System Setup

Doppler SODAR PCS.2000-64/MF

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1 SODAR Components

The main components of the PCS.2000 are:

- Acoustic antenna with acoustic shield; type ASP008
- PC with integrated antenna interface and Lab Jack modul; type SAE050
- Antenna electronic; type AEP005
- Power supply ± 30 VDC; type SVS011
- Power connection cable (1,1m) power supply – antenna electronic; type VBK011
- Power cable drum 230VAC (50m); type NKT003
- Control cable drum (50m); type KTS005
- Temperature (5m) sensor connected to the Lab Jack modul
- Accessories and tools: Guys with nails, grounding cable with nail, compass
- Spare parts

The delivered the standard PCS.2000 system uses a PC DELL tower as the main control and processing unit.

All outside electronic devices and plugs of the PCS.2000 are embedded in a weatherproof housing IP65, which allows to operate the SODAR without any further protection in the outside field.

All tools that are required for a quick, convenient and safe set up of the SODAR system can be found in a tool set, which is delivered with the SODAR system. Use only these tools and use only the original replacements.

Figure 1: PCS.2000-64 with electronics in weatherproof outdoor cases

1.1 Acoustic Antenna

The SODAR antenna consists of an antenna panel with 64 loudspeakers and surrounding acoustic shield panels, which are covered inside with absorbing foam. The antenna electronic and the power supply are housed in a weatherproof box (IP65), which must be located close to the indoor PC in a distance of maximum 100 m.

1.1.1 Antenna Panel

The acoustic antenna is designed as a quadratic panel with 64 loudspeaker elements and is made from a hard foam material with closed cell structure that sustains outdoor conditions, so no special care must be taken for temperature extremes within min. –30 °C to max. +60 °C, rain, hail, snow, or other meteorological conditions. Due to the weight of the antenna panel (about 110 kg) it requires 4 persons to carry the antenna.

The 64 loudspeakers of the panel can form up to 5 antenna beams in principle but for nearly all standard applications only 3 antenna beams are required which are labeled as A1 and A2 on the panel. Beam A3 points up vertically.

Fig. 1 indicates the horizontal direction of the beams A1, A2 and A4, A5. The tilt angle depends on the adjusted frequency as listed below.

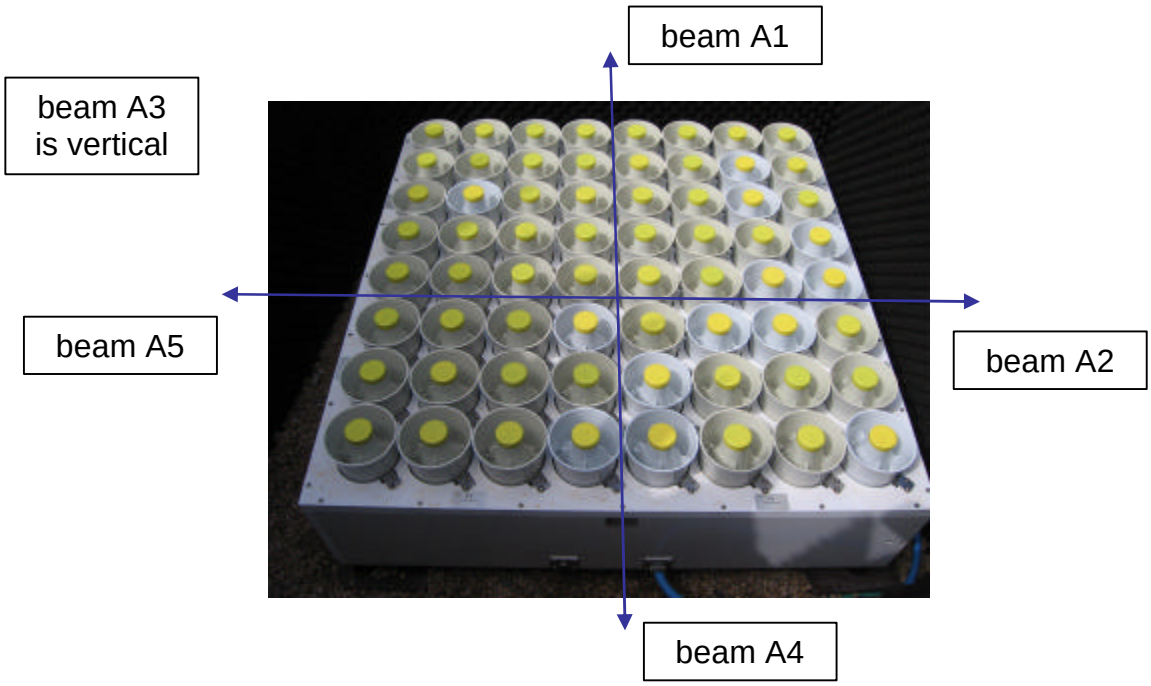


Figure 2: Antenna panel with 8 * 8 loudspeaker elements

The 64 loudspeaker elements are arranged in a way that the signals of each row or column may differ in phase by 0° or 90° from their neighbored elements. A phase shift of 90° in the time domain corresponds to a difference of ?/4 in the wavelength. Other phase shifts of 180° and 270° are derived from this basic signal form. The main lobe (i.e. the direction where the acoustic pulse is transmitted) is formed up by constructive superposition of acoustic signals simultaneously emitted from all loudspeakers.

Therefore, the tilt angle is of this main lobe is determined by the adjusted frequency. The fundamental relation between tilt angle and frequency for the PCS.2000-24 is:

(1) $\sin T = ? / (4 * d)$

T tilt angle
? acoustic wavelength
d distance between loudspeakers

or

(2) $= C_0 / (4 * d * f)$

C_0 sound speed
f acoustic frequency

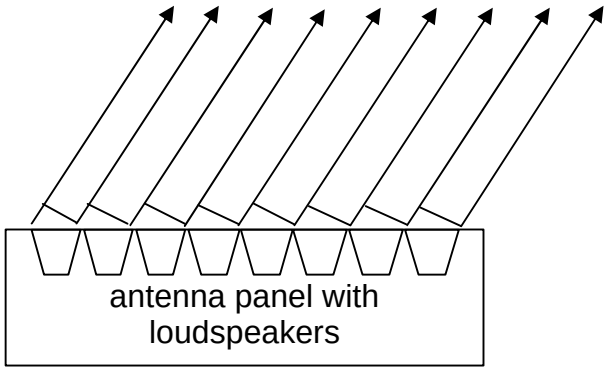
The following table gives a rough estimation for the relation between frequency and tilt angle:

(3)

frequency [Hz]	wavelength ? [m]	tilt angle uncorrected T [°]
1800	0,184	19,9
1900	0,174	18,9
2000	0,166	17,9
2100	0,157	17,0
2200	0,151	16,2
2300	0,144	15,5

with C_0 assumed as 331,5 m/s by 0°C
d assumed here as 0,135 m

The below diagram demonstrates the relation between the tilt angle and the loudspeaker separation:



Acoustic panels are required to suppress the cross talk between the SODAR antenna and the site environment. Such interference can cause fixed echoes and noisy signals in the SODAR system or -vice versa- annoyance of the neighbourhood due to the audible signal pulses, especially near residential areas or in public parks.

The acoustic shield consists of 4 internal panels, 8 lower (4 right and 4 left side) and 8 upper (4 right and 4 left side) panels. All panels are identical, so you may exchange panels within their level. Fix the right and left lower and the triangular shaped with the metal bars. The panels are lined on the inner side with inflammable, open cell structured sound absorbing foam.

1.2 Set Up of Acoustic Antenna

For the installation of the SODAR a solid and flat area of about 4 x 4 m is required. The acoustic antenna with all electronic devices is connected with cable up to 50m length for the control and 50m for the power cable. In order to prevent that animals destroy the cables, try to lay them not on the ground, but hang them on sticks or similar devices. The acoustic antenna is protected from underneath with a solid metal grid so that animals won't find a home in it.

Before you start with the set up, check that no obstacles are close to the beams A1 or A2 which might cause fixed echoes. As a rule of thumb a separation angle of 45° between the beams and the line of sight to the obstacles is required. The typical beam angle to the vertical is about 20°, so no obstacles should appear outside of an elevation angle of 25°. If so, change the orientation of the antenna accordingly to avoid interference with such obstacles.

Adjust the antenna panel in a position, which is horizontal within 1°. There are height adjustable screws on each corner of the antenna, use the wooden panels to support these screws. Check the horizontal position of the antenna by the spirit level on the antenna panel. Determine the azimuth orientation of beam A1 with the delivered compass. Please note that you have to agree with the user of the data whether the magnetic deviation must be considered or not.

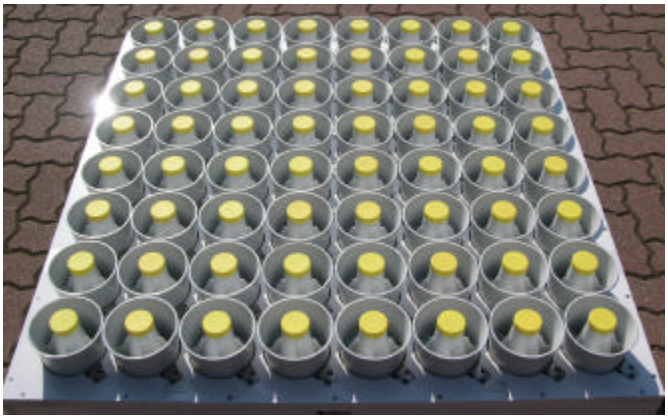


Figure 3: Place the Antenna panel

Place the four internal panels closely around the antenna panel and fix them to each other with the locking clamps. Start with two panels first. The antenna cable must be conducted below the base panel. Make sure that the cable is not folded.

Figure 4: Place the internal panels

Figure 5: Clipping together left and right shields

Cilping the right and left lower shields together with the metal bras.

Figure 6: Place the lower panels

Place now the lower shields around the internal shields and fix them to each other with the locking clamps.

Figure 7: Insertion of the triangular top panels

Insert the 4 upper shields with the fixed hinges. Then erect the shields and tighten each shield to the neighbored shields by means of the clamps.

These triangular shaped top panels reduce sound refraction effect, they are used within the vicinity of high buildings or other reflecting structures to reduce fixed echoes contribution in the received scattered signal.

Figure 8: Fixture of the acoustic shields

Always secure the acoustic shields with the 4 guiding strings and the ground nails in order to avoid any damage or personal injuries in stormy or gusty conditions.

2 Power supply

Attention:
The power supply uses 230 VAC input voltage in the watertight case, so any opening of the case and any work in it is allowed only to trained and authorized persons. The power supply delivers “±30VDC” on the output plug (±30VDC OUT).
Additional, the power supply controlled the antenna heater, the heater switch on when outside temperature lower than 5°C.
The power supply is to fix with 4 screws M6*10 on one of the lower shield panel.

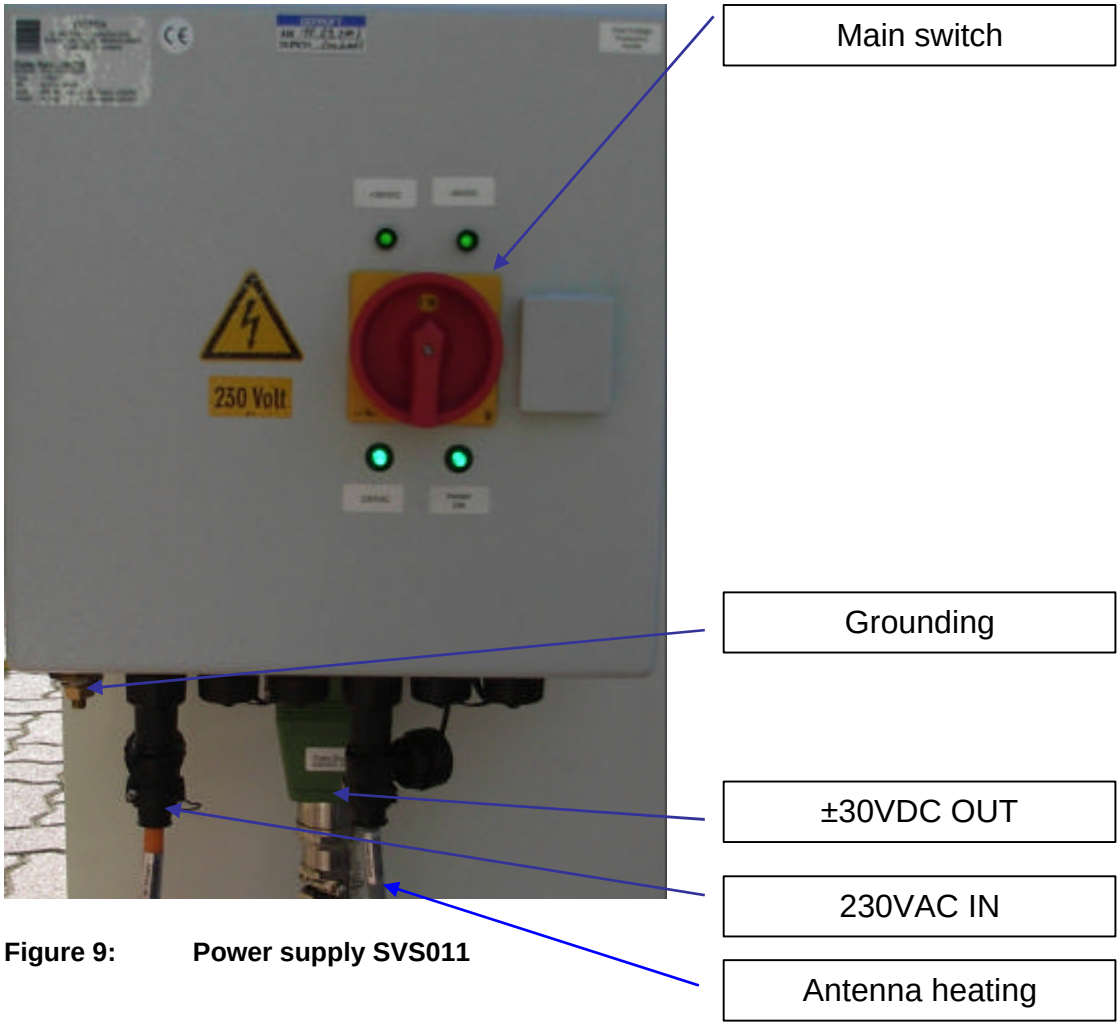


Figure 9: Power supply SVS011

3 Antenna electronic

The antenna electronic is connected to the loudspeaker panel, PC (SODAR) plug and the power supply (±30VDC OUT) plug.
The antenna electronic is to fixed with 4 srews M6*10 on one of the lower shield panel.

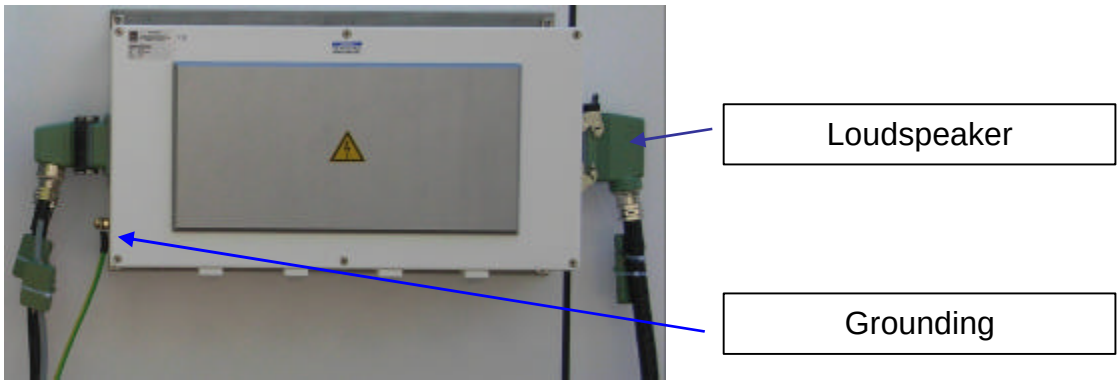


Figure 10: Antenna electronic AEP005

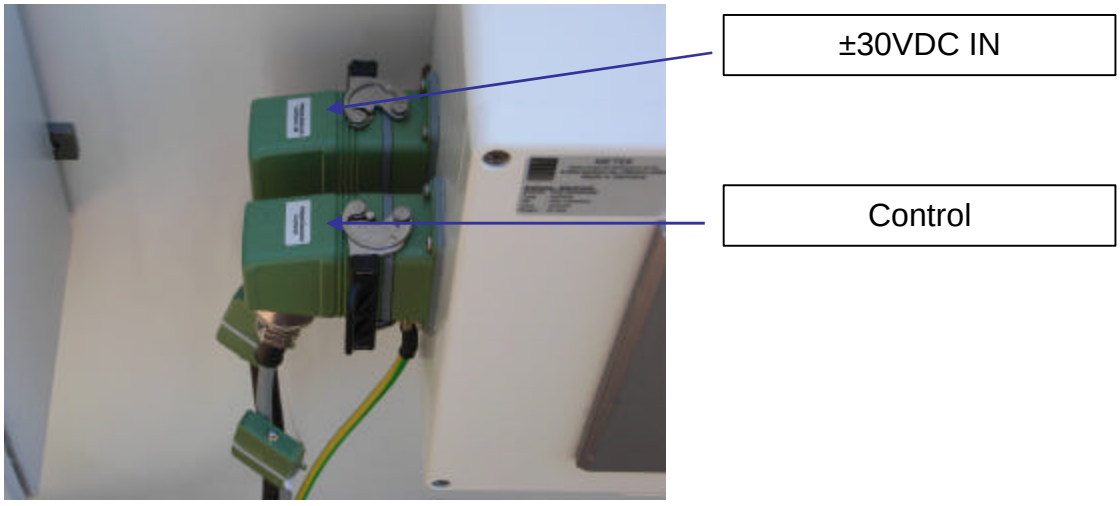


Figure 11: Antenna electronic AEP005

4 PC

4.1 Front View and Back View

RASS connector (opt.)

SODAR adapter box

SODAR control cable connector

Main switch PC

USB Mouse / unused

1st - USB Modem
(must be the left jack !)
2nd - LabJack
3rd - UPS
4th - Keyboard

VGA display

Parallel port

RS232 port COM1
(Sonic)

USB connectors for modem, LabJack, UPS, keyboard, and mouse are located at the rear panel of the PC. It is absolute essential to plug the line modem only into the lower left USB port. If you plug the modem into another USB port, Windows will install it again with a new name (MicroLink #2, #3 ...) and the modem is not automatically available for the remote access service. The batch file Modem Access offers an HyperTerminal access to the modem's virtual port COM3 (icon on desktop).

An ethernet connector (RJ45) is also located at the rear panel of the PC unit. The TCP/IP address is set to 192.168.1.239. The PC name is Sodar-39 as a member of the workgroup "SODAR". This may be changed appropriate to your own network purposes.

Furthermore there is a 9-pin D-sub male connector of a serial port which can be used for the Metek ultrasonic USA-1. A registration program (Tcopy-COM1) may be started on this port (see below).

At least there is a 15-pin D-sub connector for a standard VGA monitor. The screen resolution is set to 1280x1024 pixels.

4.2 Service Programs

To ensure unattended operation some of the METEK programs have been implemented as service programs. When properly configured (automatic start) service programs are started by the operating system after booting. It is not necessary that any user logs on to the system. This mechanism works independently.

Service programs can be stopped or started by use of the Windows 2000 control panel (start button ? settings ? control panel ? administrative tools ? services). Services can be stopped/started as well from the command line interface (DOS prompt) by use of "net stop <*service name*>"/"net start <*service name*>".

The METEK Sodar software uses three service programs:

- The "**Sodar2000**" service controls the sound interface, the beam switching (via parallel port) and the SODAR measuring cycles. This program calculates averaged and raw data. Data and system control is provided on local network ports (Port numbers 5000 for system control, 5001 for data and 5002 for future extensions).
- The "**SodarData**" service connects to the local network port 5001 (provided by the "SODAR" service) and logs the data to files. Data is divided into two categories: raw and averaged data. Both types of data are stored in separate files.
- The "**SodarComm**" provides for the local network port 5000 (provided by the "SODAR" service). This service offers an alternative network access to the system control interface provided by the "SODAR" service. As second function error messages reported by the "SODAR" service are logged to the Windows 2000/XP event log (see: start button ? settings ? control panel ? administrative tools ? events ? application). The alternative network access to the system control interface makes the system compatible to other METEK SODAR Systems (i.e. DSDPA.90 and MODOS). The alternative network access uses the "named pipe" technique instead of network ports. As an advantage this enables access to clients who are not running the TCP/IP protocol.

All three services can be stopped and started with the two batch files “Stop Services” and “Start Services” (Icons on desktop).

A third program file found in the C:\METEK directory is “**SodarCtrl.exe**”. This program offers a graphical user interface (GUI) for control and configuration of the PCS.2000. Internally it connects to the SodarComm service and generates commands according to the changes in the dialog boxes of the GUI. This program can be used as well on other PCs running Windows NT/2000XP if there is a network connection to the PCS.2000. In this case the name of the PCS.2000 unit has to be entered as a command line parameter. Refer to the SODAR Control manual.

If the “SodarComm” service is stopped, you may access the system control interface of the “SODAR” service as well by use of the telnet program (telnet local host 5000). Once the telnet window opens, you will see a command line prompt. Commands accepted by this interface are described in the PCS.2000 manual.

If the “SodarData” service is stopped, actually generated data sets (human readable ASCII text) can be viewed by use of telnet as well (telnet local host 5001). Stopping these services should be used for debugging purpose only.

Another service program is used for the registration of Sonic data (USA-1) from the serial port COM1. The program “**TCopy.exe**” was installed as a Windows service using the Microsoft tool “SrvAny”. The Installation procedure was performed with the batch file “C:\Metek\Installations\SrvAny\InstTcopy.bat”. The registry settings are defined in the script file “TCopyRegAdd.vbs” in the same directory. The service can be removed with the batch “RemoveTCopy.bat”. On this system the start up type is set to *manual*. If you want to use this registration program, set it to *automatic* (using the services program) which becomes valid after the next system boot. The batch file “Sonic Access” offers an HyperTerminal access to the Sonic port COM1.

4.3 Users, Passwords and Access Rights

Three users have been defined:

- Administrator
- Sodar
- Metek

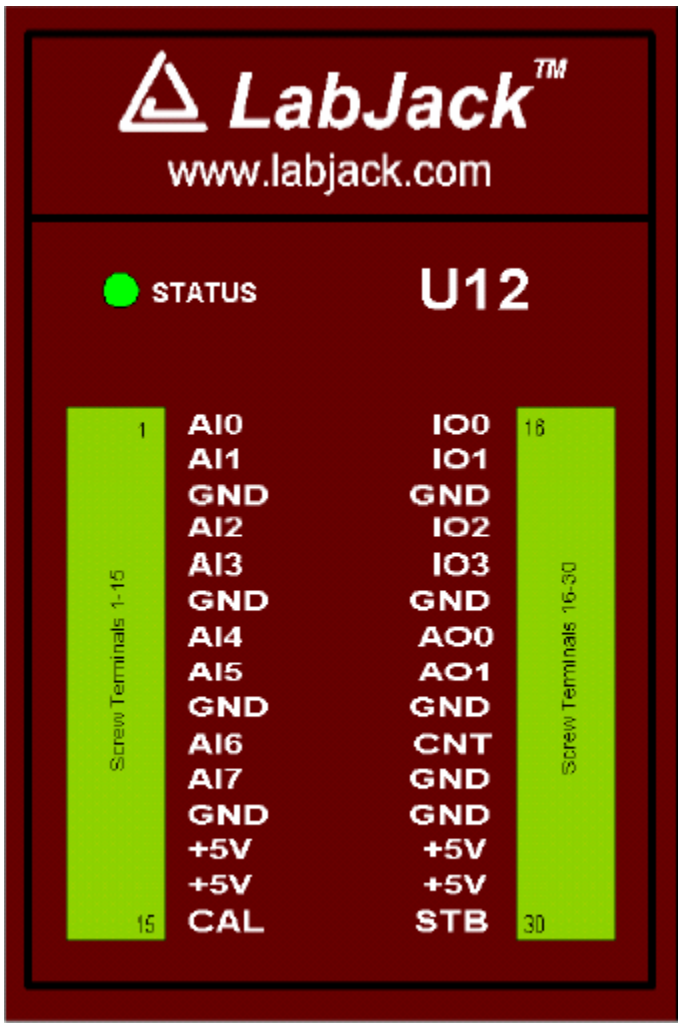
The Administrator account is a system default user. The new installed user “Metek” is equipped with administrator rights and should only be used by Metek for service purposes. The third user “Sodar” is a standard user and may be used for everyday controlling purposes.

The Administrator password is left blank and should be changed by the end user. Additional users can be added to the system by use of the control panel (start button ? setting ? control panel).

Be careful when changing users and passwords and don’t forget to grant or deny the remote access feature for each user (start button ? settings ? control panel ? network and dial-up connections ? “incoming connections”).

To enable remote access to the PCS.2000 by use of the METEK software the names and passwords of remote users must be the same on the local calling computer and the remotely called PCS.2000 !

4.4 LabJack U12



AI7: Temperature 1 Sensor Signal (white)
GND: Temperature 1 Sensor - (black)
+5V: Temperature 1 Sensor + (red)
CAL:

with 5m extension cable:
AI7: white
GND: brown/yellow
+5V: green

The picture shows the top surface of the LabJack U12. Not shown is the USB and DB25 connector, which are both on the top edge. The DB25 connector provides connections for 16 digital I/O lines, called D0-D15. It also has connections for ground and +5 volts. All connections besides D0-D15, are provided by the 30 screw terminals shown in Figure 1. Each individual screw terminal has a label, AI0 through STB.

5 Tool Kit and Accessories

For easy and convenient set up and maintenance a small tool kit is delivered with the system it contains:

- 1 Compass (performance is to be checked with reference point)
- 1 Ear protection
- 2 Protective cloves
- 1 Hammer
- 1 Set of screwdrivers
- 1 Multigrip pliers
- 1 Wire cutter
- 1 Needle nosed pliers
- 2 Screw wrench
- 12 Wooden plates

6 Spare parts

For own tests and reparation, we deliver some spare parts:

- 5 Loudspeakers
- 1 Power amplifier
- 5 Receive amplifier
- 1 Transmit plus switch
- 1 EPROM
- 1 Relais
- 1 Set of loudspeaker plugs
- 1 Set of crimping contacts for control and loudspeaker plugs
- 2 Loudspeaker test cable (BNC)
- Test cable for testing receive amplifiers of antenna electronic