, **SCSupdate** is the recommended one which comes from **SCS** directly. You can check for new firmware in the download section of the **SCS** website. If you find a newer version there than actually installed in your modem, you can download the firmware file from there. Usually it will be a compressed file (-zip) which you need to unzip before you use it. Unzip and store the file in a certain folder, for the **P4**dragon the firmware file will have the ending ".dr7".

Start **SCSupdate** and follow the instructions top down. First you select the COM port where the **P4**dragon is connected to. **SCSupdate** will automatically detect the modem there and enables the "*Browse*" button. Use this to point **SCSupdate** to the folder where you have stored the firmware file. **SCSupdate** will show all files compatible with the modem connected. Select the file you want to use, most probably the one you just have downloaded and unzipped. Afterwards press the press the "*Send Update*" button, which is enabled now. You can see the progress bar on the screen of **SCSupdate** as well as on the display of the DR7800 modem. After the firmware is transferred completely, the modem will install it automatically. You can watch the progress of this procedure on the modems display as well. When finished, the modem restarts and you can use it again.

3 The PACTOR Modes

3.1 The History

The PACTOR development begun in the year 1988 with the goal to create an easy to use data transmission mode for short waves (HF-bands). It should be robust and should have a very low bit error rate. Data that has been transmitted should reach the receiver with a very high probability of integrity. This was not possible before and PACTOR was the first and only mode that could achieve that. Digital Signal Processors (DSP) have not been available yet at this time and for that an easy but efficient FSK modulation with "Memory-ARQ" was established. With Memory-ARQ it was possible to summarize corrupted data packets in a way that eliminates the corruption and achieves good data. The result was a high robustness on weak HF channels.

In the year 1995 DSPs became available and this new technology was used by **SCS** to create PACTOR-2. The waveform became PSK and a very efficient error control coding was added, which significantly increased the speed and robustness. The PSK modulation scheme and the coding gain was made adaptive and with this, a 500 Hz wide HF channel could be used for data in dependence of its quality always in an optimized way.

As many professional users wanted to have more transfer speed while having no problems with occupying more bandwidth to achieve that, PACTOR-3 has been developed in the year 2000. Up to now, PACTOR-3 is the most used data transfer mode over HF frequencies and for that it will be described in more detail.

3.2 PACTOR-3 (P3)

PACTOR-3 is a third generation HF protocol building on latest developments in 2-dimensional orthogonal pulse shaping, advanced error control coding, and efficient source coding. Due to the advanced signal processing methods applied, PACTOR-3 provides outstanding performance under poor and moderate signal conditions. As PACTOR-3 also achieves very high throughput rates under good signal conditions, it is well-suited to HF channels with good SNR and low signal distortion as well. During the development of PACTOR-3, high importance was attached to compatibility with ordinary SSB transceivers (using standard 2.2-2.4 kHz wide IF-filters). Therefore, PACTOR-3 can achieve its maximum speed with using unmodified, common SSB transceivers. The occupied bandwidth is around 2200 Hz.

Thus PACTOR-3 is the ideal means of fast and reliable data communication over (the sometimes difficult medium) HF-radio. The new protocol is fully backwards compatible to existing PACTOR-1/2 networks.

The properties of the PACTOR-3 protocol summarized:

- Under virtually all signal conditions, PACTOR-3 is faster than PACTOR-2. Under average signal conditions a speed gain by a factor 3x to –4x is achieved, under very favourable conditions the speed improvement can exceed 5x.
- Maximum data throughput (without compression) greater than 2700 Bit/sec, around 5200 Bit/sec if PMC (online text compression) is applied.
- PACTOR 3 is at least as robust as PACTOR-II under extremely poor signal conditions.
- Maximum bandwidth only about 2200 Hz.
- Low crest factor (high mean output power).
- High spectral efficiency – PACTOR-3 makes very good use of the bandwidth.
- Fully backwards compatible to existing PACTOR-1/2 networks.

3.3   PACTOR-4 (P4)

As over the years the computation power of the Digital Signal Processors being available has dramatically increased, it seemed possible also to increase the transfer speed and robustness of PACTOR-3 by at least factor two, while maintaining the bandwidth being occupied. The development of PACTOR-4 begun in the year 2006 on a new DSP chipset from Freescale which was called "*StarCore*". The PACTOR modes including PACTOR-4 have finally been implemented into the **P4**dragon modem using a 400 MHz quad "*StarCore*" 64 bit DSP system.

PACTOR-4 (P4) is designed for superior performance under adverse multipath channel conditions. The demodulator utilizes a powerful adaptive equalizer compensating for channel distortions. P4 provides a wider useful adaptation range compared to PACTOR-3 (P3). The ARQ protocol is even more adaptive and flexible.

Compatibility: P4 modems are fully capable of P1-P3 and thus fully backward compatible to older P1-P3 systems.

ARQ-Protocol: Similar to P3 but faster adaptivity.

Modulation: 10 speed levels, DBPSK/DQPSK (non-coherent, spreading factor 16), BPSK-32QAM (coherent), adaptive equalizing.

1800 symbols/second (compatible to HF "amateur" transceivers).

Bandwidth: 2400 Hz @ -40 dB.

Crest Factor: Always < 4 dB.

Data speed: Max. 5512 bps (compression off, @ ca. +17 dB on AWGN channel, after all protocol overhead). Max. raw bit rate prior to protocol overhead:

9000 bps (uncoded) / 7500 bps (coded)

Compression: **PMC** (compression factor: 1.9 on plain text data),

AMC (compression factor: 4.5 on plain text data; ca. 2.0 on average "binary" data). (Remark: AMC, Adaptive Markow Compression, is still under development.)

Minimum SNR: -19 dB required for maintaining a connection on AWGN channel.

Throughput
Comparison: Compared to P3 (compression off):

Ca. factor 2 on AWGN channel above 0 dB, ca. 1.5 below 0 dB.

Ca. factor 2.5-5 on ITU "good / moderate / poor" channels above 0 dB.

Ca. factor 1.5-2.5 below 0 dB.
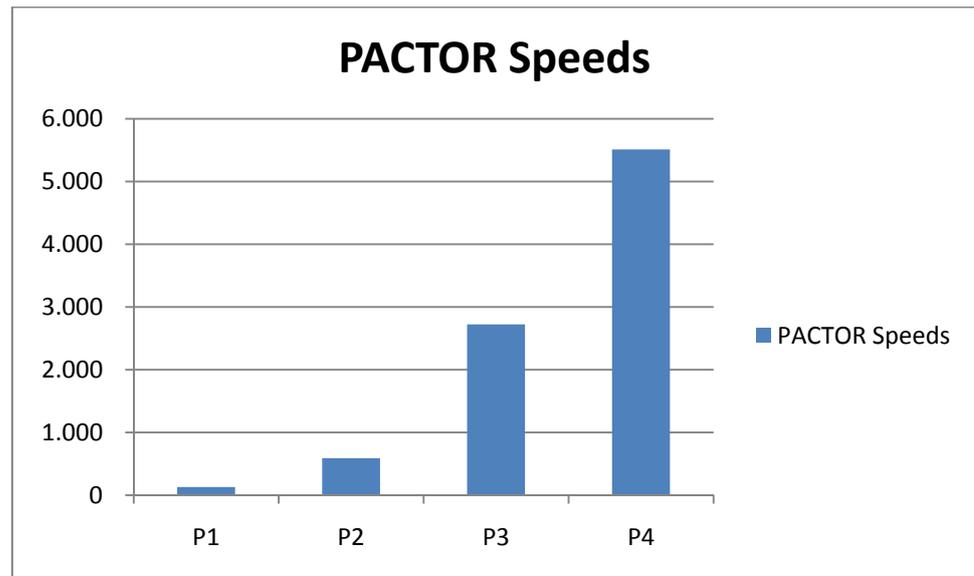
Figure 1: Comparison of the PACTOR modes

Special Features: P4 modems provide a new FSK sync algorithm (normal PACTOR link setup) with excellent sensitivity (-18 dB) and instant frequency offset compensation (±280 Hz). The IRS (base station) corrects the receive AND transmit offsets immediately after FSK synchronization. The ISS (user system) then only must correct the residual offset (smaller than ±5 Hz) right after the FSK synchronization and thus P2-P4 connections start up with full speed even if the initial offset was as high as ±280 Hz! Even the first FSK-ACK/NACK signal from the IRS appears on the "correct" frequency. This feature is especially valuable on higher HF bands. A TRX frequency accuracy of 10 ppm already yields a deviation of ±140 Hz on the 20 m band.

3.4 PACTOR-IP-Bridge (future feature of the DR7800)

The PACTOR-IP-Bridge (PIB) is a Network Integration Protocol developed by **SCS**. The dominant protocols of the Internet like TCP/IP, as well as the Point-to-Point Protocol (PPP), which have become standard for establishment of links between Internet applications, are combined with the PACTOR modes. The result of this intelligent protocol combination is a data transparent and relatively fast Internet access via HF-radio using standardized user interfaces. The **P4**dragon appears to an attached PC as if it were a Hayes compatible "telephone modem". The **P4**dragon locally takes over both the complete PPP and TCP/IP handling. Except for a minimum fraction of protocol overhead, the physical PACTOR link only carries useful data. The huge amount of overhead of the TCP/IP and PPP protocols (which are designed for broad banded wired links) is reduced to the absolute minimum required. By locally carrying out the PPP protocol between the PC and the **P4**dragon a further decisive advantage arises: Because of the very short timeouts, PPP used to be nearly impossible over slow communication channels with relatively large delays. Timeout problems are now solved by the PACTOR-IP-Bridge.

Summarizing the qualities of the PIB:

- TCP/IP-transparent and relatively fast Internet access via HF-radio.
- Internet-services accessible via PACTOR, e.g. E-Mail (SMTP/POP3), FTP, HTTP, ...
- Up to 4 Internet channels ("sockets") over one physical PACTOR link.
- Extreme compression of the TCP/IP and PPP"overhead".
- Full PPP compatibility: Use of common client/server-software, like Netscape, Outlook, Eudora and others is possible.
- Easy embedding and configuration under all common operating systems.
- No "timeout"-problems on PPP and TCP/IP.

4 Support

If you have questions, problems, proposals, or comments relating to the **P4**dragon or PACTOR, please contact the following address.

SCS

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Homepage

Visit our Internet sites: http://www.scs-ptc.com

Here you will find:

- Information to PACTOR and the **P4**dragon
- The actual firmware versions
- Links to interesting software for the **P4**dragon
- Links to related sites

On our homepage you can also subscribe to our mailing list to receive actual information about PACTOR and the **P4**dragon automatically by email.

4.1   Repairs

If a problem occurs and it's necessary to send your **SCS** product to maintenance, please take care of the following:

- **Always contact SCS by email before sending a modem. You will be supplied with return instructions which are important for receiving modems from outside the EU.**
- Package the device with care. Use suitable and enough packaging material.
- Attach a cover note to the shipment. Do this **always**, also if you have emailed or talked to us previously. Printouts of exchanged emails are helpful.
- Describe the problem as good as you can.
- Write clearly.
- Give us your phone number and/or email address so that we can contact you if necessary.
- Don't forget your return address and if available your MASTER or VISA card information for billing!

5 Installation

The installation of the **P4**dragon is simple. You only need to configure the cable between the **P4**dragon, the computer and the transceiver, if this is not already available.

5.1 Power supply

The **P4**dragon has three inputs for its power connections which can be used alternatively. Either connect via the DC-in screw terminal socket at the rear of the unit, or via one of the connectors for the short-wave transceiver (MAIN Audio or AUX Audio, pin 5). All power connections are decoupled with relays and protected against reverse polarity. An input voltage between 10…25 VDC is allowed. The current consumption is usually around 250 mA at 13.8 V. The power supply inputs on the **P4**dragon are isolated from the rest of the electronic (isolating DC/DC converter) and especially filtered so that harmonics of the switch mode regulator cannot pass to the outside of the unit. The inputs are also protected by a self-resetting fuse.

5.1.1 Switching the P4dragon on and off

The **P4**dragon has a capacitive touch sensor on the front panel. When supplied with power a small stand-by circuit is running and waiting for the sensor to be touched ⏻. In this situation the **P4**dragon is drawing a little current between 20..30 mA. When the sensor it touched, the **P4**dragon switches on and shows a boot message on the display. After that, the display switches to "waterfall" mode which shows the spectrum of the received signal.

To switch off the unit, touch the sensor for more than 2 seconds. The display will show a good bye message and the **P4**dragon goes to stand-by mode again. While displaying the good bye message, the **P4**dragon saves some settings into a nonvolatile memory. For the case that the microprocessor of the **P4**dragon is hanging and unable to react on the users attempt to switch it off, just access the sensor field for more than 5 seconds. This enables a hardware controlled emergency shutdown which should always work. Certainly the **P4**dragon can also be shut down by cutting the main supply power, it is not a PC and does not suffer damage from that.

The ⏻ can also be used to switch between several display modes and pages. For this, the sensor is to be accessed for a short time (e.g. 1 second).

Always *ON* feature:

In many cases a modem is supplied by the radio connected to it (mostly ICOM radios) and it is desirable, that the modem immediately starts when the radio is powered on. To archive this, the rear dip switch #1 (labeled with *ON*) must be set. In this condition the **P4**dragon is always on when it has supply power. It cannot be switched off any more with the sensor and also the "emergency off" (when the processor is not responding) is not working. The modem can only be switched off by cutting the external power supply. The sensor certainly still works to step through the display modes. If the user touches the sensor for more than 2 seconds, a message on the display reminds him that the *ON* switch is set and the modem won't power down.

5.2 USB connection to the computer

The **P4**dragon is a USB 1.1 device and can be operated in an USB 2.0 environment as well. The connection to the computer is done with the attached USB cable. The USB interface is electronically isolated and does not share the ground with any other device connected to the modem.

For USB operation an appropriate driver needs to be installed on your computer. This driver is on the **SCS** -CD that comes with the modem.

Below you find a short description on how to install the driver on Windows XP (service pack 2). With later Windows versions the installation runs in a similar way.

- Insert the **SCS** -CD in the CD-rom drive of your computer.

- If "Autostart" has started your webbrowser then close it again.

- Connect the **P4**dragon to the power-supply while it is still switched off.

- Now connect the **P4**dragon with to the USB connector of your computer.

- The PC finds the new hardware (**SCS P4**dragon 7800) and opens the "Found New Hardware Wizzard".

- To the first question if Windows shall connect to "Windows Update to search for new software" you answer with "No, not this time" and then click on "Next".

- The wizzard now wants to install the driver for the **SCS** Radio Modem Device. Select the option "Install the software automatically" and click on "Next".

- Next the Wizzard wants to install the driver for the device "USB Serial Port". Same as before you select the option "Install the software automatically" and click on "Next".

- After successful installation you click on "Finish".

- With this the driver for the **P4**dragon is installed.

The installed driver creates a virtual COM port which is used by the applications similar to a normal (hardware) COM port.

To find out which number the virtual COM port has beed assigned to, you have to look into the Device Manager of your computer!

Select: Start → Control Panel → System → Hardware → Device Manager. Now click on the small "plus"-sign left besides the table entry "Ports (COM & LPT)" to see all connections of your PC. Look for the entry "USB Serial Port" where right besides the COM number is shown. Enter this COM number into all programs you want to use with the **P4**dragon.

5.3   Bluetooth

The **P4**dragon is available with optional **Bluetooth**. Bluetooth is a low power high frequency (2.4 GHz) radio link which serves as a cable replacement for short distances. In the interference susceptible shortwave environment of the **P4**dragon, the USB cable connection between the modem and the PC can be eliminated.

5.3.1   Advantage:

The data stream signal of a USB interface is located in the middle of the shortwave bands. Therefore, the USB data signal cannot be separated from the shortwave signal being transmitted or received by simply filtering. Mutual interference is possible, especially where the antenna is located close to the modem/PC setup (ship borne installations). Mutual interference in this case means that the transmitted HF-signal can disturb the USB data stream between PC and modem, as well the USB data stream can disturb the radio reception of short waves. Bluetooth can help solve this problem, as Bluetooth and shortwave radio signals don't interfere with each other. Additionally, eliminating the USB cable connection, the danger of ground loops and parasitic currents distorting the radios signal modulation are removed, which will lead to a better transmission quality.

5.3.2   Installation at the PC side:

Many modern laptop computers are already equipped with Bluetooth. In this case there is no further installation required. All the others need to purchase a "Bluetooth stick" which is plugged into a free USB connector.

Bluetooth Sticks of various brands are available from computer stores. The installation should be done in accordance with the instructions of the Bluetooth Stick vendor (driver and software, etc.). **SCS** does not supply Bluetooth stick software on the **SCS**-CD. Please use the CD from the Bluetooth Stick manufacturer for the installation!

After installation (or after the first connection with the **P4**dragon), a virtual COM port is generated (just like with USB) which can be accessed by any terminal or PACTOR specific program.

5.3.3   Installation at the P4dragon side:

You can order the **P4**dragon with Bluetooth option already installed, or you can install the Bluetooth transceiver module inside the **P4**dragon by yourself. For the prices for both versions please refer to the price list or ask your dealer. Bluetooth transceiver module is sitting in a socket and is fixed on the main board of the modem with three standoffs.

Getting started:

Disconnect the **P4**dragon from all cables that may be attached to it. Remove the two green screw terminals "DC-in" and "GPS" by pulling them out of their socket. They should look like this now:

Figure 2: Removing the screw terminal

Opening the P4dragon:

Remove the two black TORX screws in the plastic frame on the front side of the modem. (Do not try to open the modem from the back side.) Remove the plastic frame and flap down the front panel. The front panel contains the display and hangs on a flat print cable. Be careful and do not pull on the front panel.
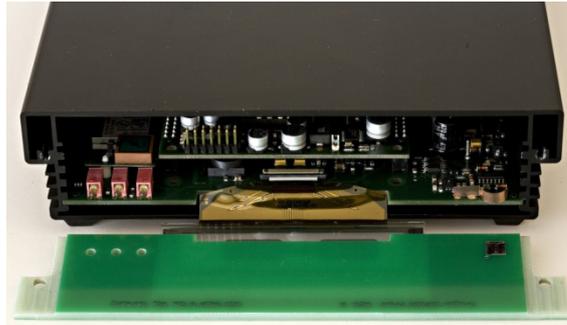
Figure 3: **P4**dragon with flipped down front panel

Now, from the rear side, press a bit on the network cable connector to unlock the main board:

Figure 4: Pushing out the mainboard

Now the main board can be pulled out of the aluminium housing.

The Bluetooth transceiver is to be installed behind the three LEDs on the front side of the modem. This location ensures a good radiation of the Bluetooth signal and a good long range performance.

Next, press in the standoffs into the mainboard. The standoffs have two ends with are different:

Figure 5: Bluetooth module fastening standoff

The mainboard side has to be inserted into the **P4**dragon mainboard. Best it to use a calliper for that while the mainboard lies on soft but solid ground.
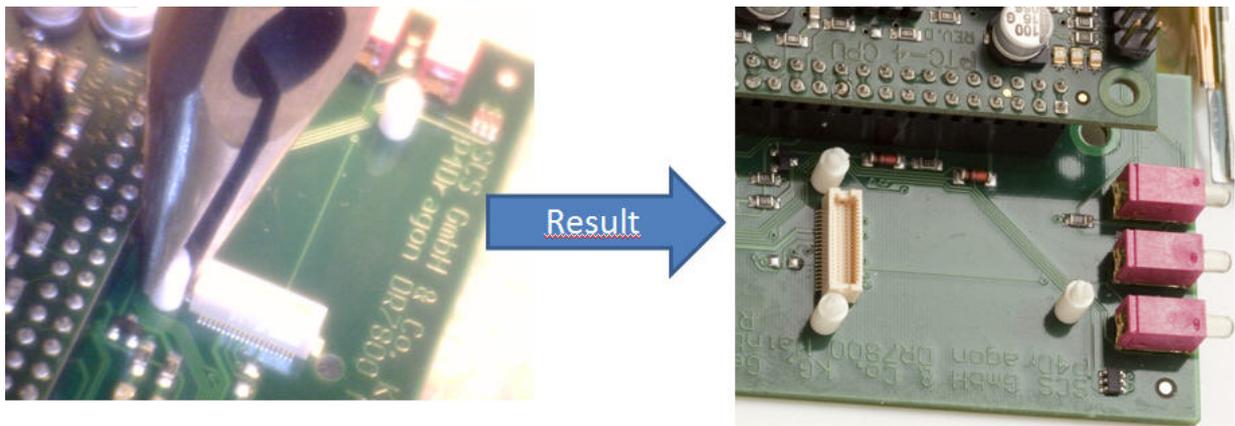
Figure 6: Installing the standoffs

The bottom side of the Bluetooth transceiver has a connector which mates with the connector on the **P4**dragon mainboard.
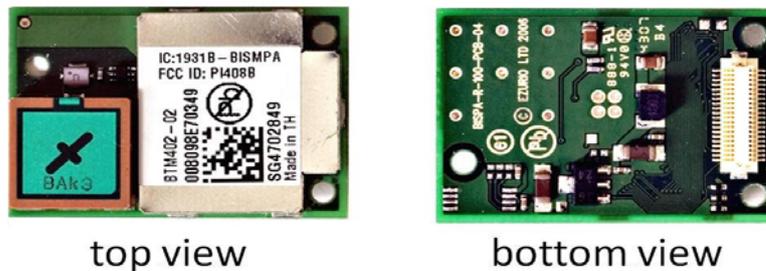
Figure 7: The Bluetooth module

Align the Bluetooth transceiver on the standoffs so that the mating connectors are close together and matching. Then press down the Bluetooth transceiver so that it rests in the standoffs while the connectors slip in each others. It is recommended to press the small forks on the top of the standoffs a bit towards each others using a calliper to reduce the necessary insertion force. But it will still need some force to press the module down, although it must be done very carefully. This picture shows the Bluetooth transceiver when being installed:
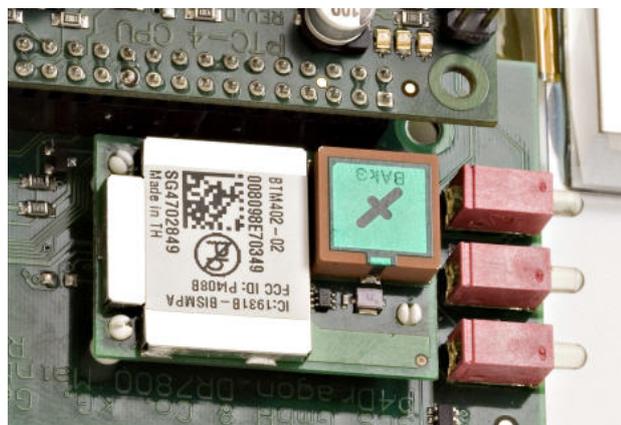
Figure 8: The Bluetooth module installed

Reassembling the P4dragon:

After the installation is done the **P4**dragon mainboard can be fitted again into the housing. While doing this, have a close look to the green "*GPS*" and "*DC-in*" connectors and ensure that they slip completely through their holes on the rear panel. Use an appropriate tool (e.g. tweeters) to align them if necessary. When they are aligned, some pressure is necessary to make the LAN/USB connector slip into its hole, so don't hesitate to use moderate force. With this done, flip up the front panel and make it rest in the correct position. Afterwards install the plastic frame and drill in the screws. The installation is complete now and can be tested.

Switch on the **P4**dragon and step through the display menus using the sensor field and enable the "*Status*" page.

Figure 9: The Bluetooth pairing key
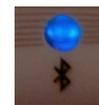
The Bluetooth LED on the front panel of the **P4**dragon should be flashing.

You see the Bluetooth pairing key, remember it for later usage.

Locate the **P4**dragon near your PC being equipped with Bluetooth.

Start the Bluetooth manager software on your PC. The user interface of the manager may vary with different brands, so that only the basic operation can be described here.

Let your Bluetooth manager search for Bluetooth devices in range. The **P4**dragon should be found within a short time and be displayed as a **symbol** in the manager. Now you need to "pair" the **P4**dragon with the PC, so that both will recognize each other next time. Usually the manager offers you the pairing option when you double-click on the symbol, or when you select it and press the right mouse button. After you have started the pairing, you will be prompted to enter a key or password. The last 8 characters of the **P4**dragon's electronic serial-number represents this key, which is exactly the key as displayed above. For verification, you also find the serial-number on the bottom of the modem. Enter the key, which can be numbers and letters, and take care that you enter the letters in upper case. After you have confirmed the entry, the pairing should have been completed successfully.

Remark: The pairing might have a limited lifetime and may require to be repeated when the **P4**dragon and the PC have not been connected by Bluetooth for a few days or weeks. If you use Bluetooth more frequently, repetition of the pairing usually is not necessary.

After the pairing the Bluetooth connection can finally be established. This usually happens by a double-click on the modem's symbol in your manager. At connection a virtual COM port is created and the number of the COM port is usually displayed. Enter this COM number into the

terminal programs you intend to use. From now on, as long as your Bluetooth manager is operating, starting and terminating the terminal program will also start or terminate the Bluetooth connection between the modem and the PC. From now on you're wireless.

Many current Bluetooth sticks come with the Bluetooth manager software **BlueSoleil**. A step-by-step introduction for this manager with screenshots can be downloaded from our homepage.

5.4 Ethernet

The computer connection to the **P4**dragon can also be established via Ethernet (10Base-T or 100Base-T), provided the Network option (Linux computer module DNP) is installed inside. If this is the case you can see in the Status window of the display, just below the Bluetooth key. Easily connect the **P4**dragon to your router, switch or hub using a general purpose patch cable.

The **P4**dragon is able to accept his IP-address assigned by DHCP. If you don't have a DHCP server in your network you need to configure the **P4**dragon to use a fixed IP-address. This choice is done using the DIP switch #3 labeled *DHCP* on the back side of the **P4**dragon. DHCP is *off* then the switch is in the upper position and *on* when in lower position. With DHCP off, the default IP-address then is **192.168.0.100** and Netmask **255.255.255.0**.

The configuration of the **P4**dragon then continues with the help of a comfortable web-interface. Here you can change all important settings as well as the IP-address.

The web-interface is mainly self explaining. For every item an online help is available. Just click on the name of the item you require help for.

You connect the web-interface of your **P4**dragon by entering the IP address as URL into your preferred web browser, e.g. http://192.168.0.100. The user name is "**root**" and the password is "**DR7800**".

5.4.1 Using the SER2NET feature of the P4dragon

The SER2NET feature allows the **P4**dragon to be used as a "quite normal" PACTOR modem via a network connection. PACTOR modems can be used with simple terminal programs, or programs for special applications like eMail or FAX. All this programs are made to access the modem via a serial connection, a COM port. The SER2NET feature "tunnels" the serial data connection of the modem as TCP/IP through the Ethernet connection and makes it available to a special SER2NET driver, which must be running on the PC that wants to access the modem. This SER2NET driver creates a virtual serial com port, as it is well known from USB adapters or the USB/Bluetooth connection of the **P4**dragon. This virtual COM port number is entered into the program(s) used to access the **P4**dragon. From now on everything runs as normal and the **P4**dragon behaves the same way as connected via USB or Bluetooth.

Using SER2NET feature brings several viewpoints to the operation of a PACTOR modem at all. For the easiest application, it is enough to connect the **P4**dragon with the network connector of a local PC. But as a networking device, the **P4**dragon can also be connected at any possible location in the network (or the Internet) and can be operated from a PC which is located elsewhere in the local network, or Internet. The exciting fact is, that the **P4**dragon and the controlling PC could have theoretically any distance between each others, as long as both have contact to the Internet. If the **P4**dragon is accessed in terminal mode, the distance between **P4**dragon and PC really does not matter. Just with timing critical access protocols like hostmode and applications like FAX the response time of the Internet can be the limiting factor. A hostmode connection between two **SCS** locations inside Germany, however, was no problem.

While the **P4**dragon can be located some distance from the computer, it is still connected to that one computer only, just as a serial-port or USB modem, except being connected via a network. It can also be "disconnected" from one computer and "connected" to another, just like a serial or USB-modem, except this happens by opening and closing TCP/IP network connections. This means that a **P4**dragon, installed in a network, **cannot be accessed by more than one computer at the same time!** It cannot be shared, although networking technology would imply that it could be.

5.4.2   Installing the SER2NET driver on the PC

On the PC that shall control the **P4**dragon, a SER2NET driver must be installed. We

recommend HW Virtual Serial Port from HW-group   .

The driver is freeware and can be used at no charge. Alternatively, when you're a software developer and want to integrate the driver into your product, we recommend the driver from FabulaTech.

Download the driver from the given website and double-click the EXE file to start the installation. The following procedure is self explaining. When you're prompted to select the components to be installed, it is sufficient to use the "Standalone Application".
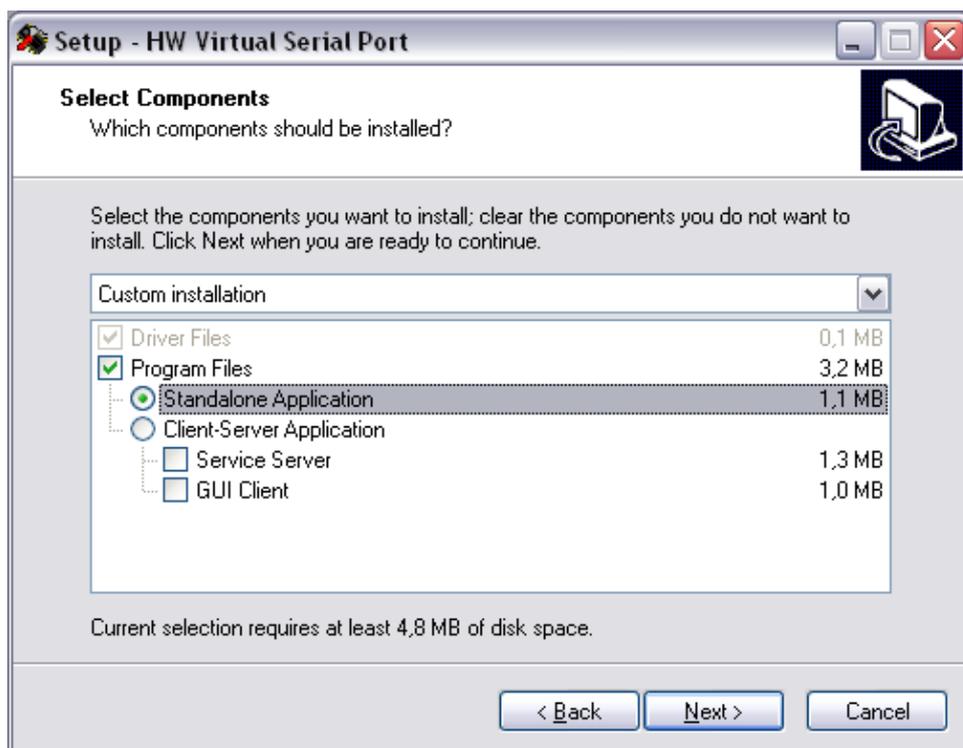
Figure 10: SER2NET installation

5.4.3   Configuring SER2NET

After starting "HW Virtual serial Port" with the icon that has been created by the installation process, you have to enter some settings. The field **"IP Address"** requires the IP address of your **P4**dragon, the field **"Port"** defines the **"Data Port"** of the **P4**dragon and **"Port Name"** characterizes the COM port generated by "HW Virtual serial Port". **"Port"** must match with the port setting of the **P4**dragon's SER2NET configuration. Default is 3000, it can be left as it

is or changed to another desired value. **Data Port** is the only configuration necessary at the **P4**dragon side. It must have the same value as **"Port"** in the SER2NET setup. See below.
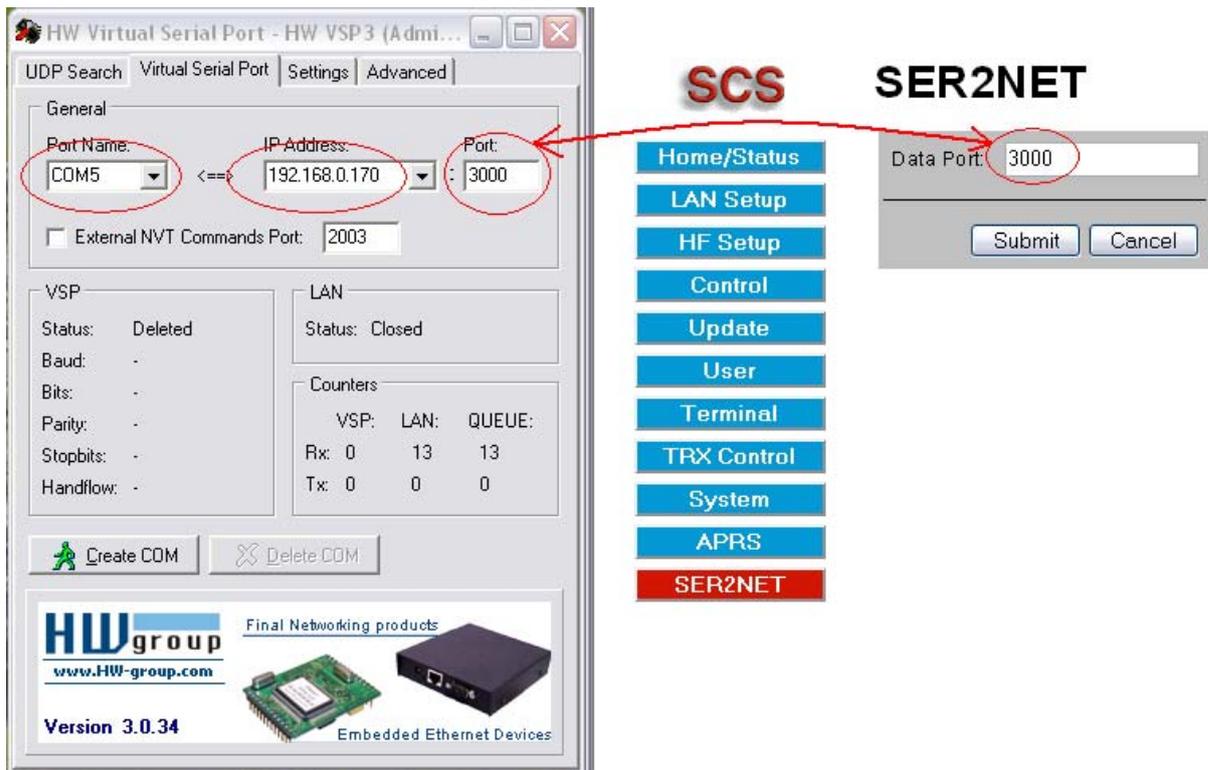
Figure 11: Entering the port number

Entries in the **Settings** tab can be left at default. Other settings are not necessary.
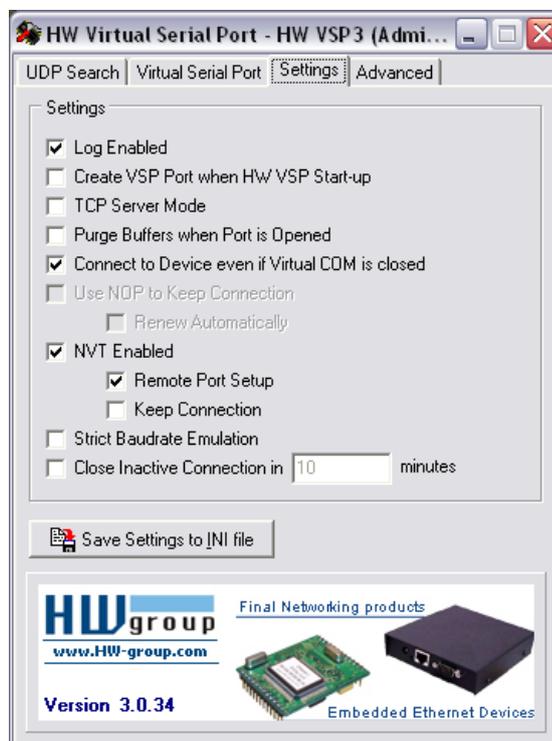
Figure 12: SER2NET configuration

5.4.4 Using SER2NET

After having made the settings described above, simply press the button **Create COM** .

Figure 13: SER2NET configuration

You now see the VSP (**v**irtual **s**erial **p**ort) Status has switched to **Created** and the LAN Status has switched to **Connected.**

As soon as a program is started which uses the created COM port (in this example COM5), the window shows the VSP status **Opened** and the serial port parameters (baudrate and so on) are displayed. The **Counters** field counts the packages transferred and increases the values with usage time and amount of data running through the virtual serial link.

Certainly, as shown below, the **Port Name** must match with the COM port used in the terminal program (the example below shows Airmail's Dump-Terminal).

To remove the virtual serial port again, first close the (terminal) program which is using it to access the modem. Then click at **Delete COM**. The modem is now released and can be used by other users in the network or from the Internet.

If the modem is **not released**, other users trying to access it will receive an error message from the SER2NET driver. The VSP status "Created" and the LAN status "Connected" will not be achieved. The error message received depends a bit on the version of the HW-group driver used. The current one shown here for example displays an "Access violation". Earlier versions simply remain in the "Disconnected" condition.
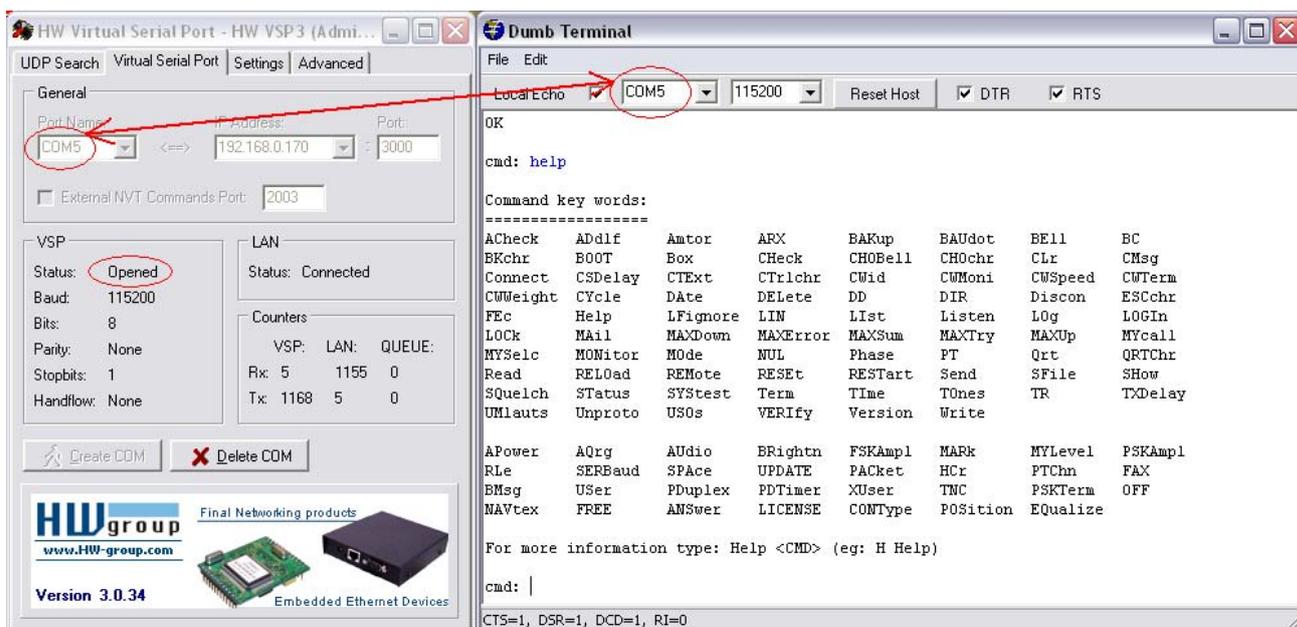
Figure 14: COM port configuration within SER2NET

5.4.5 Using the SER2NET feature with Airmail

Airmail *can* be used in the manner described above, which means by using the HW-groups SER2NET driver. But Airmail is an intelligent program, it does not need it and with this, Airmail makes it much easier for the user to access the **P4**dragon and to operate it. This shall be described now.

Airmail can communicate with the **P4**dragon directly via network! This eases the operation of the **P4**dragon with Airmail dramatically. To have advantage of this feature, be sure to use always the most recent version of Airmail.

To configure the **P4**dragon, simply select "PTC-IInet" either in the first-time "Startup Wizard", or open Airmail's Tools menu, Options window, connection tab. When the PTC-IInet is selected then Airmail will look for it, and if found then the IP-address and port number appear automatically (e.g. "192.168.0.170:3000". If the IP address does not immediately appear then the modem was not found, check the connections and try again.

Alternatively, the correct IP-address with port extension, separated with a ":" (e.g. **192.168.0.170:3000**), can be entered directly as COMM Port in Aimail's configuration window. Don't worry if you feel that the line is not long enough, it will fit, but it may not be displayed completely.
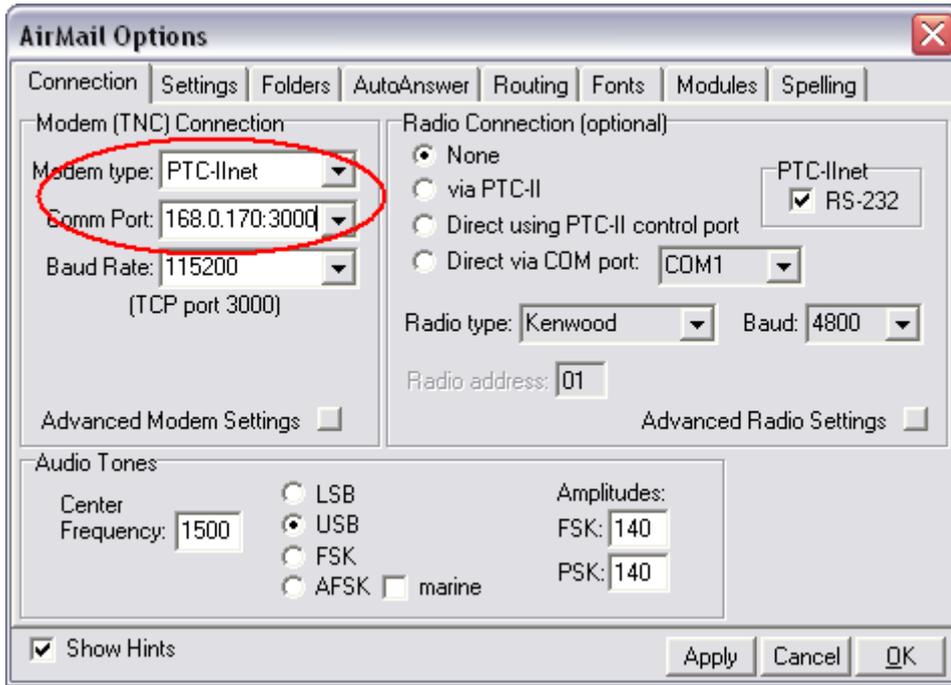
Figure 15: SER2NET integrated in Airmail

6 Connectors

6.1   Grounding and Shielding

The **P4**dragon has several connectors where cables can be or must be attached for a proper operation. All this cables should be and are shielded. The shield is usually connected to the shelf of the connector. Each connector of the **P4**dragon will get in contact with the cable shield and feeds the *shield* signal to a ground plane on the bottom side of the printed circuit board (PCB). Every connector has its own *shield* ground plane and they are separated to maintain signal isolation.

All connectors of the **P4**dragon are isolated from each other by DC/DC converters, data-isolators, transformers or photo-couplers, so also their shields are. This done for safety and to avoid parasitic currents to flow. But in operation environments where all devices connected to the **P4**dragon use a common ground anyway, it may be desirable or recommended to "catch up" all the shields as a common signal and to connect it to the systems grounding or "earthing" stud. The **P4**dragon provides the possibility to do this, so system integrators may want to use this way of installation. As most of the radios and computer devices have the shield and the signal ground connected together, this way of installation certainly **removes** the isolation which the **P4**dragon normally provides.

To archive a *shield* signal common with all connectors, the **P4**dragon must be opened (as explained in chapter 5.3.3). Turn the bottom side up and observe the rear area of the PCB where the connectors are placed. You will see separated ground planes associated with every connector. There are solderable areas on the borders of all the ground planes where they can be soldered together. This creates a large and common ground plane to all shields which is connected to the outside with the *Shield* pin of the GPS connector. This pin should be used to tie the shield signal to the system grounding point.
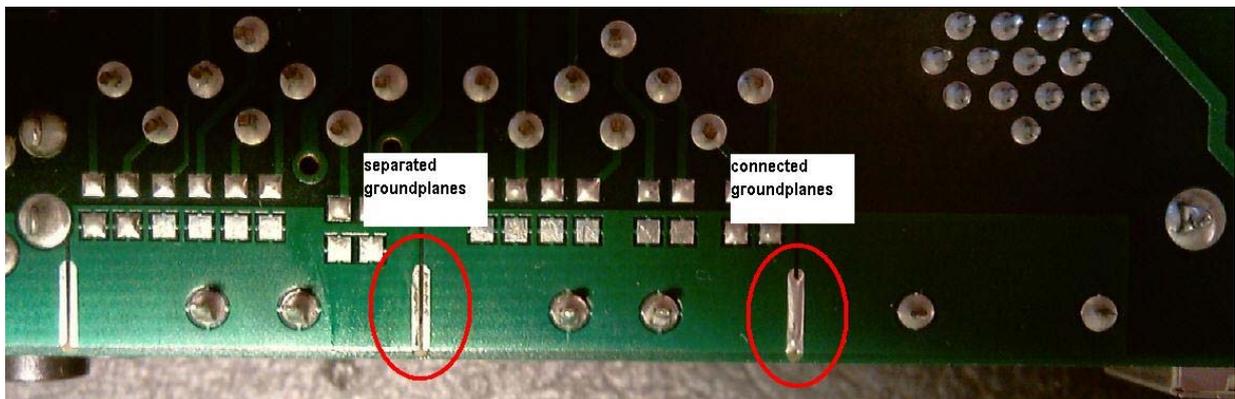
Figure 16: Connecting the shield ground planes together

6.2   The Audio Connectors in General

Due to the variety of possible transceiver types which can be used with the **P4**dragon, it is somewhat more difficult to find out the correct connection. For many common transceivers complete manufactured cables are available as accessory (chapter 10 on page 89). For all the others the attached DIN-8 pigtail cable must be used and completed by the user. Your dealer will be helpful to find the proper connection scheme.

PACTOR-2/3/4 use complicated phase- and amplitude modulations (DPSK, 32QAM), which leads to a small and effective spectrum. To maintain the advantages on the HF-frequencies, a proper adjustment of the transceiver's settings and modulation levels is essential. Over-modulating the transceiver would lead to unwanted enlargement of the spectrum. Refer to chapter 7.3 on page 81 for how to set the modulation levels properly.

PACTOR-2/3/4 modulation schemes are totally different to and have nothing to do with simple FSK, which was used in older HF transmission modes. It is therefore IMPOSSIBLE to use the FSK modulator which can be found in some transceivers to generate the signal. The PACTOR-2/3/4 signal must always go the indirect way, which is using the SSB modulator to generate the HF signal. This is of no disadvantage, providing the transceiver is not overdriven.

Some useful hints to properly setup the transceiver:

- For PACTOR-3/4 use a 2.4 kHz wide IF-filter (usually also used for SSB/voice). Do **not** use a smaller one. If you limit the modem's operation to PACTOR-2 (e.g. for saving bandwidth reasons), you can use a 500 Hz IF-filter.

- Under no circumstances use audio processors. The speech-compressor of the transmitter will damage the PACTOR signal in the same way as external DSP audio filters will do. These external DSP audio filters create inpredictable signal propagation delays which are not acceptable. The modem filters the signal optimal with the integrated DSP and requires no "external help".

- Noise blanker and notch filter should be switched off.

The **P4**dragon is connected to the transceiver via an 8 pin DIN socket (HF-Transceiver Audio). Although you can use the *MAIN Audio* or *AUX Audio* connectors the same way, we recommend to begin with *MAIN Audio* as long as only one radio shall be connected. If you're using an ICOM radio, the ICOM also supply the modem via the one or the other connector. Other radios not supplying the modem will require that the modem is supplied using the *DC-in* screw terminal.

6.2.1 Balanced and unbalanced operation

In difference to earlier **SCS** modems, the **P4**dragon provides a complete signal separation and balanced audio in/outputs. Also the PTT is isolated by an optical circuit. The transceiver ports *MAIN Audio* and *AUX Audio* are isolated against each other and also the transceiver control port is isolated from all the rest. The audio in/outputs are coupled via transformers, which means that the input and the output consists of two signal lines now. Also PTT consists of two lines and is a bi-directional switch, which means that it does not care which pin is connected to high and which to low. As many professional radios also provide balanced, transformer coupled audio lines, it is recommended to connect the modem respectively to archive best signal quality and rf immunity.

For all other radios, it is possible to internally ground one leg of the transformers and the PTT line. This is done with internal DIP switches, for both transceiver ports separately. With this switches set to *ON* the DR7800 is fully connection compatible with all earlier **SCS** modems, while maintaining the signal isolation. This is how the **P4**dragon is delivered by default to the customer. This means, when true balanced operation is required, the modem must be opened and the switches must be set to OFF respectively. The picture below shows the location of the switches and how they are associated to the port connectors.
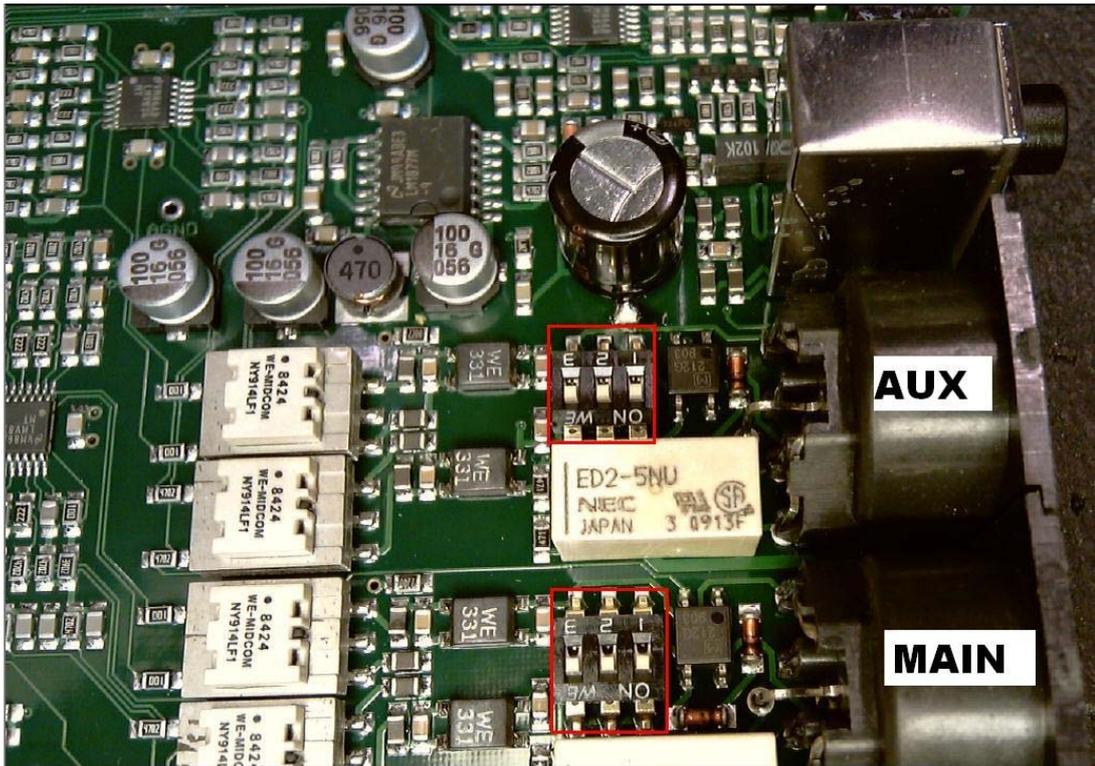
Figure 17: Location of the balanced/unbalanced switches

The following schematic shows how the switches work:
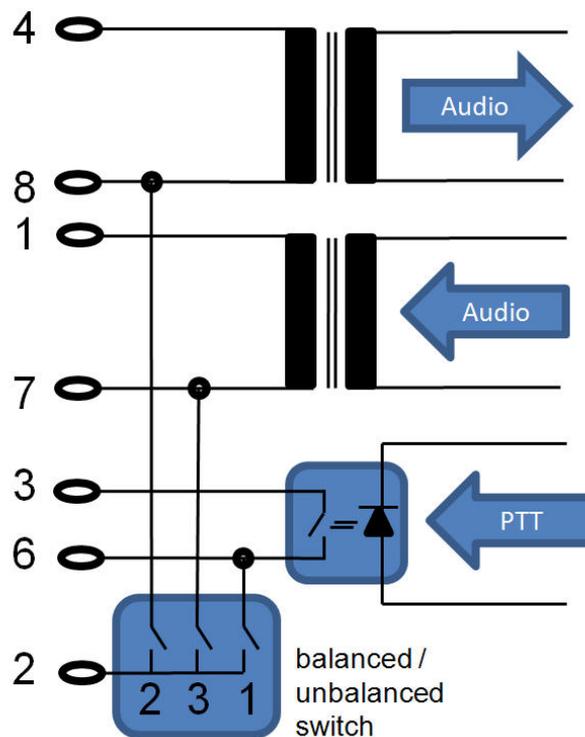
Figure 18: Function of the balanced/unbalanced switches

6.2.2   Connector Pin Description

PIN 1: Audio output 1 from the modem to the transmitter. The modem supplies a pure audio signal to the microphone (or ACC) input of the transceiver. The output amplitude can be adjusted with the **FSKA** and **PSKA** commands from 30 to 6000 mV (peak to peak) open circuit. The output impedance is 600 Ω. Is to be used in conjunction with audio output 2 (PIN 7).

PIN 2: Ground (GND). Collective ground for all signals in unbalanced mode.

PIN 3: PTT switch 1. While transmission this output is switched to PIN 6 by an optically isolated solid state relay. Is to be used in conjunction with PTT switch 2 (PIN 6).

PIN 4: Audio input 1 from the receiver to the modem. The modem receives signals directly from the loudspeaker output of the receiver. The volume should not be turned up too much. A *fairly low* volume is quite sufficient. It is better to take the AF signal from a low level output which is independent of the volume control. These outputs are often labeled AUX or ACC. The input impedance of the **P4**dragon is 47 kOhm. The modem operates with an input signal down to approx. 10 mV$_{p-p}$ and should not be driven with more than 6 V$_{p-p}$. Is to be used in conjunction with audio input 2 (PIN 8).

PIN 5: Optional power supply input. The modem can be supplied with power via this input. This is especially useful if the transceiver gives a power supply output via the AUX socket. The modem requires approximately 10 to 25 V at a maximum of 300 mA, typically 250 mA @ 12V. Is to be used in conjunction with the ground signal (PIN 2).

PIN 6: PTT switch 2. While transmission this output is switched to PIN 3 by an optically isolated solid state relay. Is to be used in conjunction with PTT switch 1 (PIN 3). This pin can be switched to ground (PIN 2) for unbalanced operation. See schematic above.

PIN 7: Audio output 2 from the modem to the transmitter. The modem supplies a pure audio signal to the microphone (or ACC) input of the transceiver. The output amplitude can be adjusted with the **FSKA** and **PSKA** commands from 30 to 6000 mV (peak to peak) open circuit. The output impedance is 600 Ω. Is to be used in conjunction with audio output 1 (PIN 1). This pin can be switched to ground (PIN 2) for unbalanced operation. See schematic above.

PIN 8: Audio input 2 from the receiver to the modem. The modem receives signals directly from the loudspeaker output of the receiver. The volume should not be turned up too much. A *fairly low* volume is quite sufficient. It is better to take the AF signal from a low level output which is independent of the volume control. These outputs are often labeled AUX or ACC. The input impedance of the **P4**dragon is 47 kOhm. The modem operates with an input signal down to approx. 10 mV$_{p-p}$ and should not be driven with more than 6 V$_{p-p}$. Is to be used in conjunction with audio input 1 (PIN 4). This pin can be switched to ground (PIN 2) for unbalanced operation. See schematic above.

For immediate connection of the **P4**dragon to the transceiver use one of the cables you find in the accessories catalog chapter 10 page 89. If you do not find a matching cable there, then use the attached 8 pin DIN cable and complete it to connect the **P4**dragon to the transceiver:

PIN	Color	PIN	Color
1	Violet	5	Blue
2	White	6	Red
3	Yellow	7	Black
4	Green	8	Brown

Table 1: Cable Colors: 8 pin DIN cable

The socket is wired as follows (viewed from the rear of the **P4**dragon).
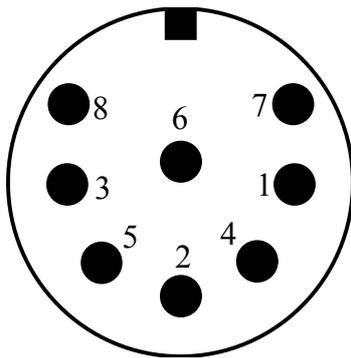
Pin 1: Audio output 1 from the modem to the transmitter
Pin 2: Ground for unbalanced operation, power minus.
Pin 3: PTT switch 1 (to transmitter PTT line)
Pin 4: Audio input 1 from the receiver to the modem
Pin 5: Optional power supply plus input.
Pin 6: . PTT switch 2 (to transmitter PTT line)
Pin 7: Audio output 2 from the modem to the transmitter
Pin 8: Audio input 2 from the receiver to the modem

Figure 19: Connection to the transceiver.

NOTE: There are 8 pin plugs with different pin numbering for pin 7 and pin 8. The **P4**dragon needs an 8 pin plug with U-shaped contact footprint. Plugs with circular footprint don't fit or can only be attached to the **P4**dragon with damaging force! Do not blindly rely on the printed numbers on the plug. The connections as shown in the manual should be used as reference.
The 8 pin DIN socket is designed in a way that a 5 pin DIN plug (180°) may be plugged into it too. It is possible to use a 5 pin DIN plug if an 8 pin is not available, or when balanced operation is not required. For unbalanced operation, all switched must set to ON.

If a 5 pin DIN plug is used, then the connections are as shown:
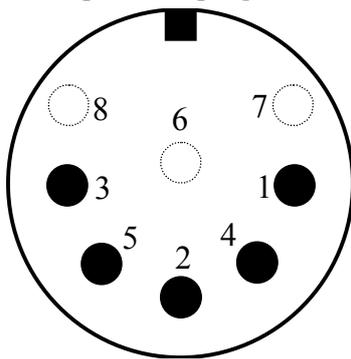
Pin 1: Audio output from the **P4**dragon to the transmitter.
Pin 2: Ground (unbalanced operation).
Pin 3: PTT output (to transmitter PTT line).
Pin 4: Audio input from the receiver to the **P4**dragon (loudspeaker or appropriate AUX socket).
Pin 5: Optional power supply input.

Figure 20: Connections to the transceiver (5 pin DIN).

Note: **All cables described herein are only useable for unbalanced operation. This means all internal switched must be set to ON! See chapter 6.2.1 for details.**

6.3   Transceiver Remote Control connection

The **SCS P4**dragon is equipped with a connector for controlling many common modern amateur radio transceivers. Virtually all newer transceivers from KENWOOD, ICOM, YAESU, SGC and R&S allow remote controlling of various functions via a serial interface. Depending on type and manufacturer, almost all the transceiver parameters can be read out and changed. For example frequency, filter, operating mode and much more can be controlled. With radio equipment that is digitally controlled the list of functions is almost unlimited.

The **P4**dragon uses this features in conjunction with the controlling PC software mainly to set the frequency of the transceiver. You find more about the transceiver remote control in chapter TRX in the main manual.

6. Connectors

The 13 pin DIN Remote-control socket is connected as follows.

Seen from the back of the P4dragon:
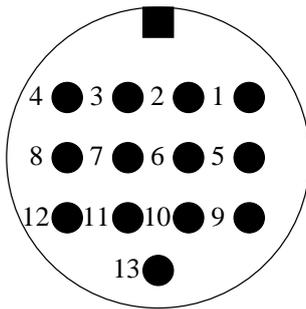
Figure 21: Transceiver remote-control

Pin 1: RxD TTL.
Pin 2: RTS V24.
Pin 3: TXD V24.
Pin 4: CTS V24.
Pin 5: CTS TTL.
Pin 6: ICOM.
Pin 7: Not connected.
Pin 8: RxD V24.
Pin 9: TxD TTL.
Pin 10: RTS TTL.
Pin 11: PTT in
Pin 12: GND.
Pin 13: GND.

TxD TTL   Transmit data from the **P4**dragon to the transceiver. TTL level!

RxD TTL   Receive data from the transceiver to the **P4**dragon. TTL level!

CTS TTL   Handshake signal from the transceiver to the **P4**dragon. TTL level!

RTS TTL   Handshake signal from the **P4**dragon to the transceiver. TTL level!

TxD V24   Transmit data from the **P4**dragon to the transceiver. V24 level!

RxD V24   Receive data from the transceiver to the **P4**dragon. V24 level!

CTS V24   Handshake signal from the transceiver to the **P4**dragon. V24 level!

RTS V24   Handshake signal from the **P4**dragon to the transceiver. V24 level!

ICOM   Special bi-directional data signal for controlling ICOM equipment.

GND   Ground reference for all TRX control signals and PTT in.

PTT in   Tie to GND to activate PTT in. For future purposes.

For many common transceivers completely assembled cables are available, which you find in our accessories catalog in chapter 5. For all the other transceivers use the attached 13 pin DIN cable and complete it in the desired way.

PIN	Color	PIN	Color
1	violet	8	red
2	white	9	pink
3	yellow	10	light blue
4	green	11	black/white
5	blue	12	grey
6	black	13	orange
7	brown		

Table 2: Cable Colors: 13 pin DIN cable

6.4   DC-in

This is the main supply power input of the **P4**dragon. For details refer to chapter 5.1.

6.5   USB

As the **P4**dragon is an USB slave device (modem), this "USB type B" connector is used to connect it to a PC. Use the attached USB cable to do so. Refer to chapter 5.2 for details.

6.6   GPS

The **P4**dragon uses a 3-pole screw terminator to connect to a GPS receiver. This input is compatible with 5V-TTL and RS232/V24 signal levels and accepts data streams according to NMEA 0183 standards. It is optically isolated. The pins are assigned as follows:

Figure 22: GPS connector

The Shield pin can be used as grounding point for the case that a common ground for all cable shields is required. See chapter 6.1 for details.

6.7   SPKR and MIC

This is a headset connection which can be used for future applications.

6.8   LAN/USB

This is an interface which can be used when the network option is installed optionally. When installed, the **P4**dragon can be fully controlled over an Ethernet network, see chapter 5.4 for reference.

The USB type A (master) connector can be used for future applications in conjunction with the network option.

7 Connecting to a Transceiver

7.1   Audio connecting

7.1.1   Connection to ICOM

Most ICOM transceivers that use 8 pin DIN plug (ACC) can be connected this way:

Signal	**P4**dragon	Color	ICOM 8 pin
GND	PIN 2	white	PIN 2
PTT	PIN 3	yellow	PIN 3
AF-OUT	PIN 1	violet	PIN 4
AF-IN	PIN 4	green	PIN 5
POWER	PIN 5	blue	PIN 7
This cable is available completely assembled. Refer to chapter 10 on page 89.			

Table 3: ICOM 8 pin

The *smaller* ICOM transceivers (e.g. IC-706) often use a 13 pin DIN plug for ACC:

Signal	**P4**dragon	Color	ICOM 13 pin
GND	PIN 2	white	PIN 2
PTT	PIN 3	yellow	PIN 3
AF-OUT	PIN 1	violet	PIN 11
AF-IN	PIN 4	green	PIN 12
POWER	PIN 5	blue	PIN 8
This cable is available completely assembled. Refer to chapter 10 on page 89.			

Table 4: ICOM 13 pin

Some ICOM marine radios (e.g. IC-M801, M710-GMDSS) use a 9 pin SUB-D connector:

Signal	**P4**dragon	Color	ICOM 9 pin
GND	PIN 2	white	PIN 2, 4, 9
PTT	PIN 3	yellow	PIN 5
AF-OUT	PIN 1	violet	PIN 1
AF-IN	PIN 4	green	PIN 3
POWER	PIN 5	blue	PIN 7
This cable is available completely assembled. Refer to chapter 10 on page 89.			

Table 5: ICOM 9 pin

7.1.2 Connection to Kenwood

Most Kenwood transceivers that use 13 pin DIN plug (ACC2) can be connected this way:

Signal	**P4**dragon	Color	Kenwood
GND	PIN 2	white	PIN 4, 8, 12
PTT	PIN 3	yellow	PIN 9
AF-OUT	PIN 1	violet	PIN 11
AF-IN	PIN 4	green	PIN 3
This cable is available completely assembled. Refer to chapter 10 on page 89.			

Table 6: KENWOOD

The TS-50 can only be connected via the microphone jack:

Signal	**P4**dragon	Color	Kenwood
GND	PIN 2	white	PIN 7, 8
PTT	PIN 3	yellow	PIN 2
AF-OUT	PIN 1	violet	PIN 1
AF-IN	PIN 4	green	PIN 6

Table 7: KENWOOD TS-50

The TS-480 has a 6 pin Mini-DIN connector:

Signal	**P4**dragon	Color	YAESU
GND	PIN 2	white	PIN 2
PTT	PIN 3	yellow	PIN 3
AF-OUT	PIN 1	violet	PIN 1
AF-IN	PIN 4	green	PIN 5
This cable is available completely assembled. Refer to chapter 10 on page 89.			

Table 8: KENWOOD 6 pin Mini-DIN

7.1.3 Connection to YAESU

Some YAESU transceivers use a 5 pin DIN plug (Packet) and can be connected this way:

Signal	**P4**dragon	Color	YEASU
GND	PIN 2	white	PIN 2
PTT	PIN 3	yellow	PIN 3
AF-OUT	PIN 1	violet	PIN 1
AF-IN	PIN 4	green	PIN 4

Table 9: YAESU 5 pin

Smaller YAESU's use a 6 pin Mini-DIN connector, whereby with multiband transceivers two different connection schemes must be distinguished:

- For HF and 1k2 Packet-Radio:

Signal	**P4**dragon	Color	YAESU
GND	PIN 2	white	PIN 2
PTT	PIN 3	yellow	PIN 3
AF-OUT	PIN 1	violet	PIN 1
AF-IN	PIN 4	green	PIN 5
This cable is available completely assembled. Refer to chapter 10 on page 89.			

Table 10: YAESU 6 pin Mini-DIN

- For 9k6 Packet-Radio:

Signal	**P4**dragon	Color	YAESU
GND	PIN 2	white	PIN 2
PTT	PIN 3	yellow	PIN 3
AF-OUT	PIN 1	violet	PIN 1
AF-IN	PIN 4	green	PIN 4
This cable is available completely assembled. Refer to chapter 10 on page 89.			

Table 11: YAESU 6 pin Mini-DIN

7.1.4   Connections to KENWOOD

Many KENWOOD radios use a 6 pin DIN socket for remote control. Into some older transceiver types the serial interface has to be installed previously. Please read the equipment handbook or consult your dealer.

Signal	**P4**dragon	Color	KENWOOD
TxD	**PIN 9**	**pink**	**PIN 3**
RxD	PIN 1	violet	PIN 2
CTS	PIN 5	blue	PIN 5
RTS	PIN 10	light blue	PIN 4
GND	PIN 13	orange	PIN 1

Table 12: KENWOOD TTL

Newer Kenwood transceiver (since TS-570) have a 9 pin SUB-D connector and operate with V24 levels for transceiver control. It´s intended for direct connection to a COM port of a PC. Also these transceivers can easily be controlled by the **P4**dragon. Just solder a 9 pin connector to the attached cable as shown in the table below.

Signal	**P4**dragon	Color	KENWOOD
TxD	PIN 3	yellow	PIN 3
RxD	PIN 8	red	PIN 2
CTS	PIN 4	green	PIN 8
RTS	PIN 2	white	PIN 7
GND	PIN 13	orange	PIN 5

This cable is available completely assembled. Refer to chapter 10 on page 89.

Table 13: KENWOOD V24

7.1.5 Connections to ICOM

Many ICOM's use a 3.5 mm jack socket for remote control. Bi-directional communication is carried out over a single wire. Different transceivers have different addresses, so it is possible for more than one transceiver to be connected to the remote control cable. Further information can be found in the appropriate literature from ICOM.

Signal	**P4**dragon	Color	ICOM
ICOM	PIN 6	black	inner
GND	PIN 13	orange	outer

This cable is available completely assembled. Refer to chapter 10 on page 89.

Table 14: ICOM

GND

ICOM-Signal
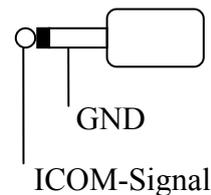
Figure 23: ICOM plug

7.1.6 Connections to YAESU

Some YAESU's like the FT890 or FT990 use a 6 pin DIN socket for remote control:

Signal	**P4**dragon	Color	YAESU
TxD	PIN 9	pink	PIN 3
RxD	PIN 1	violet	PIN 2
GND	PIN 13	orange	PIN 1

Table 15: YAESU FT 890/990

Older transceivers like the FT757 supports serial input only. In this case the **P4**dragon adjusts the frequency but could not read it out.

Signal	**P4**dragon	Color	YAESU
TxD	PIN 9	pink	PIN 3
GND	PIN 13	orange	PIN 1

Table 16: YAESU FT 757

Newer YAESU's (FT-920, FT847, FT-1000MP) use a 9 pin SUB-D connector and V24 levels for control, intended for connection to a COM port of a PC. Also these radios can be controlled by the **P4**dragon. Solder a 9 pin connector to the attached cable as shown in the table 16.

Signal	**P4**dragon	Color	YAESU
TxD	PIN 3	yellow	PIN 3
RxD	PIN 8	red	PIN 2
GND	PIN 13	orange	PIN 5

**This cable is available completely assembled.
Refer to chapter 10 on page 89.**

Table 17: YAESU V24

Portable transceivers like the FT-100, FT-817, FT-857 or FT-897 use a 8 pin Mini-DIN connection:

Signal	**P4**dragon	Color	YAESU
TxD	PIN 1	violet	PIN 4
RxD	PIN 9	pink	PIN 5
GND	PIN 13	orange	PIN 3

**This cable is available completely assembled.
Refer to chapter 10 on page 89.**

Table 18: YAESU 817

7.2   Assembled cables

Many modern transceivers from KENWOOD, ICOM and YAESU are equipped with a so-called Data-Connector, which usually is a 6 pin Mini-DIN on the rear side of the transceiver. For this connector we can supply 2 ready assembled cables, one for 9K6 and the other for 1K2 Packet-Radio operation. Refer to the list of accessories in chapter 10 on page 89.

7.3   Amplitude Adjustment

The **P4**dragon's output amplitude has to be adjusted very carefully to the connected transceiver. If you don't pay attention on this item a signal much too wide will be the result!

The output amplitudes are adjusted separately depending on the FSK modes (PACTOR-1) and the PSK modes (PACTOR-2/3/4). A common adjustment with one command was in practice not the best way.

The audio input sensitivity of most transceivers is adapted to the output voltage of a common dynamic microphone. 100% modulation is reached at low mic gain settings with 200 mV (peak to peak) input voltage. It is not recommended to use very high `PSKAmpl` values and compensate this by lowering the mic gain setting, because this may already overdrive the first amplifier stages which are very sensitive and located in the signal path before the mic gain controlling device. We recommend for the first approach to use the default PSKA value of 140 and then regulate the output power for PSK with the mic gain setting (if available). To do this connect the TRX to a dummyload resistor capable to dissipate the power or to an antenna with good SWR (take care that the frequency being used is not already occupied). Entering Ʊ 3 <Return> starts the Unproto mode 3 (=100 Bd DBPSK). Now you can use the mic gain knob to increase the transmitting power until the ALC voltage reaches the allowed limit.

Don't overdrive the TRX because in this case the signal will be spreaded by intermodulation!

With proper settings the peak envelope power will nearly be equal to the maximum output power of the TRX. In this case the average power will approximately be the half of the maximum power, so also continuous operation will not cause problems at all. Don't be confused as many modern TRX only display the peak envelope power. If it is necessary to set the MIC-Gain value to more than half of ist maximum, it is recommended to increase the **PSKAmpl** value. This for example can be done entering <ESC> **FSKA** 200 <RETURN>. If no MIC-Gain potentiometer is available the proper PSK amplitude setting has to be evaluated with only using the **PSKAmpl** command.

After the PSK amplitude is carefully adjusted, the MIC-Gain setting at the transceiver should not be touched any more, otherwise it could be difficult to achieve the desired output level for non-PSK modes.

To adjust the output level for non-PSK modes (PACTOR-I) only the **FSKAmpl** command should be used now. Entering **U** 1 <RETURN> starts the Unproto mode 1 (=100Bd FSK). Now you have the chance to adjust the output value using the **FSKAmpl** command e.g. <ESC> **FSKA** 100 <RETURN>. Same as before, during this procedure take care for not to exceed the ALC limit.

To prevent damage from the transceiver at continuous operation we recommend to limit the FSK output level to half of the maximum possible, that means 50 W if the transceiver is made for 100 W at max.

All unused wires of the TRX control cable **must not** be twisted or soldered together. All unused wires have to be **insulated seperately** avoiding to touch each others.

8 Display and LEDs

Figure 24: The **P4**dragon front view.

The **P4**dragon is equipped with 3 LEDs and a large monochrome (blue) OLED display.

8.1 The OLED Display

The display used in the **P4**dragon has 256 x 64 pixels. OLED means "**O**rganic **L**ight **E**mitting **D**iode". The OLED is a state of the art technology

As with any other display (e.g. LCD), the maximum brightness of the display can degrade over the years of usage. It degrades faster the higher the operation brightness is set to.

At high brightness, burn-in effects can occur when the display shows the same content over a long time.

Generally it is recommended to set the display to the lowest possible brightness, with respect to the environmental light conditions. In most cases a "very dim" operation will be bright enough for good reading. Maximum brightness is close to be a pain in the eye of the user anyway.

To change the brightness, use the ⏻ sensor and step into the brightness menu. Then use the sensor to set the desired brightness. Stop touching when the desired brightness is reached, the **P4**dragon will automatically leave the brightness menu after some seconds.
Like all displays, also the OLED has a glass body. Glass can break when it is treated with damaging force. Do not press on the display with force (it is not a touch screen anyway). Do not throw (or let fall) items against the display.

8.1.1   Contents of the OLED Display

There are several display pages available which can be selected with the [power icon] sensor. The user is encouraged to just "play" with the sensor and the display contents. The pages count and contents available will vary and extend over the lifetime of the product, as firmware development will continue in a progressive way. With this, it is not possible anyway to show all pages and menus in this manual. Some examples:

Figure 25: Main Menu
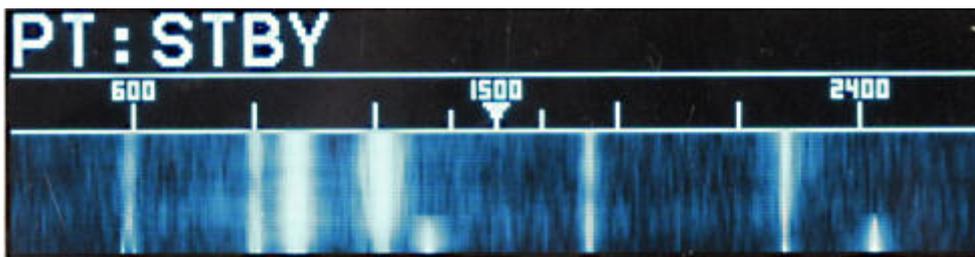
Figure 26: Waterfall

Figure 27: Spectrum

Figure 28: Status display

8.2   The LEDs

The **P4**dragon has 3 LEDs on the front panel:

shows Bluetooth activity with a blue LED flickering, when installed

Shows USB activity with a bi-color LED (red/green)

Shows activity on the Ethernet network when a DNP is installed

Also the LED on the rear side Ethernet connector show activity on the Ethernet
network when a DNP is installed.

9 Configuration switches

The **P4**dragon has 3 DIP switches to do some basic configuration.

9.1 Rear side configuration switch
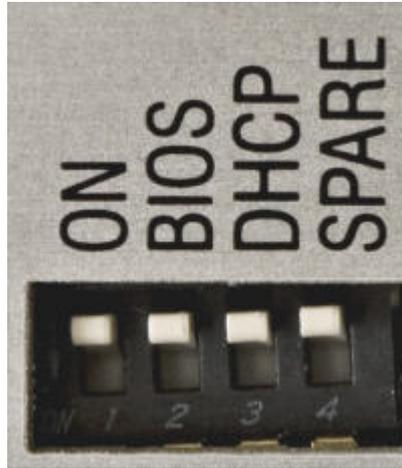
Figure 29: Configuration switches

This switch has 4 positions with different meanings. All of these can be switched on or off. ON means that the switch is set to the lower position, OFF is the higher position. When set to ON, the labeled condition is enabled.

9.1.1 ON switch

This switch enables the "permanent ON" feature which is described in chapter 5.1.1.

9.1.2 BIOS switch

This switch enables the Bootloader of the **P4**dragon. The Bootloader allows some of the basic functions **P4**dragon of the system to be used and works totally independently from the presently loaded firmware. The Bootloader has a very basic and essential task, and is thus is placed in a specially protected area of the FLASH memory.

Normally, the user does not need to worry about the existence of the Bootloader. However due to various unlucky or exceptional circumstances, it is possible that the **P4**dragon will no longer load the PACTOR firmware. Under these conditions, it could only possible to access the **P4**dragon via the BIOS.

If, for example, there is a power failure during a normal firmware update, one part of the FLASH is programmed with the new version, while the other still contains a part of the old firmware. It is very unlikely that such a mixture will run, and the Bootloader is then the only way the system can be recovered.

The BIOS is automatically activated as soon as the **P4**dragon detects an error on loading the PACTOR firmware, or the user wishes access to the BIOS by setting the DIP-switch to ON.

9.1.3   DHCP switch

This switch enables the DHCP function of the network option when installed. DHCP means that the device gets the IP address assigned automatically by the DHCP server (router) in the network. With DHCP off, the IP address can be configured manually. Also refer to chapter 5.4 on this matter.

9.1.4   Spare switch

This switch has no function currently but may be filled with life in a later firmware revision.

10 Accessories

For the **SCS P4**dragon the following accessories are available:

- **Bluetooth option**
  High power Bluetooth transceiver to plug in the DR7800.
  Order-No.: TBD

- **Network Option (Linux Computer Module DNP)**

  Enables the DR7800 to be used and controlled in Ethernet network environment
  Order-No.: TBD

- **Packet-Radio 9k6 cable**
  Direct connection from VHF/UHF-transceivers with DATA-connector (6 pin Mini-DIN) to the **P4**dragon (5 pin DIN).
  Order-No.: 8050

- **ICOM 8 pin cable**
  ICOM audio cable, **P4**dragon 8 pin DIN to ICOM 8 pin DIN (e.g. for M710, IC-735, IC765, IC-M802 and more).
  Order-No.: 8090

- **ICOM 13 pin cable**
  ICOM audio cable, **P4**dragon 8 pin DIN to ICOM 13 pin DIN (e.g. for M706, IC-718)
  Order-No.: 8110

- **ICOM 9 pin cable**
  ICOM audio cable, **P4**dragon 8 pin DIN to ICOM 9 pin SUB-D (e.g. for M801, M710 GMDSS)
  Order-No.: 8190

- **YAESU Audio cable**
  P4dragon 5 pin DIN to YAESU FT-817 6 pin Mini-DIN (e.g. for FT-100, FT-817, FT-897). Also usable for 1k2 Packet-Radio.
  Order-No.: 8120

- **KENWOOD Audio cable**
  P4dragon 8 pin DIN to KENWOOD ACC2 13 pin DIN.
  Order-No.: 8160

- **2 m Audio extention cable**
  8 pin DIN socket to 8 pin DIN connector.
  Order-No.: 8140

- **3 m Audio extention cable**
  8 pin DIN socket to 8 pin DIN connector.
  Order-No.: 8150

- **TRX-Control V24 cable**
  TRX-control (13 pin DIN) to 9 pin SUB-D connector and 3.5 mm speaker connector (e.g. for YAESU FT-1000 and KENWOOD TS-570, TS-870, TS-2000 and more).
  Order-No.: 8080

- **TRX-Control V24 cable ICOM**
  TRX-control (13 pin DIN) to 9 pin SUB-D connector and 3.5 mm speaker connector (e.g. for ICOM IC-M801, IC-M802, and more).
  Order-No.: 8083

- **TRX-Control V24 cable YAESU**
  TRX-control (13 pin DIN) to 9 pin SUB-D connector and 3.5 mm speaker connector (e.g. for YAESU FT-847).
  Order-No.: 8085

- **TRX-Control cable YAESU**
  TRX-control (13 pin DIN) to YAESU FT-817 (8 pin Mini-DIN) (e.g. for YAESU FT-817, FT-100, FT-897…).
  Order-No.: 8130

- **TRX-Control cable ICOM CIV**
  TRX-control (13 pin DIN) to ICOM CIV port (3.5 mm pin connector) and 3.5 mm speaker connector.
  Order-No.: 8170

- **Bluetooth USB-stick**
  For computers that do not have Bluetooth installed. Connects to a free USB connector.
  Order-No.: 2370

Shielded cables with molded connectors on one side, tinned open ends on the other side (pigtail), 1,5 meter.

- **Cable with 5 pin DIN connector**
  Order-No.: 8010

- **Cable with 8 pin DIN connector**
  Order-No.: 8020

- **Cable with 13 pin DIN connector**
  Order-No.: 8070

For additional accessories and prices please refer to our homapage http://www.scs-ptc.com or call for a recent pricelist.

11 Technical Data

Audio input impedance:	15 KΩ balanced/unbalanced, transformer coupled
Audio input level:	10 mVp-p... 5.5Vp-p
Audio output impedance:	300 Ω balanced/unbalanced, transformer coupled
Audio output level:	Max. 9 Vp-p (open circuit), adjustable in 1 mV steps
Processing:	Quad StarCore Digital Signal Processor (DSP) 400 MHz, 64 BIT
ROM:	2 Mbyte FLASH memory for easy updating
RAM:	32 Mbyte SDRAM
System monitoring:	With an internal processor watchdog
Operating temperature:	-20 to +70 °C
Front panel:	Colored printed, partly transparent front foil on Epoxy carrier A total of 3 LED´s in combination with a 256 x 64 dot blue OLED display. Touch sensor for ON / OFF and display mode selection
Rear panel:	Labelled aluminium panel Input for power supply Socket for connection to the transceiver Socket for transceiver remote control connections GPS-connector as 3 wire screw terminal USB connectors (master/slave) LAN connector, headset connector
Power Supply:	10 to 28 V DC, 400 mA max, 300 mA typical. Reverse polarity protected. Fuse selfresetting
Dimensions:	Width 172 x Height 43 x Depth 205 mm
Weight:	770 g