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Scintec Flat Array Sodars

Software Manual

APRun

SFAS, MFAS, XFAS

including RASS and windRASS

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1 Introduction

APRun is the new generation of Scintec's Sodar Operation Software. It is the tool to configure, operate and control the measurement with all types of Scintec Sodars (SFAS, MFAS and XFAS), the RASS and windRASS extensions.

APRun provides real-time data output during measurement and permits the user to reprocess any previously recorded data using different data processing settings.

2 Quick Start

The following instructions provide a fast and easy way to install APRun, to perform a self-test of your instrument and to configure and start a basic measurement. For more detailed instructions and information please refer to the subsequent sections of this document.

2.1 Quick Start Instructions

2.1.1 Quick Start: Installation

Run the program setup.exe from the installation CD to start the APRun Setup.
Accept the default installation folder `C:\APRun` and follow all further instructions to install APRun to your hard disk.

2.1.2 Quick Start: Local Storage Path

When starting APRun for the first time you will be asked for the path of the Local Storage Folder that shall be used by APRun. You may accept the default `C:\APRun` by clicking OK.

2.1.3 Quick Start: Workspace

Settings and Data Files are organized in so-called Workspaces. You must create at least one Workspace specifying some basic parameters.

Fill in all requested information including your Sodar type and its serial number. Entering the correct serial-number is important to let the software manage the compatibility issues for your instrument.

2.1.4 Quick Start: Start Device Server

If necessary, APRun interacts with your Sodar using the Device Server – an intermediate software module running in the background that handles all communication with your instrument. In order to start the Device Server, click the Start Device Server entry of the Device menu.

The Device Server will now try to connect to the Sodar and report its connection state next to the status indicator labeled Sodar Status.

On successful connection after some seconds, you will see the message ‘Transferring SPU program’ in the system log. When the program transfer has finished (this may take some minutes) the Sodar Status state indicator will turn green, telling you that the SPU is now connected and ready for operation.

If the Sodar connection cannot be established, you should check the following

- the Sodar power supply and its connection to the antenna
- the connection between SPU and PC
- the connection settings of APRun such as the serial port and the connection speed, which are located in the Hardware, Site, Environment Settings dialog of the menu Other Settings.

2.1.5 Quick Start: Self-Test

Before starting a measurement or at least every month during continous operation, we recommend to perform a self-test to check the health of your Sodar hardware. From the Device menu choose Self-Test to open the self-test window. From there you may start the full sequence of all available tests by choosing Start Test – All Tests from the menu.
The full test course may take from 15 to 60 min – depending on your device type.
Please note that an evaluation of the self-test results (in terms of 'test passed' or 'test failed') is currently only provided for the Antenna Test. The other tests possess only informational character.

2.1.6 Quick Start: Primary Settings

All basic measurement parameters are set via the Primary Settings Creator dialog from the menu Primary Settings.

- Select the measurement modes (sodar, RASS or windRASS),
- set the height range that shall be covered and
- choose an output time interval from the list.

This is all information that is required to configure a basic measurement from scratch.

2.1.7 Quick Start: Start Measurement

The measurement is started by clicking Start Measurement from the Device menu. In the course of the measurement you can monitor the current state in the system status frame (the box below the menu with the coloured status indicators). The measurement results are displayed by opening some plots from the menu View.

2.1.8 Quick Start: Stop Measurement

To stop or interrupt a running measurement, please issue Stop Measurement from the menu.

3 Installation

3.1 System Requirements

The following list summarizes the system requirements that should be met by the PC running APRun.

	Minimum Requirements	Recommended
processor (CPU)	1.5 GHz or more	2 GHz or more
memory (RAM)	500 MB or more	2 GB or more
free hard disk capacity for installation of APRun	20 MB or more	100 MB or more
free hard disk capacity for raw data storage (100 days)	10 GB or more	50 GB or more
I/O ports	serial port (RS232)	serial port (RS232)
graphics adapter	1024x768 pixels or more	1280x1024 pixels or more
operating system	Windows 2000, Windows XP Home, Windows XP Professional Windows Server 2003 Windows Vista Windows 7	Windows XP Professional Windows Vista Windows 7

Logon as administrator or assure sufficient administrative privileges of your user account in order to install, remove or update the software.

3.2 Setup

To start the installation, run `setup.exe` from the CD-ROM and follow the instructions.

We recommend to accept the default installation folder `C:\APRun` – even if previous versions of APRun already exist on the PC. The software will create a new subfolder `C:\APRun\APRun 1.xx` (with 'xx' as the current minor version number) where all binary and configuration files will be installed.

3.3 Removal

The 'Add/Remove Programs' tool of the Windows Control Panel permits to remove an APRun version. The installation folder `C:\APRun\APRun 1.xx` will be removed completely in this process.
The Workspace folders, containing settings and data files, will remain on your hard disk until you manually choose to erase them. They are usually named `workspace_xx` and reside in `C:\APRun`.

3.4 Updates

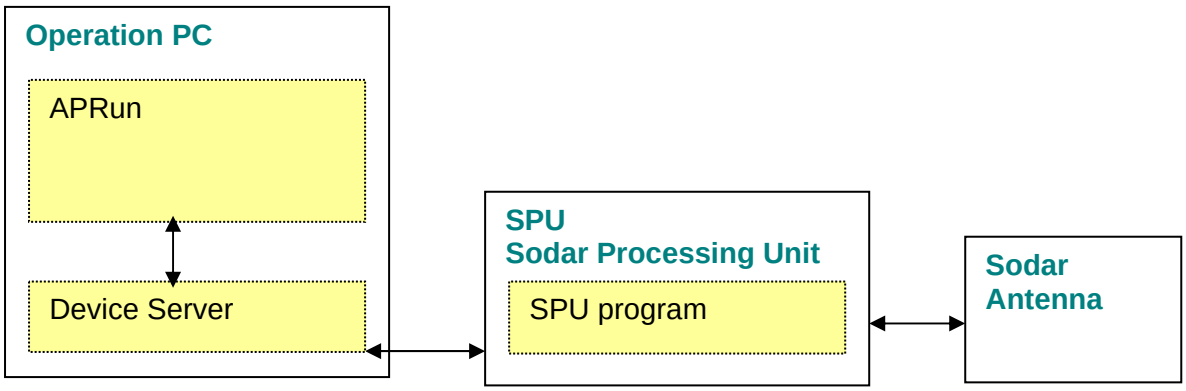
Since the Sodar Operation Software is constantly being improved and new features are added, Scintec recommends to check regularly for updates. Software updates are available after a free registration for all customers at http://www.scintec.com. After you login, the latest version of the manual and the software is found in the menu 'Support'.

Although not strictly required, we recommend to remove previous versions of APRun before installing a new version. As mentioned above, settings and data files will not be removed during deinstallation. You may find it convenient to continue using your previous settings and data by choosing the same Local Storage Path when starting the updated APRun version for the first time.

4 Concepts

4.1 Software Modules

The Sodar Operation Software consists of APRun, the Device Server and the SPU program.



4.1.1 APRun

Program file path	`C:\APRun\APRun 1.xx\aprun.exe`
Running on	Operation PC

APRun calculates wind speed, temperature and all other output data from the raw data received from the device server during measurement or from previously recorded raw data files during reprocess. Data plots are available online and offline.
APRun provides a user interface for

- setting measurement parameters
- controlling the measurement
- performing self-tests

4.1.2 Device Server

Program file path	`C:\APRun\APRun 1.xx\devsrv_sodar\aprun_devsrv_sodar.exe`
Running on	Operation PC

The Device Server is a program running in the background that works as an interface between the Sodar Processing Unit and APRun. It is launched by APRun if you select Start Device Server from the Device menu. The Device Server quits automatically if you select Stop Device Server from the menu or if APRun itself is closed.

When the Device Server is running, it will show a symbol as indicated below in the tray bar. By right-clicking on this symbol, it can be terminated manually in case of a problem.

4.1.3 SPU Program

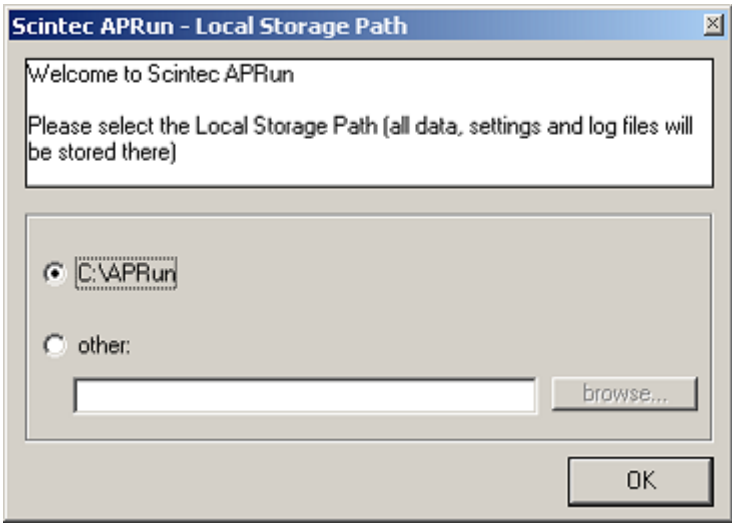
Program file path	`C:\APRun\APRun 1.xx\devsrv_sodar\FASxxx_x.SPU`
Running on	Sodar Processing Unit

When connecting to the Sodar, the Device Server checks automatically if the SPU program running on the SPU matches the most recent version that is installed on the Operation PC. If there is a newer version available – for example after a software update has taken place - the SPU program is automatically transferred to the SPU and replaces the outdated version. A notification message will be shown in the APRun system log. The transfer may take up to some minutes. Older Sodar Processing Units are not equipped with non-volatile storage, so that this transfer is done each time the Sodar is powered up.

4.2 Files and Folders

4.2.1 Local Storage Path

APRun creates and writes a lot of different files during operation: parameter files that hold the current configuration, data files that are created during measurement, temporary files that are used internally. All these files are stored in one single folder and its subfolders. This folder is called 'Local Storage Path' and must be set once when APRun is launched for the first time after installation. We recommend to accept the default location `C:\APRun`.



It is important that the user who is running APRun has read and write access to this Local Storage Path and its subfolders.

In the case that the Local Storage Path must be changed later, this can be done by manually modifying the Windows Registry entry:
`HKEY_LOCAL_MACHINE\SOFTWARE\Scintec\APRun x.xx\BasePath`.

4.2.2 Workspaces

Settings and data files are organized in 'Workspaces,' which are subfolders of the Local Storage Path that contain their own sets of measurement settings and data folders. Under some circumstances having several different Workspaces is advisable:

- If you are doing several measurement campaigns you should keep each campaign's data in a separate Workspace.
- If APRun is shared amongst several users on the same PC, they can all create their own Workspaces with their personal settings and data.
- If more than one Sodar is operated from one single PC, a new Workspace should be created for each device.
- If several instances of APRun are running at the same time, each instance must use its own Workspace that will be locked for all other instances.

When started, APRun always tries to open the previously used Workspace. If this is not possible, the Workspace selection dialog is displayed after start-up.

Each Workspace consists of the following subfolders:

Workspace Folder:	`C:\APRun\workspace_mfas_xyz`
'mfas' indicates the Sodar type that is associated with this Workspace	
'xyz' is the label that has been set by the user when the Workspace has been created.	

Data Output Folder:	`C:\APRun\workspace_mfas_xyz\data`
The Data Output Folder is the place where the actual data files are stored during a measurement.	

Log Folder:	`C:\APRun\workspace_mfas_xyz\log`
The Log Folder archives any log messages that are generated during operation of APRun. It contains all messages that appear in the System Log frame.	

Settings Folder:	`C:\APRun\workspace_mfas_xyz\settings`
All kinds of settings are stored in this folder.	

4.2.3 Data Files

During measurement or reprocess APRun creates different types of files, containing measurement results from different processing stages. The files are automatically stored in the Data Output Folder of your Workspace.
You should access these data files mainly through the interfaces that APRun provides for this purpose, i.e. the plots from the Views menu and the Raw Data reprocess. If you plan to read and process the data from other applications, you should instead make use of the Userdefined Output features that are presented in a later next section.

Main Data
All measurement results, such as wind speed, wind direction, temperature, total backscatter, etc. are stored in Main Data files. The data is written in a special ASCII file format called 'FORMAT-1'. Detailed file format specifications are provided in a later section of this document. You may read Main Data files using the APRun Recorded Data plots.

Statistics Data
Statistics Data files contain statistical data (i.e. availability statistics, average wind speeds, wind rose data) for preconfigured time periods.

Raw Data
Raw Data files are binary data files that contain the unprocessed raw spectra, that is the power spectra of the received signals. Raw Data files can be reprocessed to re-create Main Data files for a measurement period using different Processing Settings. Most importantly, it is possible to choose another output interval for the reprocessed data. Depending on the Sodar type and settings, storing (and keeping) Raw Data requires a free disk capacity of 20 to150 MB (depending on sodar type and configuration) per day of measurement.

Self-Test Data
Self-Test Data files are automatically stored each time a self-test is performed.

The following table shall provide an overview of the filenames and data formats.

Type	**File Name**	**File Format**
Main Data	YYMMDD**.mnd**	ASCII, FORMAT-1
Raw Data	YYMMDD**.raw**	Binary, FORMAT-2B
Statistics Data	statistics{INTERVAL}LABEL**.stat**	ASCII, XML
Self-Test Data	YYMMDD_HHNNSS**.tst**	ASCII

(YY=year, MM=month, DD=day, HH=hour, NN=minute, SS=second)

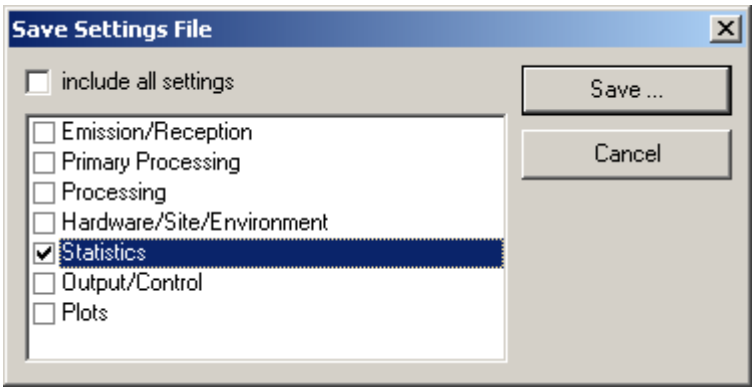
A detailed description of the file format FORMAT-1 will be given in a later section of this manual. A description of the binary file format FORMAT-2B is available on request.

4.2.4 Settings Files

The current settings are automatically stored in the Settings Folder (e.g. `C:\APRun\workspace_mfas_xyz\settings`).

At the beginning of a new measurement a copy of all current settings is stored in a settings file, labeled `YYMMDDx_settings_backup.set` in the Data Folder.

To exchange settings between different PCs or Workspaces, you may utilize the Save Settings File and Load Settings File commands from the menu Program.



A settings file contains different categories of settings. When saving a settings file you may select from a list what kind of settings you wish to include into the file. When loading a settings file you may choose which of the included settings categories shall be loaded into APRun.

This way it is possible to copy for example only the statistics settings from one PC to another without the threat of accidently modifying any site or hardware specific settings.

The following list describes all settings categories that are used by APRun:

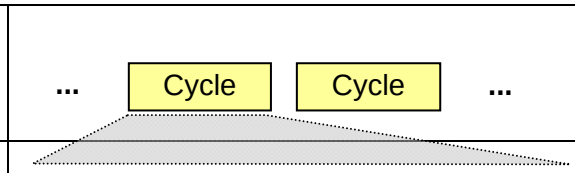
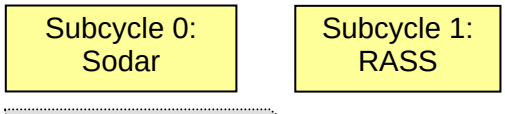
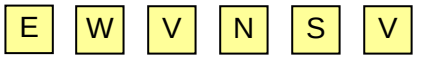
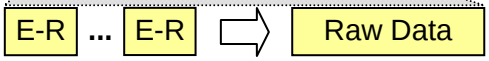
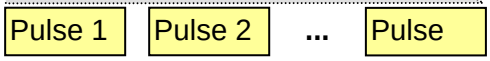
Filename	**Description**
Emission/Reception	includes: - Primary Settings: Emission/Reception - Other Settings: Sodar Power Schedule

	remarks: - It is not possible to change any of these parameters for reprocess. - All these parameters can be restored from a raw data file
Primary Processing	includes: - Primary Settings: Composit Construction - Primary Settings: Periods and Heights
	remarks: - These parameters can be changed for reprocess.
Processing	includes: - Other Settings: Processing
	remarks: - These parameters can be changed for reprocess.
Hardware/Site/ Environment	includes: - Other Settings: Hardware, Site and Environment - Other Settings: Atmospheric Modeling - Other Settings: CT^2 Calibration
	remarks: - These parameters are all site-specific or device-specific.
Statistics	includes: - Other Settings: Statistics
	remarks: - These parameters can be changed for reprocess.
Output/Control	includes: - Other Settings: Data Output - Other Settings: Control - Other Settings: Units
Plots	includes: - Other Settings: Plot Settings

4.3 Measurement Sequence

4.3.1 Schematic

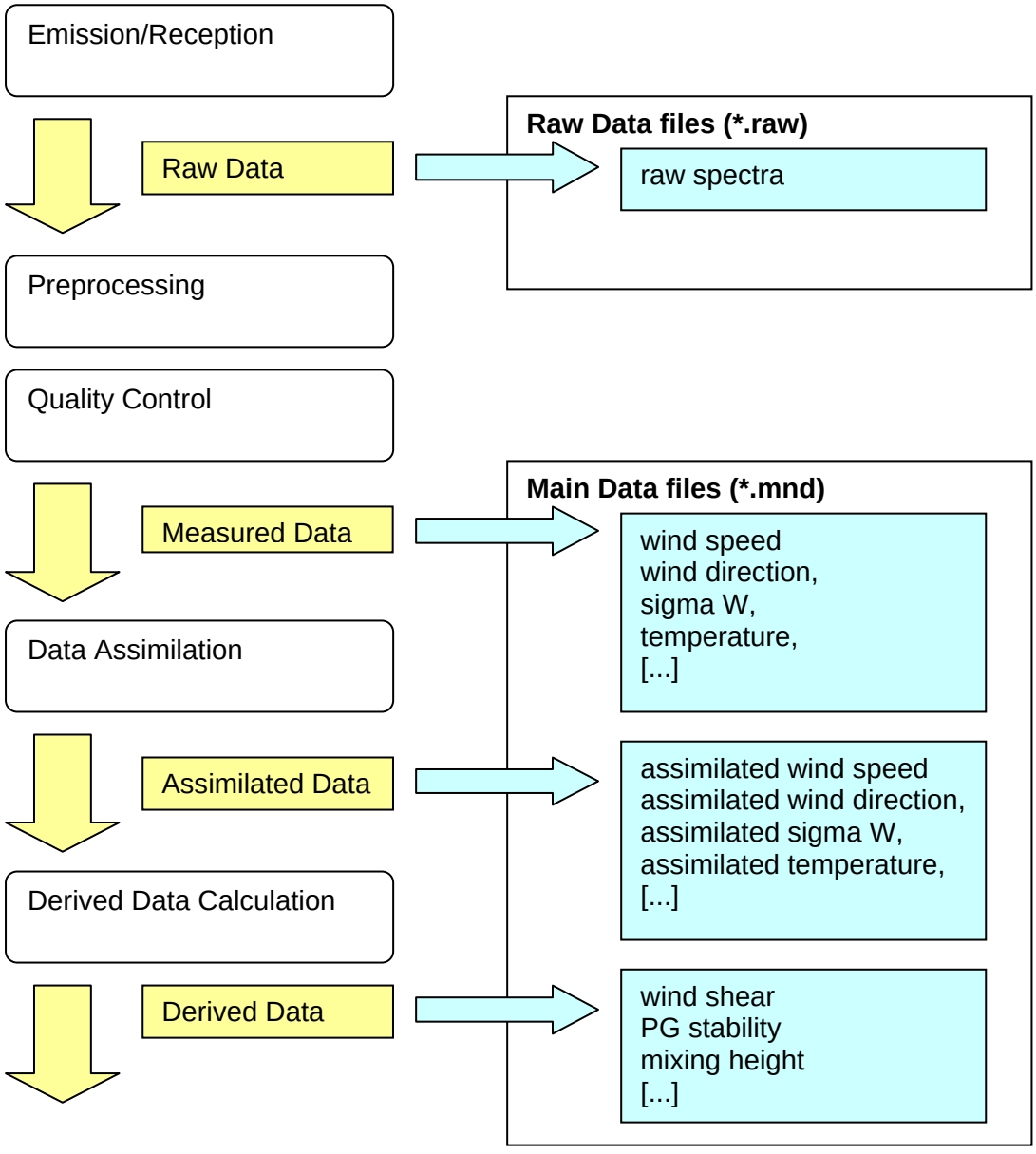
The following schematic provides an overview of the measurement sequence and the terms used in this context.

Measurement Cycle after cycle is repeated until the measurement is stopped manually.	
Cycle Each Cycle consists of up to five Subcycles. Subcycles can be configured for Sodar , RASS or windRASS measurements.	
Subcycle Each Subcycle has its own dedicated emission/reception parameters assigned to it. Sodar Subcycles are configured for up to six subsequent Directions (N=North, E=East, S=South, W=West, V=Vertical).	
Direction The Emission-Reception Sequence is repeated typically 10 times for each Direction. At the end of each Direction the raw spectra are averagedm, transferred from the SPU to the PC and stored as Raw Data (*.raw).	
Emission-Reception Sequence A sequence of pulses is emitted into the atmosphere, then the Sodar switches into reception mode and receives an echo of the emitted pulses.	
Pulse Sequence The emitted Pulse Sequence consists of up to 10 individually configurable pulses of different frequencies.	

4.4 Measurement Data Processing

4.4.1 Schematic

This scheme shows the principal data flow during measurement.



4.4.2 Raw Data

Raw Data contain raw received signal data (fourier power spectra) that are obtained during measurement.

4.4.3 Preprocessing

The raw data is filtered and preprocessed. It is averaged over one full averaging interval. Various corrections and filters are applied such as ground clutter detection and removal. All signals of the

different subcycles, measurement beams and acoustic frequencies are decoded and combined according to a composition matrix (Composit Construction Table). A pattern recognition and fit procedure obtains primary results for wind components and signal quality scores.

4.4.4 Quality Control

The primary results are checked against local signal quality criteria, combined signal quality criteria and two-dimensional spatial/temporal consistency tests. Any data that does not pass all quality control tests is devalidated and removed.

4.4.5 Measured Data Results

After passing quality control procedures the following Main Data results are immediately available. These are typically the most important outputs:

- horizontal wind speed
- horizontal wind direction
- wind components U,V,W
- sigma U,V,W
- temperature (only with RASS or windRASS)
- quality control data
- [...]

4.4.6 Data Assimilation

In order to remove short-term noise fluctuations and provide stable inputs for subsequent derived data calculations the spatial and temporal evolution of the Measured Data values is approximated using a two-dimensional polynomial fit. The assimilation includes data obtained during the latest 120 minutes (configurable).

4.4.7 Assimilated Data Results

The results of Data Assimilation are especially valuable as input data for applications that perform any kinds of atmospheric modeling. Assimilated data values include:

- assimilated horizontal wind speed
- assimilated horizontal wind direction
- assimilated sigma U,V,W
- assimilated temperature
- [...]

4.4.8 Derived Data

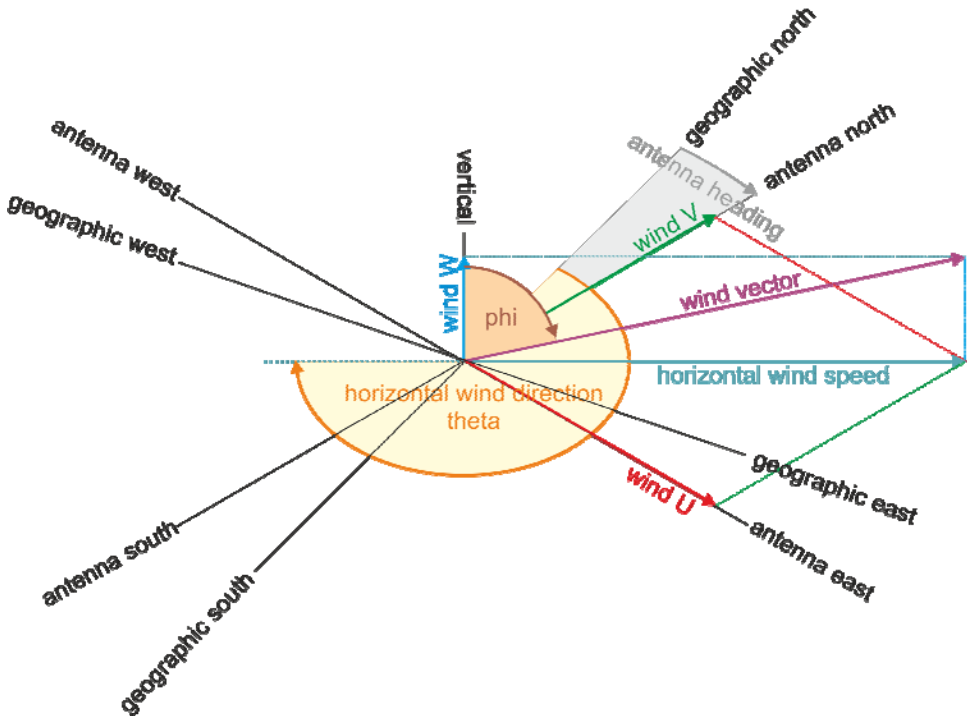
Based on this assimilated data the following secondary variables are computed:

- wind shear
- Pasquill-Gifford stability class
- mixing height
- turbulent kinetic energy
- eddy dissipation rate
- [...]

4.5 Measurement Results

4.5.1 Wind Definitions

A Doppler Sodar works as a wind profiler: the vertical profile of the three-dimensional wind vectors is measured. The following scheme illustrates the definitions of wind direction, wind components and angles as used by APRun:



The violet arrow points into the direction into which the wind is blowing. A positive W component means that the wind is blowing upwards. The horizontal wind vector displayed above corresponds to a south-westerly wind direction, it is blowing from south-west to north-east. It has a positive U and a positive V component. The components U and V refer to the antenna directions, while horizontal wind direction is provided with reference to true geographic north.

4.5.2 Output Variables

The Output Variables are divided into two different categories:

Profile Variables	Results are provided for each height level individually. Each data set contains a full height profile of these variables. (Examples: wind speed, wind direction, ..)
Non-Profile Variables	A single result is provided that is independent from height. (Example: mixing height, stability class)

The Main Data files that are automatically produced by APRun may contain both kinds of variables at the same time.

However, individual Userdefined Output data files may not mix the two classes. If you need both at the same time, you would have to store them into separate files, for example the Profile Variables into a file with extension *.ex1, the Non-Profile Variables into a file with extension *.ex2.

The background color of the table rows indicate the detail level of the respective output variable:

basic	output variables that are required for most applications
advanced	output variables that are intended for special applications, only
expert	output variables that are used very rarely and in very special applications

Main Data, Profile Variables:

Variable	Symbol	Unit	Remarks
height	z	m	Center of output height level
wind (measured data)			
wind speed	speed	$\frac{m}{s}$	Horizontal wind speed
wind direction	dir	deg	Horizontal wind direction 0°: wind coming from the north, 90°: wind coming from the east 180°: wind coming from the south 270°: wind coming from the west
wind U	U	$\frac{m}{s}$	U wind component. Positive U means wind blowing to antenna east.
wind U [QC class]	U[QCC]		Quality Control class for wind U (see later section for details)
wind U [QC ignore]	U[ign]	$\frac{m}{s}$	Unfiltered results for wind U
wind U [QC significance cumulative]	U[siC]		Cumulative signal quality score for complete veraging interval
wind U [QC significance cumulative]	U[siD]		Average signal quality score of individual measurements
wind V	V	$\frac{m}{s}$	V wind component. Positive V means wind blowing to antenna north.
wind V [QC class]	V[QCC]		Quality Control class for wind V (see later section for details)
wind V [QC ignore]	V[ign]	$\frac{m}{s}$	Unfiltered results for wind V
wind V [QC significance cumulative]	V[siC]		Cumulative signal quality score for complete averaging interval
wind V [QC significance cumulative]	V[siD]		Average signal quality score of individual measurements
wind W	W	$\frac{m}{s}$	Vertical component of wind speed. Positive W means wind blowing upwards.
wind W [QC class]	W[QCC]		Quality Control class for wind W (see later section for details)
wind W [QC ignore]	W[ign]	$\frac{m}{s}$	Unfiltered results for wind W
wind W [QC significance cumulative]	W[siC]		Cumulative signal quality score for complete averaging interval
wind W [QC significance cumulative]	W[siD]		Average signal quality score of individual measurements
sigma U	sigU	$\frac{m}{s}$	Horizontal standard deviation of wind component U (antenna east).

sigma U (radial)	sigU_r	$\frac{m}{s}$	Radial standard deviation along the antenna east beam axis.
sigma U (radial) [QC class]	sigU_r[QCC]		Quality Control class for sigma U (radial) (see later section for details)
sigma U (radial) [QC ignore]	sigU_r[ign]	$\frac{m}{s}$	Unfiltered results for sigma U (radial)
sigma U (radial) [QC significance cumulative]	sigU_r[siC]		Cumulative signal quality score for complete veraging interval
sigma U (radial) [QC significance cumulative]	sigU_r[siD]		Average signal quality score of individual measurements
sigma V	sigV	$\frac{m}{s}$	Horizontal standard deviation of wind component V (antenna north).
sigma V (radial)	sigV_r	$\frac{m}{s}$	Radial standard deviation along the antenna north beam axis.
sigma V (radial) [QC class]	sigV_r[QCC]		Quality Control class for sigma V (radial) (see later section for details)
sigma V (radial) [QC ignore]	sigV_r[ign]	$\frac{m}{s}$	Unfiltered results for sigma V (radial)
sigma V (radial) [QC significance cumulative]	sigV_r[siC]		Cumulative signal quality score for complete veraging interval
sigma V (radial) [QC significance cumulative]	sigV_r[siD]		Average signal quality score of individual measurements
sigma W	sigW	$\frac{m}{s}$	Standard deviation of vertical wind component.
sigma W [QC class]	sigW[QCC]		Quality Control class for sigma U (radial) (see later section for details)
sigma W [QC ignore]	sigW[ign]	$\frac{m}{s}$	Unfiltered results for sigma U (radial)
sigma W [QC significance cumulative]	sigW[siC]		Cumulative signal quality score for complete veraging interval
sigma W [QC significance cumulative]	sigW[siD]		Average signal quality score of individual measurements
wind (assimilated data)			
assimilated wind speed	{speed}	$\frac{m}{s}$	Assimilated horizontal wind speed.
assimilated wind direction	{dir}	deg	Assimilated horizontal wind direction
assimilated wind U	{U}	$\frac{m}{s}$	Assimilated U wind component
assimilated wind V	{V}	$\frac{m}{s}$	Assimilated V wind component
assimilated wind W	{W}	$\frac{m}{s}$	Assimilated vertical component
assimilated sigma U	{sigU}	$\frac{m}{s}$	Assimilated horizontal standard deviation of wind component U (antenna east).
assimilated sigma U (radial)	{sigU_r}	$\frac{m}{s}$	Assimilated radial standard deviation along the antenna east beam axis.

assimilated sigma V	{sigV}	$\frac{m}{s}$	Assimilated horizontal standard deviation of wind component V (antenna north).
assimilated sigma V (radial)	{sigV_r}	$\frac{m}{s}$	Assimilated radial standard deviation along the antenna north beam axis.
assimilated sigma W	{sigW}	$\frac{m}{s}$	Assimilated standard deviation of vertical wind component.
wind (derived data)			
wind shear	shear	$\frac{m/s}{m}$	Size of the vertical gradient of horizontal wind vector, i.e. the 'change rate' of horizontal wind with height.
wind shear direction	shearDir	deg	Geographic orientation of the wind shear vector, i.e. the 'change direction' of horizontal wind with height.
sigma speed	sigSpeed	$\frac{m}{s}$	Standard deviation of longitudinal component of horizontal wind vector
sigma lateral	sigLat	$\frac{m}{s}$	Standard deviation of lateral component of horizontal wind vector
sigma Phi	sigPhi	deg	Standard deviation of wind elevation angle
sigma Theta	sigTheta	deg	Standard deviation of horizontal wind direction
turbulence intensity	TI		Turbulence intensity, i.e. the ratio: sigSpeed / {speed}
PG stability profile	PGz		Pasquill-Gifford stability class height profile
turbulent kinetic energy	TKE	$\frac{m^2}{s^2}$	Specific kinetic energy of turbulent motion
eddy dissipation rate	EDR	$\frac{m^2}{s^3}$	Dissipation rate of specific kinetic energy of turbulent motion (eddy dissipation rate). Calculation assumes neutral or near-neutral stratification.
temperature (measured data)			
temperature	T	°C	Air temperature
temperature virtual	T_v	°C	Virtual air temperature (i.e. the equivalent temperature at 0% humidity)
temperature virtual [QC class]	T_v [QCC]		Quality Control class for temperature virtual (see later section for details)
temperature virtual [QC ignore]	T_v [ign]	$\frac{m}{s}$	Unfiltered results for temperature virtual
temperature virtual [QC significance cumulative]	T_v [siC]		Cumulative signal quality score for complete veraging interval
temperature virtual [QC significance cumulative]	T_v [siD]		Average signal quality score of individual measurements
temperature (assimilated data)			
assimilated temperature	{T}	°C	Assimilated air temperature
assimilated temperature virtual	{T_v}	°C	Assimilated virtual air temperature
temperature (derived data)			
temperature ID	T_ID		Temperature ID: 0 – no inversion detected,

			1 – inversion detected
backscatter data			
backscatter (raw)	bck_raw		Total intensity of the received signal (raw).
backscatter	bck		Total intensity of the received signal, filtered and range-normalized.
backscatter ID	bck_ID		Backscatter ID: 1 – strong inversion detected 2 – upper end of backscatter range
temperature structure function constant CT^2	CT^2	$K^2 m^{-2/3}$	Structure function constant of temperature fluctuations. This value is calculated from backscatter and requires CT^2 calibration.
error code			
error code	error		Error code

Main Data, Non-Profile Variables:

Variable	Symbol	Unit	Remarks
PG stability	PG		Pasquill-Gifford stability class
maximum range height	h_range	m	Maximum height up to which backscatter signals are detected
inversion height	h_inv	m	Estimated height of lowest temperature inversion
mixing height	h_mixing	m	Estimated mixed layer depth
surface heat flux	H	$\frac{W}{m^{-2}}$	Estimated kinematic surface heat flux (under convective conditions only)
monin obukhov length	L*	m	Estimated Monin Obukhov Length (under convective conditions only)
friction velocity	u*	$\frac{m}{s}$	Estimated Friction Velocity (under convective conditions only)

4.5.3 Quality Control Classes

All data values that do not pass the quality control checks are automatically devalidated, i.e. the output files (Main Data and Exported Main Data) contain error values (for example 99.999). The QC class output variable indicates which particular tests are passed and which are not. Furthermore the data whose signal quality scores significantly exceed the acceptance thresholds are indicated as very high confident.

Quality Control Classes:

QCC	Data	Description
0	Invalid	No data measured or algorithm is unable to determine data
1	Invalid	Low cumulative significance (siC) and low significance density (siD)
2	Invalid	Low significance density (siD)
3	Invalid	Low cumulative significance (siC)
4	Invalid	Consistency check not applicable because of invalid other wind component
5	Invalid	Consistency check failed
6	Invalid	*Reserved for future use*
7	Invalid	*Reserved for future use*
8	Invalid	*Reserved for future use*
9	Invalid	*Reserved for future use*

10	Valid	High confident data All quality control checks passed
11	Valid	Very high confident data All quality control checks passed and any thresholds significantly exceeded

4.5.4 Error Codes

Additional status information is encoded in the output variable 'error code'. It represents a binary combination of the following possible error codes. Simultaneously occuring error codes sum up.

Bit	Code	Meaning
0	1	*Reserved for future use*
1	2	*Reserved for future use*
2	4	*Reserved for future use*
3	8	*Reserved for future use*
4	16	*Reserved for future use*
5	32	*Reserved for future use*
6	64	*Reserved for future use*
7	128	*Reserved for future use*
8	256	Ground clutter contamination of horizontal wind detected and removed
9	512	*Reserved for future use*
10	1024	*Reserved for future use*
11	2048	*Reserved for future use*
12	4096	*Reserved for future use*
13	8192	*Reserved for future use*
14	16384	*Reserved for future use*
15	32768	*Reserved for future use*

4.5.5 Main Data – File Format

The Main Data files are stored in an ASCII format, called FORMAT-1. This section describes the file format in general and gives an example of a typical output file of APRun.

If you intend to manually or automatically extract data from Main Data files, please strongly consider using the Userdefined Output features instead, which are described in a later section.

Main Data files are stored on a daily basis, i.e. all data that is included in one data file belongs to the same day of measurement. At midnight a new file is created for the next day.

The basic structure of a FORMAT-1 file is:

```
FILE HEADER

TIME STAMP 1
NON-PROFILE DATA 1
PROFILE DATA 1

TIME STAMP 2
NON-PROFILE DATA 2
PROFILE DATA 2

TIME STAMP 3
NON-PROFILE DATA 3
PROFILE DATA 2

...
```

Notes:

- Any lines starting with the character '#' are comments and are to be ignored.
- The NON-PROFILE DATA blocks are missing if there aren't any Non-Profile output variables are included.

*The **FILE HEADER** has the following syntax:*

```
FORMAT-1
[YYYY-MM-DD, day] [HH:MM:SS, start time] [file count (per day)]
[type of instrument]
[number of comment lines] [number of variables] [number of height levels]

[comment of the specified number of lines]
Main Data
[variable label] # [symbol] # [unit] # [type] # [error mask] # [gap value]
[variable label] # [symbol] # [unit] # [type] # [error mask] # [gap value]
[...]
[error label] # [error bit labels] # # E # [error default mask] #
```

*The **TIME STAMP** is set as follows:*

```
[YYYY-MM-DD, day] [HH:MM:SS, end time of interval] [HH:MM:SS, interval duration]
```

*Each **NON-PROFILE DATA** entry has the following syntax:*

```
 [variable 1] [variable 2] [variable 3] [...]
```

*Each **PROFILE DATA** entry has the following syntax:*

```
 [height level 1] [variable 1] [variable 2] [variable 3] [...]
[height level 2] [variable 1] [variable 2] [variable 3] [...]
[height level 3] [variable 1] [variable 2] [variable 3] [...]
[...]
```

Example of a typical FORMAT-1 file:

```
FORMAT-1
2002-08-24 10:10:00 0
SFAS
3 9 58

#
# file information
#
device S/N   :
station code :
software     : APRun
#
# file type
#
Main Data
#
# variable definitions
#
height # z # m # Z1 # 0 #
wind speed # speed # m/s # G1 # 0(EWWIIIIIWWIIIIII) # 99.99
wind direction # dir # deg # R1 # 0(EWWIIIIIWWIIIIII) # 999.9
wind U (east) # U # m/s # X1 # 0(EWWIIIIIWWIIIIII) # 99.99
wind V (north) # V # m/s # Y1 # 0(EWWIIIIIWWIIIIII) # 99.99
wind W (vertical) # W # m/s # S # 0(WEWIIIIIWWIIIIII) # 99.99
sigma W # sigW # m/s # S # 0 # 99.99
backscatter # bck #  # S # 0 # 9.99E+37
temperature # T # deg C # S # 0(WWEIIIIIWWIIIIII) # 99.99
error code #  Quality_Wind Quality_W Quality_T - - - - - Ground_Clutter - - - - - - - #  # E #  WWWIIIIIWWIIIIII
#
# beginning of data block
#

2002-08-24 10:10:00 00:10:00
```

#	z	speed	dir	U	V	W	sigW	bck	T	error	
	15	1.40	240.0	1.21	0.70	0.07	0.03	9.99E+37		99.99	0
	20	99.99	999.9	0.96	99.99	0.06	0.04	9.99E+37		99.99	257
	25	1.92	196.0	0.54	1.84	0.13	0.12	9.99E+37		99.99	256
	30	2.89	192.0	0.58	2.83	0.19	0.13	5.14E+04		99.99	256
	35	2.91	197.0	0.86	2.78	0.33	0.11	2.63E+04		99.99	256
	40	3.03	200.0	1.03	2.85	0.29	0.10	3.03E+04		99.99	256
	45	2.91	198.0	0.89	2.78	0.14	0.14	2.47E+04		99.99	0
	50	3.35	195.0	0.88	3.24	-0.03	0.12	1.65E+04		99.99	0
	55	3.46	198.0	1.06	3.30	-0.04	0.11	1.29E+04		99.99	0
	60	3.54	199.0	1.14	3.35	-0.02	0.04	1.08E+04		99.99	0
	65	3.49	198.0	1.11	3.31	0.03	0.06	8.67E+03		99.99	0
	70	3.59	197.0	1.05	3.44	-0.04	0.07	7.26E+03		99.99	0
	75	3.67	198.0	1.15	3.49	-0.03	0.09	5.38E+03		99.99	0
	80	3.86	201.0	1.40	3.59	-0.07	0.07	4.93E+03		99.99	0
	85	4.05	205.0	1.68	3.68	-0.06	0.11	4.02E+03		99.99	256
	90	4.09	205.0	1.74	3.70	-0.06	0.11	3.79E+03		99.99	256
	95	4.19	206.0	1.81	3.78	-0.03	0.09	3.49E+03		99.99	256
	100	4.31	204.0	1.76	3.93	-0.01	0.06	3.01E+03		99.99	256

4.6 Data Export

In many situations you may want to import the data that APRun provides into other software applications for postprocessing and visualization.

In some setups the data shall be fed automatically and in realtime into another program just during the measurement. Typical examples are automated air quality modeling and automatic wind shear detection in airport applications.

Please note, that you may also create export data files just as if you were in a normal measurement when you perform a Raw Data reprocess.

4.6.1 Export plot data into text files or Excel

Any kind of data that is displayed in any of the plots from the View menu can be very easily extracted. Just right-click onto the respective plot image whose data you would like to obtain and choose Export Plot Data from the menu that pops up. The window that is displayed permits you to directly read the data into Excel or create a text file in a customizable format. This is particularly useful for extracting data from statistics plots like for example the wind rose data.

4.6.2 Automatic Data Export into text files

In order to automatically export results during the measurement into text files of a customized format, you may add Userdefined Output entries to the Output settings window from the menu Other Settings. You may specify the storage folder, the file format, the kind of results and their physical units.

4.6.3 Automatic Data Export over a network connection

Instead of writing the results into text files, you may alternatively send them via a network connection to another application that is listening for incoming data as a TCP server. This is particularly useful for online data processing, since there is no time-lag and it avoids also problems that might arise when two applications try to access the same data file simultaneously.

4.7 Data Reprocess

Reprocessing means re-calculating all Main Data results, such as wind speed, temperature, backscatter from previously recorded Raw Data files. In many situations it might be desired to perform a raw data reprocess – below are some examples:

- It is possible to apply different processing settings to the same data and then compare the results. For example one can use different output intervals and check their influence on data quality and availability.
- In some cases, one can improve the data quality of previously measured data by reprocessing them using an updated version of APRun.

4.7.1 Reprocess – Changeable Settings

All settings that can be changed for a Raw Data reprocess are indicated in the menu by the suffix (P). This includes:

Primary Settings:
- Advanced: Composit Construction (P)
- Advanced: Periods and Heights (P)

Other Settings:
- Hardware, Site and Environment (P)
- Statistics (P)
- Data Output (P)
- Units (P)
- Advanced: Processing (P)
- Advanced: Atmospheric Modeling (P)
- Advanced: CT^2 Calibration (P)

A change in any of the other settings has no effect on the reprocessed results – in particular the Emission/Reception Settings cannot be modified for a reprocess.

4.7.2 Reprocess – Settings Constraints

The following constraints should be respected when modifying settings for a reprocess:

Output Interval:
- You are free to increase the output interval to any interval larger than the originally used value.
- When decreasing the output interval it should not be set below the time the Sodar needed to complete at least one Cycle.
- To check the Cycle time for your data, enter the dialog for Periods and Heights from the menu Primary Settings, select an output interval of one cycle, reprocess some data and check the time spacing between subsequent results.

Measurement Height:
- It is not possible to reprocess data using a mesurement height that is higher than the originally set value.

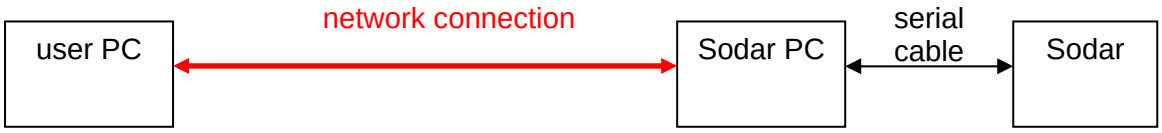
Hardware, Site and Environment Settings:
- During reprocess the currently set Hardware, Site and Environment parameters are used not only for labeling but also data calibration. You should make sure, that the

current parameters are valid for the original site and measurement period that corresponds to the raw data that is reprocessed.

- If the current settings do not match the Hardware, Site and Environment, that have been in use during the original measurement, a warning is displayed in the log message frame. In any case the new settings are used.

4.8 Remote Access

The remote access features of APRun are convenient if the Sodar is situated far from the user. The recommended setup differs with the type of network connection that is available between the user and the Sodar site.



The following table gives a brief overview:

Available Network Connection		Recommended Setup Options
LAN, cable or wireless		A1, B1, C1/C2, D1, [E1]
permanent internet connection, static IP		A2, A3, B1/B2, C1/C2, D1/D2
permanent internet connection, dynamic IP		A2, A3, A7, B1/B2, C1/C2, D1/D2
telephone line		A6, B1/B2, C1/C2, D1/D2
mobile radio: GPRS, UMTS or 3G	public IP, permanent connection	A2, A3, B2, C2, D2
	public IP, non-permanent conn.	A4, A7, B2, C2, D2, E2
	private IP, non-permanent conn.	A5, B2, C2, D2, E2
mobile radio: GSM		A6, B2, C2, D2, E2

- The used abbreviations are explained in the subsequent sections.
- Xn/Xm indicates that either option Xn or option Xm or both options together are suitable for the associated connection type.
- [Xn] indicates an option that is suitable for the associated connection type - however not required for many applications.

4.8.1 Connectivity (A)

The connectivity options encompass the most important variants to establish a basic TCP/IP network connection between the user PC and the Sodar PC.
All connections involve the Window Remote Access Service (RAS). Please refer to your Windows documentation for basic setup instructions and a more detailed description of the underlying concepts.

A1: LAN-Connection
A standard RAS-connection for a Local Area Network is utilized.
APRun Events are not required for this connection type.

A2: Permanent Internet Connection
A permanent internet connection either means
- a connection that is initiated and hold by an external internet gateway or
- a RAS-connection that is automatically dialed and hold by the Sodar PC.

In the second case you may find it convenient to use APRun Events in order to keep the internet connection alive automatically:

Example event configuration:

APRun Event	APRun Action

initialization of APRun	open RAS connection
RAS connection lost	open RAS connection

A3: Secure Incoming VPN Connections

A typical RAS setup for secure incoming Virtual Private Network (VPN) connections would require that the Sodar PC is configured

- to permit incoming VPN connections from authorized users only and
- to block any other incoming connection requests, i.e. by having all other TCP ports blocked by a firewall.

APRun Events are not required for this connection type.

A4: Non-Permanent Internet Connection On Request

If you wish that the Sodar PC initiates a non-permanent internet connection 'on request,' you may use APRun Events as in the following case:

APRun waits for some event, such as an incoming telephone call on a modem that is monitored or an incoming SMS with a predefined text.
Then APRun initiates a RAS connection, i.e. dials a preconfigured internet connection.
Now you may connect to the internet on your part and access the web interface of the Sodar PC.
The internet connection of the Sodar PC remains intact until you choose to close the RAS connection by triggering a second preconfigured event.

This option requires

- that the Sodar PC is associated with a public IP address after connecting to the internet and
- that the Sodar PC is configured to accept incoming connections.

Example event configuration:

APRun Event	**APRun Action**
incoming SMS with text 'connect'	open RAS connection (dial-up internet)
incoming SMS with text 'disconnect'	close RAS connection (dial-up internet)

A5: Non-Permanent Internet + VPN Connection On Request

Similar to the previous case you may also configure APRun to initiate a connection 'on request' in the following way:

First you should connect the user PC to the internet and make sure that it is configured to accept incoming Virtual Private Network (VPN) connections. If the user PC is not associated with a static IP address, it is necessary to register a static host name by utilizing a dynamic DNS service, consider for example the service of www.dyndns.org.

After successfully connecting your PC to the internet, you may trigger an event to let APRun know that it shall initiate the connection now. This event can be a telephone call or a SMS with a predefined text.

APRun will dial an internet connection first and then initiate a secure connection to the user PC that is now acting as a VPN server.

You will now be permitted to access the Sodar web interface or any other service through this secure VPN tunnel.

The internet connection of the Sodar PC remains intact until you choose to close the VPN connection from the user PC.

As opposed to the previous option **A4** this type of connection requires
- that the user PC is associated with a public IP address after connecting to the internet and
- that the user PC is configured to accept incoming VPN connections.

Example event configuration:

APRun Event	APRun Action
incoming SMS with text 'connect'	open RAS connection (dial-up internet)
incoming SMS with text 'connect'	open RAS connection (VPN)
incoming SMS with text 'disconnect'	close RAS connection (VPN)
incoming SMS with text 'disconnect'	close RAS connection (dial-up internet)
RAS connection lost (VPN)	close RAS connection (dial-up internet)

A6: Dial-In Connection

In order to use dial-in connections the Windows RAS must be set up to accept incoming dial-In connections.
You needn't configure any APRun Events for this connection type.

Please note that a modem that is used for incoming dial-in connections cannot be utilized by APRun at the same time.

A7: Dynamic DNS Service

If the Sodar PC is not associated with a static IP address, i.e. an IP address that can be accessed from the web (public), but changes from dial-in to dial-in (dynamic), it is necessary to register a static host name by utilizing a dynamic DNS service, consider for example the service of www.dyndns.org.

4.8.2 Controlling the PC (B)

You may find it convenient to remotely manage the whole Sodar PC environment, not only the Sodar operation software.

B1: Remote Desktop Software
There are several different commercial and non-commercial tools that provide basic remote desktop functionality:

- Windows Remote Desktop
- TightVNC (available for dowload at www.tightvnc.com)
- GoToMyPc
- PC Anywhere
- etc.

B2: SSH Server/Telnet Server
The following programs provide a command shell to remotely manage a PC. Command shell access is particularly suitable for connections with a low data transfer speed:

- Windows Telnet Server (part of Windows)
- OpenSSH for Windows (integrated into the Cygwin environment – www.cygwin.com).

4.8.3 Managing the Sodar (C)

You may choose from the following options to manage your Sodar measurements remotely:

C1: Remote Desktop Software
You may access the graphical user interface of APRun just as if you would sit in front of the Sodar PC by utilizing the above mentioned remote desktop software.

C2: APRun Web Interface
The built-in web server of APRun provides full control over the measurement and all kinds of settings. This is particularly suitable for network connections with low data transfer speeds.

4.8.4 File Access (D)

You may access your data files remotely in the following ways:

D1: Windows Filesharing
Use Windows built-in filesharing functionality to share local harddisks or folders on the Sodar PC.

D2: FTP Server
An FTP server is particularly suitable for low data transfer speeds.
Various commercial and non-commercial programs are available from the internet.

4.8.5 System Monitoring (E)

The following options permit to remotely monitor the system status and to receive notification in the case that a problem occurs with the Sodar system.

E1: Automatic SNMP Monitoring

To integrate APRun into an existing network that is monitored via SNMP requests you may utilize the SNMP interface of APRun.
See the respective section in the 'APRun Reference' part of this document for more details.

E2: Status Messages Via SMS

You may configure APRun to automatically send an SMS message if APRun detects a serious problem with the Sodar system.
You may also choose to let APRun send an SMS message with a daily status report.

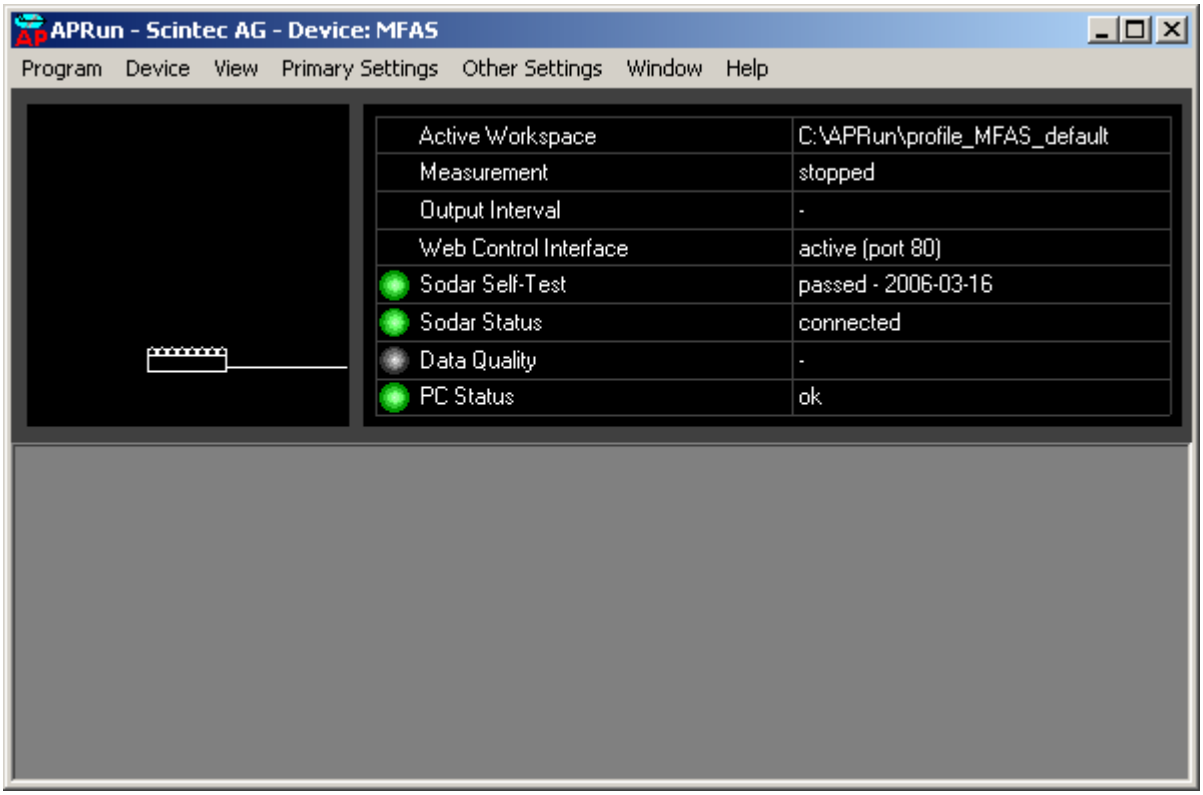
Example event configuration:

APRun Event	APRun Action
system status indicates an error	send an SMS with the text 'HELP: $SYSTEM_STATUS'
timer (1 00:00:00)	send an SMS with the text 'REPORT: $SYSTEM_STATUS'

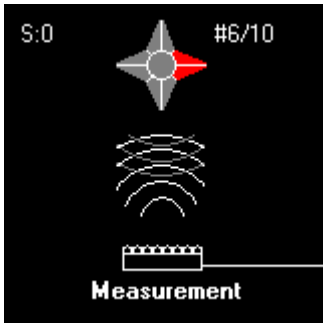
5 APRun Reference

The chapter APRun Reference contains a detailed description of the APRun graphical user interface. The following sections are - where possible - arranged with respect to the menu structure.

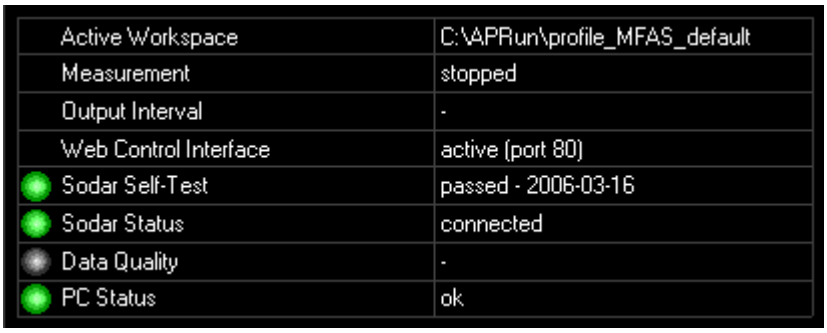
5.1 APRun Window



The APRun application window is composed of several status frames:

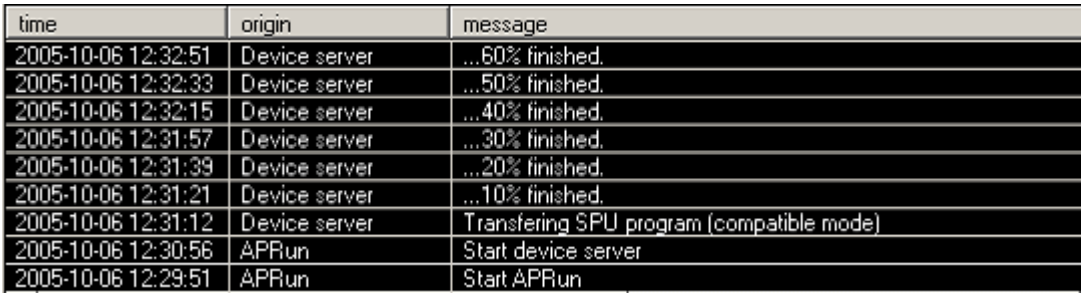
Measurement Status	
	The Measurement Status visualizes the progress of a running measurement, i.e.: upper left corner: current *Subcycle* index (here: 0) center: current *Direction* (here: east) upper right corner: number of *Emission-Reception Sequences* (here: 6 of 10) bottom: current action (here: 'Measurement')

System Status



Active Workspace	The currently loaded Workspace.
Measurement	Indicates if the measurement ist running or stopped.
Output Interval	Indicates the time that has passed so far for the current Output Interval. If the progress bar reaches the right border the current output interval will finish and new main data results will be available.
Web Control Interface	The IP address and TCP port of the web interface.
Sodar Self-Test	The result of the most recent self-test.
Sodar Status	The connection state of the Device Server and the Sodar (see System Information for details).
Data Quality	The Data Quality field is based on the latest 6 hours of data. The abbreviations possess the following meanings: W: measurement height - wind T: measurement height - temperature GC: number of height levels that are seriously disturbed by ground clutter (0 – best, 5 or more – unsuitable site)
PC Status	An Overview of the PC Status (see System Information for details).

System Log

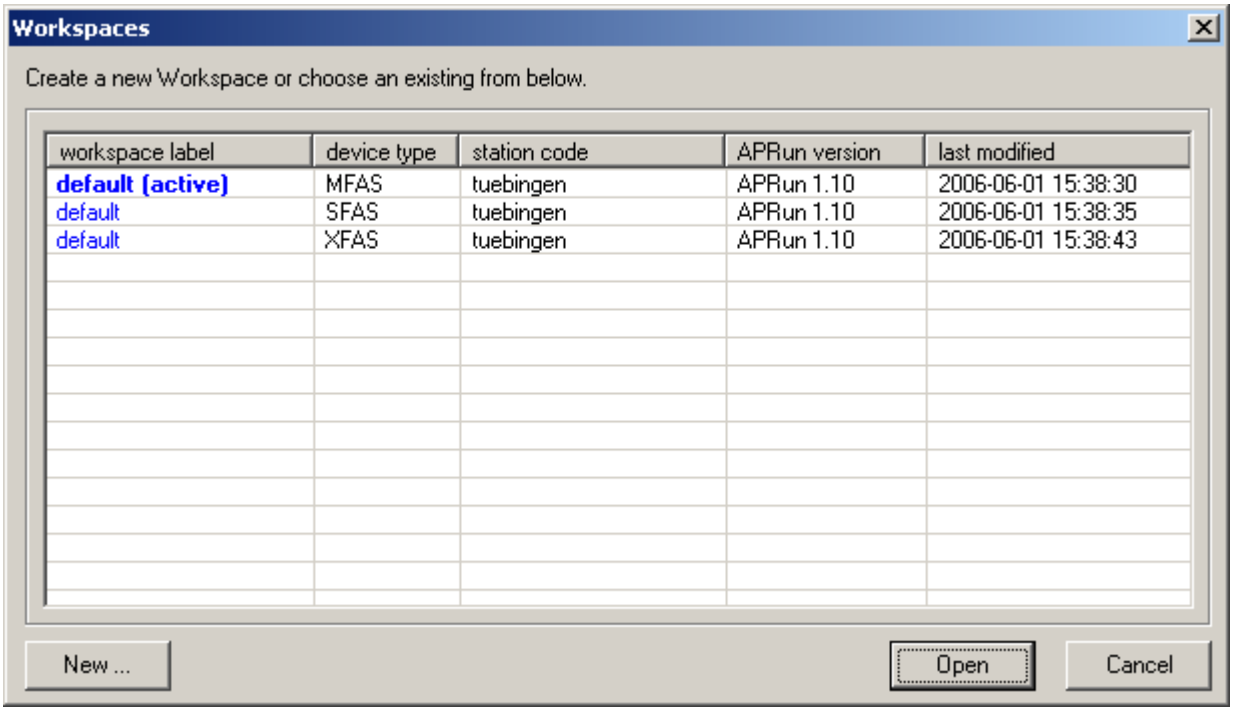


Status and error messages are added to the top of the System Log.

5.2 Menu Program

5.2.1 Workspaces

Open an existing Workspace or create a new one.



All existing Workspaces are listed. The currently active Workspace is indicated by the label (active). Workspaces that currently cannot be opened because they are in use by other instances of APRun are indicated by the label (locked).

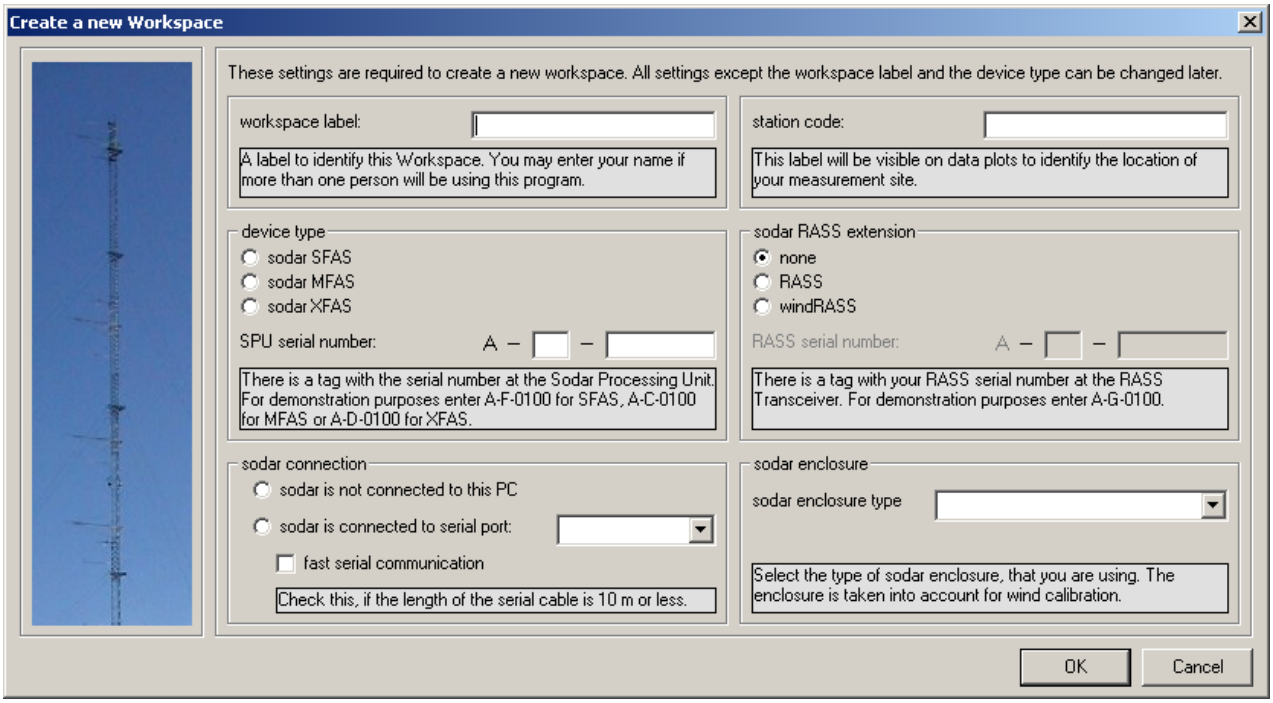
To open an existing Workspace select an entry from the list and click the Open button.

To create a new Workspace click the New... button (see next section for details).

The currently active Workspace will be closed and all modified settings will be saved.

5.2.2 Create a new Workspace

This dialog will be presented if you press the New... button in the Workspaces window. When you start APRun this dialog will popup automatically in the case that no valid Workspace is found.



All settings are required.

workspace label	a label to identify this Workspace
station code	a label to identify this Measurement Site
device type	SFAS, MFAS, XFAS
device serial number	Enter the unique serial number of your sodar system. *For device compatibility it is important to enter the correct serial number!* In the case you find different serial numbers on your Processing Unit and antenna, enter the serial number of your Processing Unit.
sodar RASS extension	Select, if your sodar is equipped with a RASS or windRASS extension.
RASS serial number	Enter the unique serial number of your RASS components. *For device compatibility it is important to enter the correct serial number!*
sodar connection	Select the connection settings if this PC is connected to the Sodar. If this PC shall be used for data reprocessing only, you may select Sodar is not connected to this PC.
sodar enclosure type	Select the type of sodar enclosure that is installed. This setting is used for beam diffraction corrections. An incorrect setting may reduce the precision of wind speed measurements.

5.2.3 Load Settings File

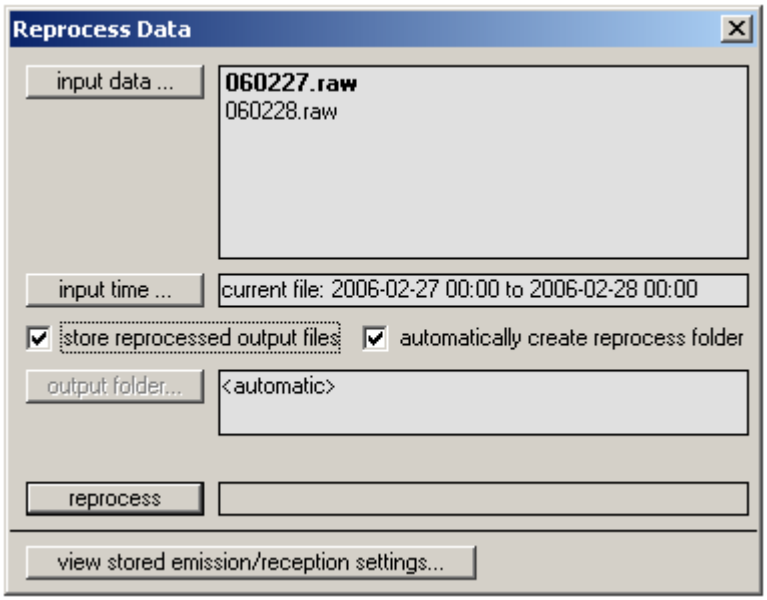
Issue this command to load a settings file into the current Workspace. You may select from the different categories of settings that are included in the file which settings shall be loaded into APRun.

5.2.4 Save Settings File

This command permits to store the current configuration in a settings file. You may choose the settings categories that shall be included in the file.

5.2.5 Reprocess Data

This command shows the Reprocess Data dialog.



Click the input data button to select the raw data files that you wish to reprocess.

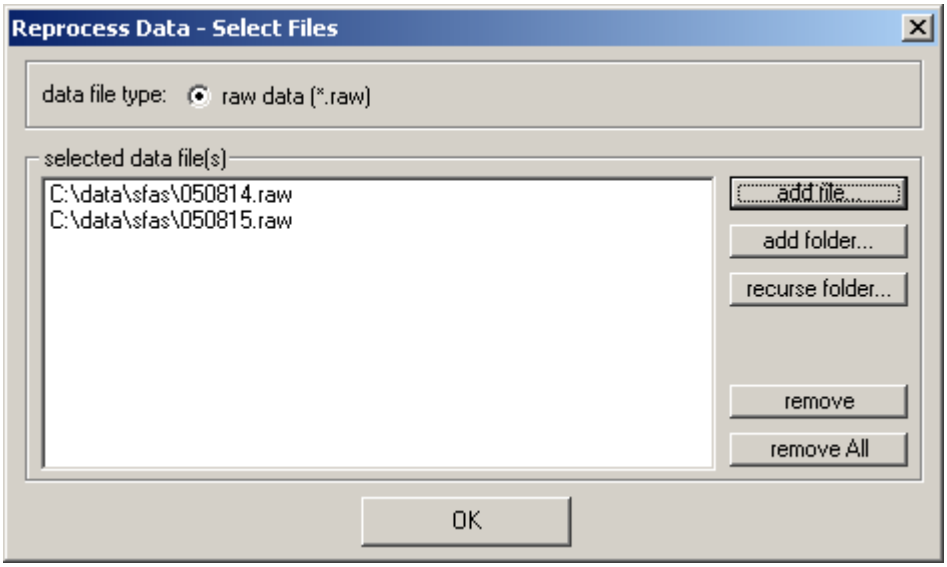
If you want to restrict the reprocessed time range to a certain period, open the time range selection window by pressing the input time button.

If you want to reprocess the selected data files without storing the new results to your harddisk you may uncheck the store reprocessed output files checkbox.

If automatically create reprocess folder is checked, APRun will create a new folder `C:\APRun\workspace_mfas_xyz\data\reprocess_YYMMDD_HHNNSS`, where the resulting main data files will be stored. Otherwise, you may manually choose an output folder by clicking output folder.

The actual reprocess is started by clicking the reprocess button. Depending on the number of raw data files, the current settings and the PC speed, this may take up to several hours to complete. The progress for the currently loaded file is indicated by the progress bar next to the reprocess button.
The reprocess can be stopped at any time by pressing the stop reprocess button.

5.2.5.1 Reprocess Data – Select Files

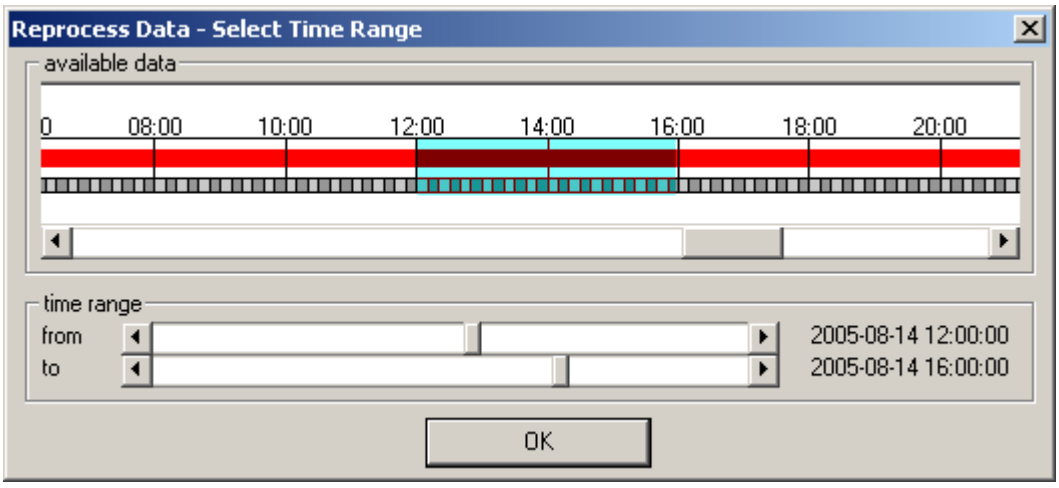


You may add single files or the content of whole folders using the buttons add file... or add folder.... The button recurse folders... will include all files from the selected folder and all its subfolders (and their subfolders recursively).

You may alternatively drag raw data files from a Windows Explorer window and drop them into the selected data file(s) list.

Press OK to finish data selection.

5.2.5.2 Reprocess Data – Select Time Range



To modify the time range that shall be reprocessed please adjust the scroll bars labeled from and to.
You may alternatively choose a time range by clicking on the image and moving over the desired time range while keeping the left mouse button pressed.

The current selection is always highlighted in light blue. Red bars indicate the presence of data sets within the currently loaded raw data file.

Please note that – in the case you have selected more than one raw data file at a time - this time range selection only applies to the first of the selected raw data files, all other raw data files will be reprocessed completely.

5.2.6 Exit

Issue this command to leave APRun. The current settings will be stored automatically.

5.3 Menu Device

5.3.1 Start Device Server

Issue this command in order to start the Device Server.

Immediately after started, the Device Server will try to connect to the Sodar and report its connection state next to the status indicator labeled Sodar Status.
On successful connection, Sodar Status will turn green, telling you that the SPU is now connected and ready for operation.

If the Sodar connection cannot be established, you should check the following
- the Sodar power supply and its connection to the antenna
- the connection between SPU and PC
- the connection settings of APRun such as the serial port and the connection speed, which are located in the Site/Hardware Settings dialog of the menu Other Settings.

The Device Server must be in operation and the Sodar must be successfully connected before you may start a measurement or perform a self-test.

Note, that the Device Server will occupy the serial port that is configured for the Sodar connection in Site/Hardware Settings – even if the Sodar is not connected. Any other application, trying to access this serial port at the same time, will fail.

5.3.2 Stop Device Server

Issue this command in order to stop the Device Server.

5.3.3 Start Measurement

Issue this command to start a new measurement or resume a previous measurement.

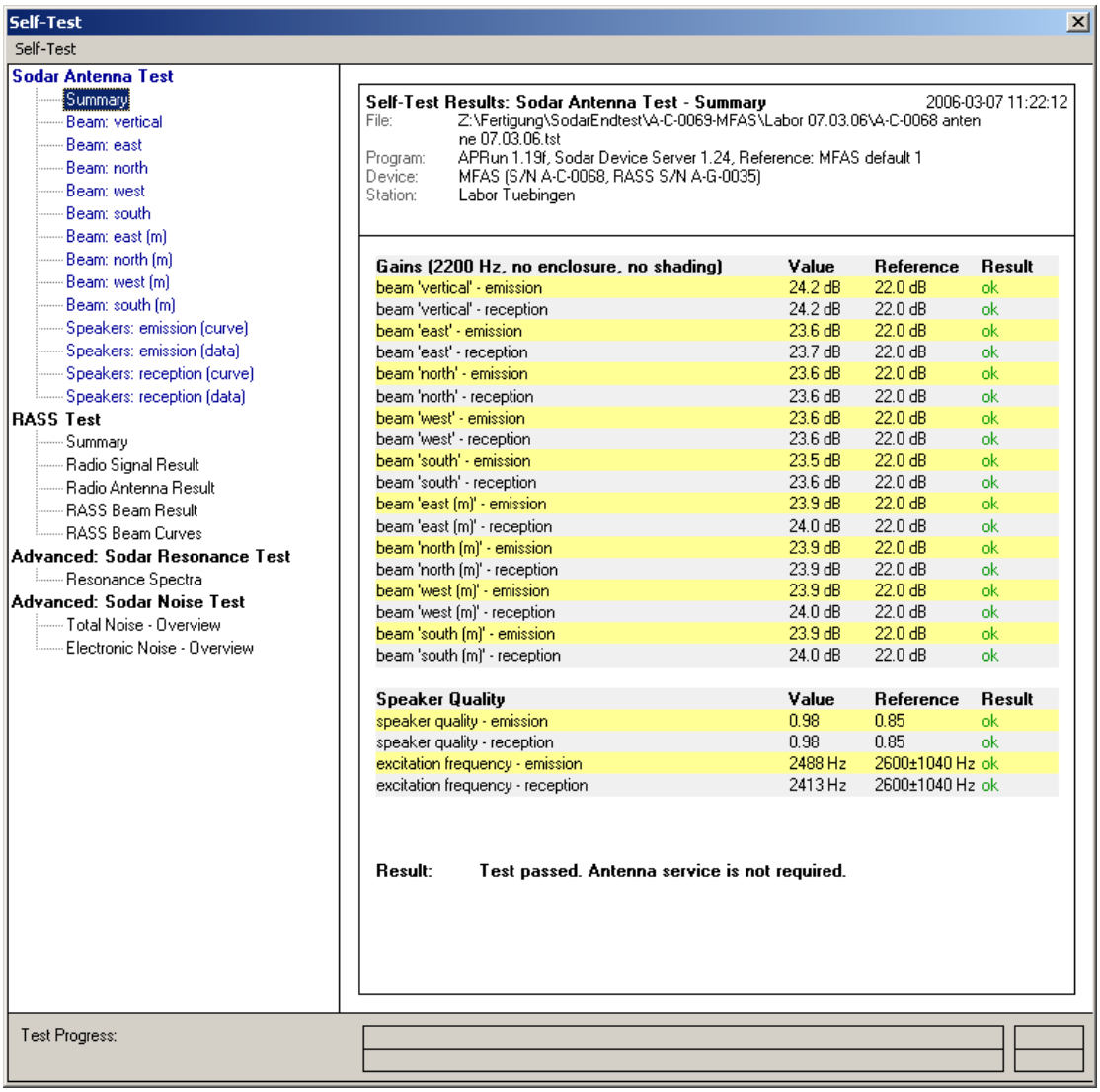
5.3.4 Stop Measurement

Issue Stop Measurement to stop a currently running measurement.

5.3.5 Self-Test

Issue this command to open the self-test window.

5.3.5.3 Self-Test – General



To perform all available self-tests in sequence, choose Start – All Tests from the menu Self-Test. To start a single self-test select one of the available tests from the list (either Sodar Antenna Test, Sodar RASS Test, Advanced: Sodar Resonance Test or Advanced: Sodar Noise Test).

The results will be automatically stored in self-test data files that reside in the data output folder, which is the folder that is also used to store the data files during measurement (typically `C:\APRun\workspace_mfas_xyz\data`).

The filename of the self-test data files is constructed as `YYMMDD_hhnnss.tst`, (YY=year, MM=month, DD=day, hh=hour, nn=minute, ss=second).

In the menu Selftest you have the following options:

Start Test	Start a Self-Test.
Stop Test	Stop the currently running test.
Clear Results	Clear the displayed self-test results.
Load Results	Load a previously stored self-test data file.
Save Results	Save a copy of the current self-test data.
Print Current Page	Print the currently displayed Self-Test page.

Print Current Test	Print all pages of the currently selected Self-Test.
Plot Settings	Displays the Plot Settings Window.
Advanced: Show Details	Shows additional self-test pages with more detailed readings, intended for advanced users and Scintec technical support.
Exit	Leave the Self-Test window.

5.3.5.4 Self-Test – Sodar Antenna Test

The antenna test performs a functionality test for all 64 (SFAS, MFAS) or 52 (XFAS) speakers and related driver electronics of the Sodar antenna. Signal amplitude and phasing are measured for each individual speaker and an average value for the speaker quality (ranging from 0 to 1) is derived.

The beam patterns are numerically calculated for all nine emission beams and the achieved antenna gains are calculated for each beam.

The summary page gives an overview of the antenna test results. The actually measured result values as well as the applicable limits for all included subtests are displayed.
If at least one of the limits is not reached, the result of the antenna test will be 'not passed'. This means that some hardware defect on the antenna is detected that might need to be checked at the next opportunity.

The beam pages visualize the beam pattern for all nine emission beams.
The speakers pages show individual signal curves and individual results for each single speaker. In the case that the self-test is not passed, this information may help Scintec Technical Support to identify the defective parts of the system.

5.3.5.5 Self-Test – RASS Test

The RASS test is a comprehensive functionality test of all RASS and windRASS components. The amount of available test parameters vary with the hardware version of the RASS/windRASS components. If a test is not supported by the current hardware configuration, the result values indicate (not supported). Please note, that the RASS serial number, that is entered in the Hardware Settings is used in order to differentiate between different hardware versions. If an incorrect serial number is entered this may cause erroneous test results.

The Summary page
- provides information about the current hardware configuration,
- shows supply voltage readings,
- summarizes the results of the additional RASS tests.

The Radio Signal Test includes:
- readings of the monitor output of the RF power amplifier, that is part of the RASS Transceiver,
- the background signal levels of the received RF signal,
- readings of an RF crosstalk indicator, that indicate the strength of the directly transmitted radio signals from transmission radar antenna to receiption radar antenna.

The Radio Antenna Test checks the operation of all connected radar antennas (transmission and reception) by generating a small RF test signal. For windRASS systems, the correct operation of transmission and reception switches are additionally verified.

During the RASS Beam Test an acoustic signal is transmitted with varying transmission angles. The reflected RF signal intensity is measured and displayed on the RASS Beam Curves page. For windRASS systems additional directivity tests are included, that verify at the same time the basic quality of the acoustic transmission beams, the quality of radar emission and the alignment of the radar antennas with respect to the sodar antenna.

5.3.5.6 Self-Test – Advanced: Sodar Resonance Test

The Resonance Test is designed to help identifying resonant mechanical responses to the emitted pulses. Such resonances often result from the mechanical mounting of the antenna in special environments like on masts, trailers and ships. Resonances of this kind may have a negative impact on the data quality and should be taken into consideration when defining the measurement parameters.

Test results are not evaluated in terms of ‘passed’ or ‘not passed’ and possess only informational character. The data should be interpreted by Scintec Technical Support, only.

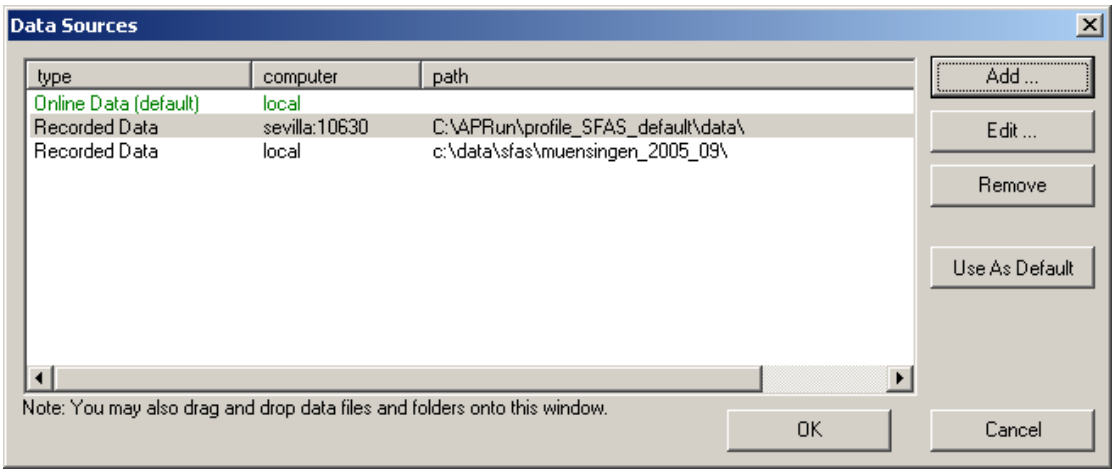
5.3.5.7 Self-Test – Advanced: Sodar Noise Test

This test measures the total noise level (ambient acoustic noise + internal electronically induced noise) and the pure electronically induced noise levels - individually for each row and column of speakers on the antenna for different sets of signal amplification factors.

Test results are not evaluated in terms of ‘passed’ or ‘not passed’ and possess only informational character. The data should be interpreted by Scintec Technical Support, only.

5.4 Menu View

5.4.1 Data Sources



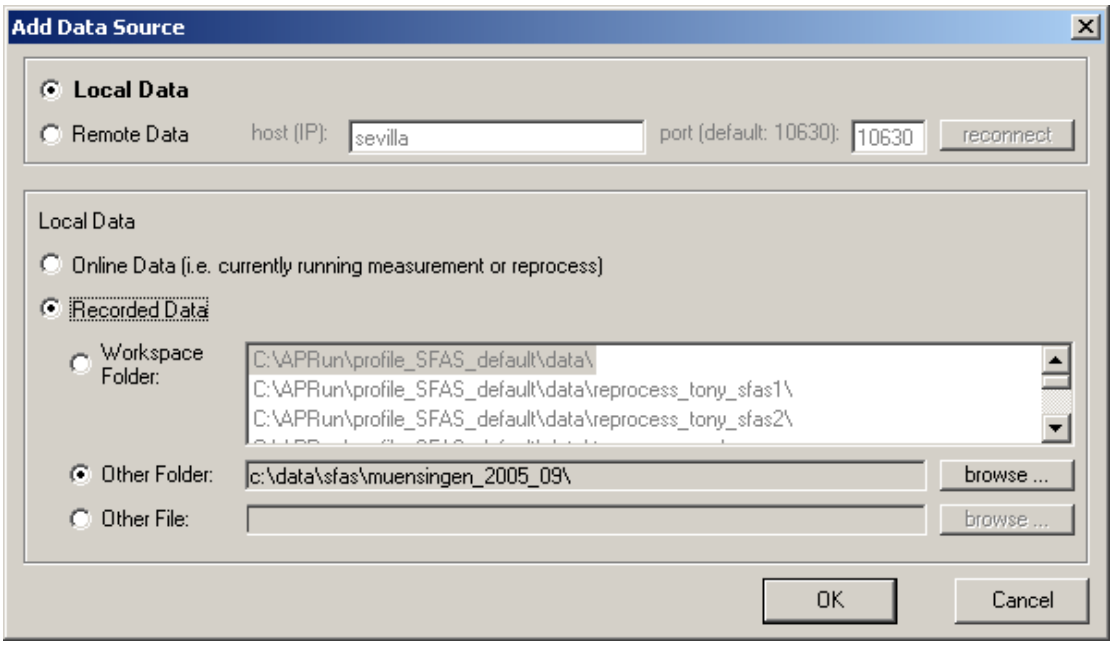
This list contains all currently defined Data Sources for plots. If you reach this window from a plot window, you may change its Data Source by selecting a different entry from the list and clicking OK.

You may add, edit and remove Data Sources with the respective buttons.

The entry that is indicated as (default) is automatically used as initial Data Source when you open new plot windows from the menu.

You may drag individual main data files or folders that contain main data files from a Windows Explorer window and drop them into the white panel (they will be added as new Local Recorded Data Sources).

5.4.2 Add Data Source



Local Data
Local Data refers to Data Sources that you access from your local PC, such as local hard drives, but also for example a shared network folder.

Remote Data
You may choose a Remote Data Source if you want to connect to an instance of APRun that is running on a remote PC. The PC must be connected via network and the Remote Plot Data Interface must be switched on in the APRun Control Settings at the remote PC.

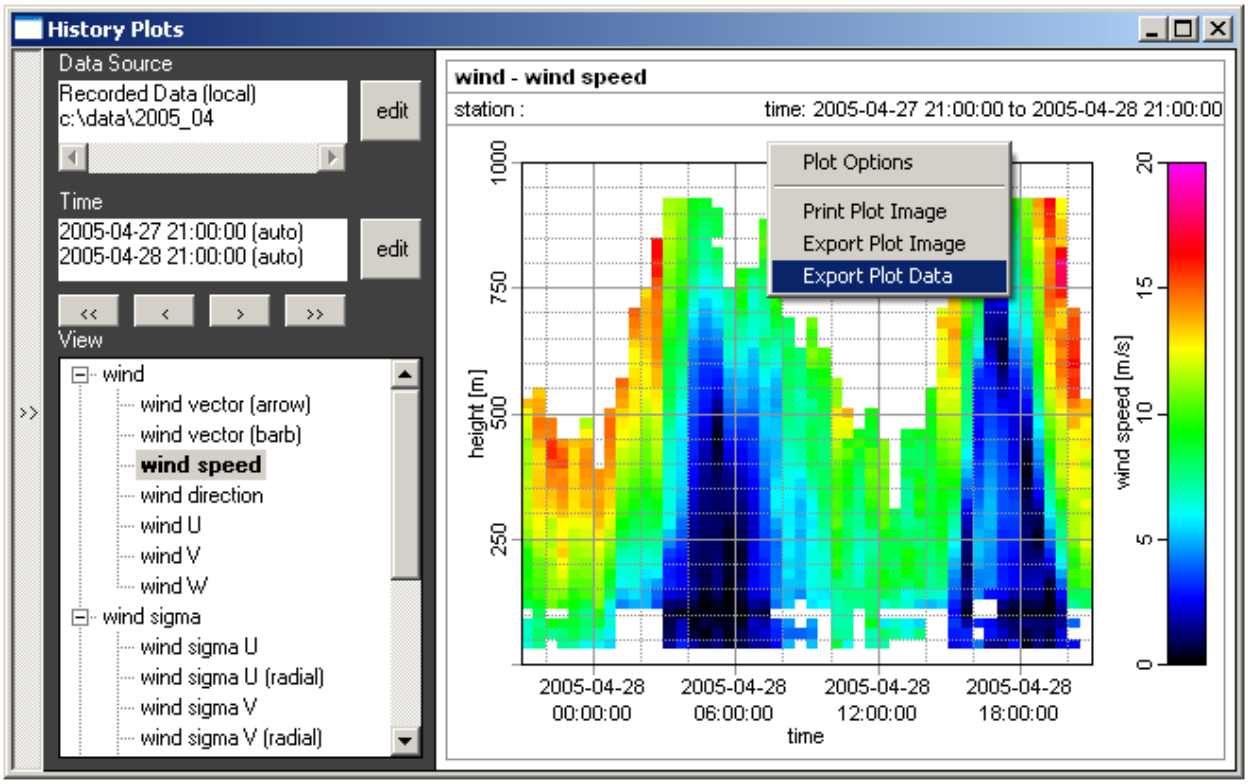
Online Data
Online Data plots present the most recent measurement results that are obtained during a measurement or a data reprocess. Instead of reading the plot data from Main Data files, it is taken directly from the online data history that APRun keeps in memory.

- Some plot types, for example Raw Data plots, are only available as Online Data plots.
- Online Data plots of any output variables are displayed - regardless if included in the Main Data file or not.
- You may access only a limited number of the most recent data sets via the Online Data plots, because the Online Data history is restricted to a limited amount of data.
- If you begin a new measurement or a new reprocess, the Online Data history is resetted and therefore all Online Data plots are cleared.

Recorded Data
Recorded Data plots present data that is read from previously recorded Main Data files. You may choose from all subfolders of your workspace data folder (e.g. `C:\APRun\mfas_workspace_xyz\data`). Each subfolder forms a different data source. Alternatively you may select Other Folder to choose an arbitrary folder as data source. APRun checks periodically for new or modified Main Data files. If you want to display the content of a single Main Data file, you may choose Other File, instead.

- Depending on the output variables that are contained in the respective Main Data files, some plot types are not be available as Recorded Data plot.

5.4.3 Plot Window



Each plot window consists of an info panel for the Data Source, a time panel with arrow buttons (upper left), a plot selection tree (lower left) and a plot area (right).
You may change the data source and time selection by pressing the edit buttons.
The arrow buttons below the time panel provide a convenient way of stepping through successive data sets:

<<	-	step six hours backward
<	-	step one data set backward
>	-	step one data set forward
>>	-	step six hours forward

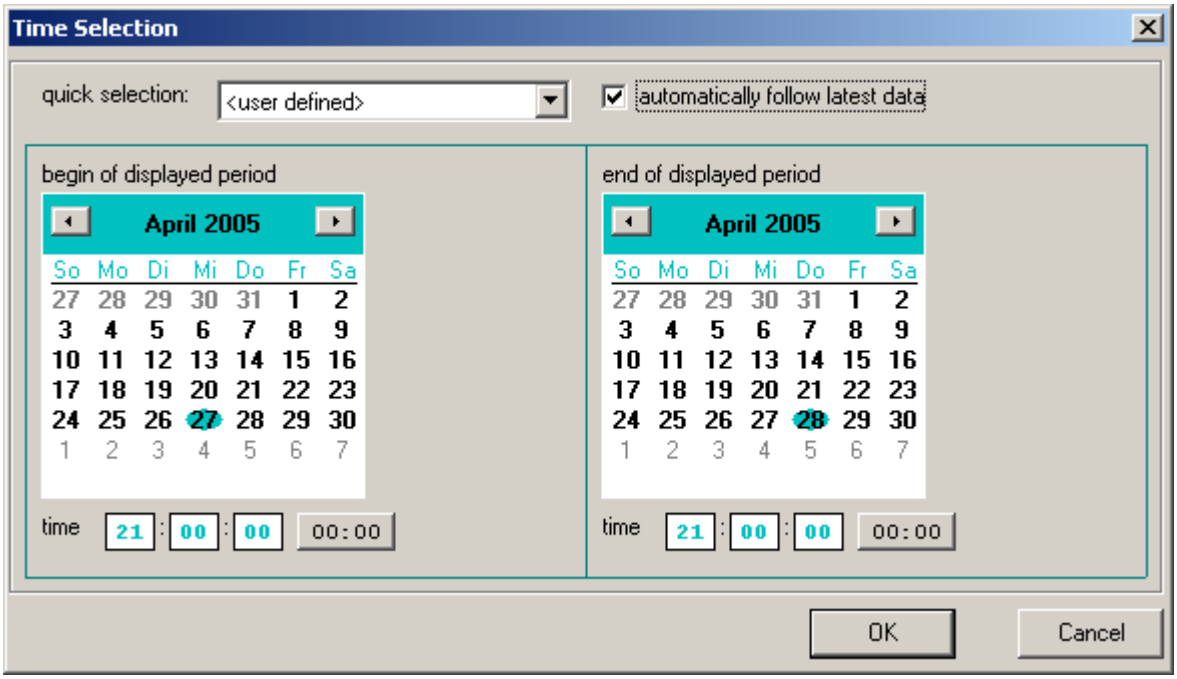
To show or hide the plot info panel and selection tree, click on the left border.

If you right-click onto the plot area a popdown-menu will appear:

Plot Options	-	customize value ranges, colors and plot styles
Print Plot Image	-	print the currently selected plot
Export Plot Image	-	export the currently selected plot into a graphics file (uncompressed Windows Bitmap or compressed JPEG)
Export Plot Data	-	export the underlying plot data

5.4.4 Time Selection

The dialog permits to modify the time selection of a plot window.



You may check automatically follow latest data if you want to automatically proceed the displayed time and refresh the plot as soon as new data gets available.

5.4.5 Data Table

The Data Table provides the most recent main data set in tabular form.

5.4.6 Vertical Profiles

The Vertical Profiles include vertical profiles of the most recent main data results, such as wind speed, wind direction, temperature, etc.

5.4.7 History Plots

The History Plots contain false color plots of wind speed, direction, temperature, etc. reaching from the most recent results back to at most 500 output intervals into the past.

5.4.8 Statistics

The Statistics Plots include graphs for the total data availability, average wind speed, average wind components and wind roses for different height levels.

5.4.9 Advanced: Raw Data Plots

The raw and intermediate data are mainly intended for diagnosis purposes.

5.4.10 Advanced: Raw Data History Plots (Signals)

The raw and intermediate data are mainly intended for diagnosis purposes.

5.4.11 Advanced: Raw Data History Plots (Processing)

The raw and intermediate data are mainly intended for diagnosis purposes.

5.4.12 System Information

This detailed overview of the current system status includes:

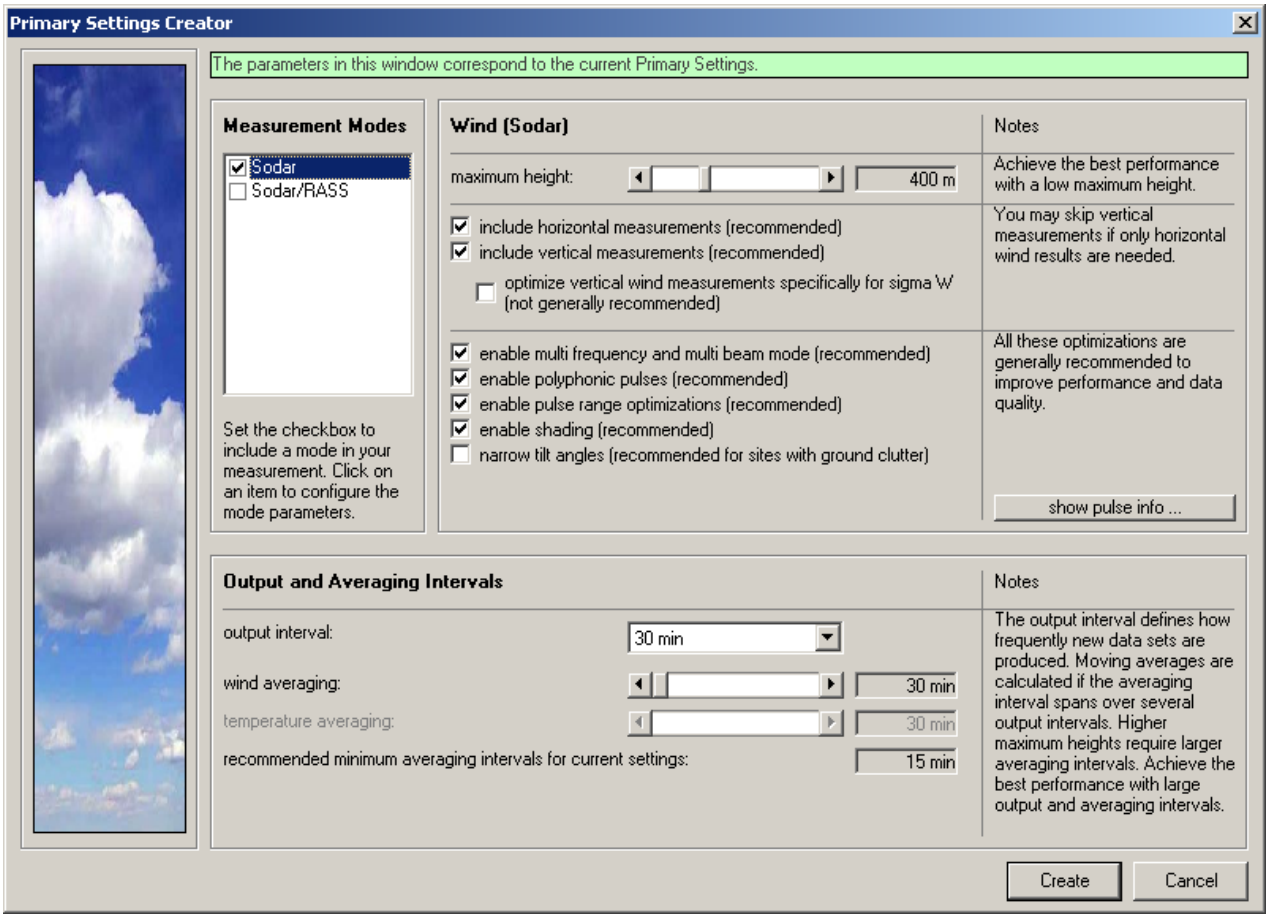
Active Workspace	the currently selected Workspace folder
Measurement	indicates if a measurement is running or not
Output Interval	the amount of time or spectra gathered so far for the current output interval
Web Control Interface	indicates if the Web Control Interface is active and - if yes- shows its local IP address and its TCP port
Sodar Self-Test	test result and date of the most recent Self-Test
Sodar Status	
Device Server	connection state of the Device Server
SPU Connection	connection state of the Sodar Processing Unit
SPU Communication	communication error statistics for the serial connection between Sodar Processing Unit and PC
SPU Internal Temperature	Sodar Processing Unit internal processor temperature
SPU Uptime	The time passed since the Sodar Processing Unit was last initialized. When the SPU is powered up it will be initialized with the first Device Server connection.
Data Quality	
Range	typically achieved wind range and temperature range taking into account the latest 6 hours of measurement
Ground Clutter	indicates all height levels that were seriously affected by ground-clutter during the last 6 hours of measurement (0 gates – best, 5 gates or more – unsuitable site)
PC Status	
Windows Version	windows version
Memory	amount of virtual and physical RAM
Free Harddisk Capacity	the amount of disk space that is left on the harddisk that is currently used for data storage

The gray highlighted entries are also displayed in the System Status frame.

5.5 Menu Primary Settings

5.5.1 Primary Settings Creator

Use this dialog to set all primary measurement parameters in an intuitive way. Experienced users may alternatively configure their measurements using the Advanced Primary Settings dialogs. However we recommend to generally begin with the Primary Settings Creator and then to modify the automatically created settings using the dialogs for advanced users.



Measurement Modes
You may include a measurement mode by checking the respective check box **Sodar:** wind and backscatter measurements **Sodar/RASS:** radio-acoustic temperature measurements (requires RASS extension) **Sodar/windRASS:** radio-acoustic wind and temperature measurements (requires windRASS extension) **Sodar** and **RASS** measurement modes can be combined. The system will then automatically switch between both modes in order to do wind and temperature measurements in short succession. The **windRASS** measurement mode provides both wind and temperature results at the same time. It cannot be combined with other measurement modes. The windRASS has advantages

over the plain Sodar mode and should be preferred, if a windRASS extension is available. ajor advantages are:

- windRASS measurements are insensitive to most site properties, that limit plain Sodar operation, such as environmental acoustic noise and ground clutter distortions.
- The windRASS mode allows for shorter averaging periods.

The RASS and windRASS measurement modes are only available if you enabled the respective RASS or windRASS extensions when the Workspace was created. You may change this belatedly in the Hardware Settings.

Wind (Sodar) - Maximum Height
Choose the maximum measurement height that is required for your application. It is important to keep the maximum measurement height as low as possible. This way the amount of measurement time that will be used for each height level (i.e. the pulse repetition frequency) will be maximized and thus the data quality and availability increased.

Wind (Sodar) – Option Name	**Check Option for Applications**	**Uncheck Option for Applications**
Include Horizontal Measurements	- General wind applications - All other applications	- Only Vertical wind speed - Only Backscatter - Only CT^2
Include Vertical Measurements	- General wind applications - Turbulence applications - All other applications	- Only Horizontal wind speed
Optimize Vertical Wind Measurements Specifically for Sigma W (See Remark 1)	- Applications that focus on wind standard deviations and wind turbulence	- General wind applications - All other applications
Enable Multi Frequency And Multi Beam Mode	- General wind applications - All other applications	- Only Backscatter - Only CT^2
Enable Polyphonic Pulses (See Remark 2)	- General wind applications - All other applications	- Only Backscatter - Only CT^2
Enable Pulse Range Optimizations (See Remark 3)	- General wind applications - All other applications	- Only Backscatter - Only CT^2
Enable Shading (See Remark 4)	- General wind applications - All other applications	- Only suitable for very good Sodar sites, i.e. very flat terrain and no surrounding obstacles
Narrow Tilt Angles (See Remark 5)	- Recommended for difficult sites with strong ground clutter exposure. - No output of SigmaU, SigmaV, SigmaTheta in this mode	- General wind applications - All other applications

Remarks:

(1) If this option is checked the raw spectra of vertical wind measurements will be individually stored and processed. This will increase the precision of standard deviation sigma W, but also requires longer averaging periods and significantly increases the size of raw data files.

(2) If checked, the first pulses within a sodar pulse sequence will be emitted serially to provide a good height coverage and the later pulses will be emitted polyphonically, i.e. several frequencies at a time like in a chord. This typically improves performance and data quality over the entire height range.

(3) If checked, the Sodar will use incrementally increase the pulse lengths (and thus use larger height resolution steps) for upper height levels. In the upper height range the availability and data quality will be increased while the best height resolution will be maintained in the lower height range.
(4) If checked, sidelobes that may cause ground clutter, will be surpressed by utilizing the antennas integrated sidelobe tapering.
(5) If checked, the tilted beams will be emitted at smaller tilt angles. This reduces side emissions and makes the measurement less sensitive to ground clutter errors at difficult Sodar sites, such as in the vicinity of buildings, masts or forests. However, narrow tilt angles may result in a stronger variability of horizontal wind speed measurements. Standard deviation of horizontal wind components SigmaU, SigmaV will not be calculated if the measurement runs in this mode.

Wind (Sodar) – More Info - Resulting Effective Height Resolution

This table possesses informational character only and cannot be modified directly.

Although the wind results are always provided in the best possible height resolution (SFAS 5m, MFAS 10m, XFAS 20m) the effective height resolution is often larger depending on the pulse lengths that are in use. This table provides an overview of the effective height resolution for the current settings.

An example:

The MFAS always provides results in 10m steps.
Let's assume the following height resolution table:

height	*resolution*
30 m – 50 m	10 m
60 m – 100 m	30 m
110 m – 150 m	50 m

This would imply the following nominal output heights and resolutions:

nominal output height	*height resolution*	*data represents an average of*
30 m	10 m	25 m to 35 m
40 m	10 m	35 m to 45 m
50 m	10 m	45 m to 55 m
60 m	30 m	45 m to 75 m
70 m	30 m	55 m to 85 m
80 m	30 m	65 m to 95 m
90 m	30 m	75 m to 105 m
100 m	30 m	85 m to 115 m
110 m	50 m	85 m to 135 m
120 m	50 m	95 m to 145 m
130 m	50 m	105 m to 155 m
140 m	50 m	115 m to 165 m
150 m	50 m	125 m to 175 m

Temperature (Sodar/RASS) – Maximum Height

Choose the maximum measurement height for temperature that is required by your application. Similar to the maximum height for wind measurements, keeping the maximum height as low as

possible will improve data quality, since this will permit the system to perform more measurements per minute.

Temperature (Sodar/RASS) – Range
Choose a temperature range that fits your site. Bear in mind that the temperature may fall below the ground temperature with increasing height (approx. -1°C per 100m).

Temperature (Sodar/RASS) – Measure with longer sweep lengths
If this option is chosen the sound emissions during RASS mode will last longer. This results in stronger RASS signals and therefore increases the vertical measurement range. However, in this mode the measurement is sensitive to crosstalk distortions. To reduce these a RASS enclosure should be installed around at least one RASS antenna if longer sweeps are selected.

Wind + Temperature (Sodar/windRASS) – Maximum Height
Choose the maximum measurement height for wind and temperature that is required by your application. Keeping the maximum height as low as possible will improve data quality, since this will permit the system to perform more measurements per minute.

Wind + Temperature (Sodar/windRASS) – Range
Choose a temperature range that fits your site. Bear in mind that the temperature may fall below the ground temperature with increasing height (approx. -1°C per 100m).

Wind + Temperature (Sodar/windRASS) – Range
Choose a temperature range that fits your site. Bear in mind that the temperature may fall below the ground temperature with increasing height (approx. -1°C per 100m).

Wind + Temperature (Sodar/windRASS) – Measure with longer sweep lengths
If this option is chosen the sound emissions during windRASS mode will last longer. This results in stronger windRASS signals and therefore increases the vertical measurement range. However, in this mode the measurement is sensitive to crosstalk distortions. To reduce these RASS enclosures should be installed around both windRASS transmission antennas if longer sweeps are selected.

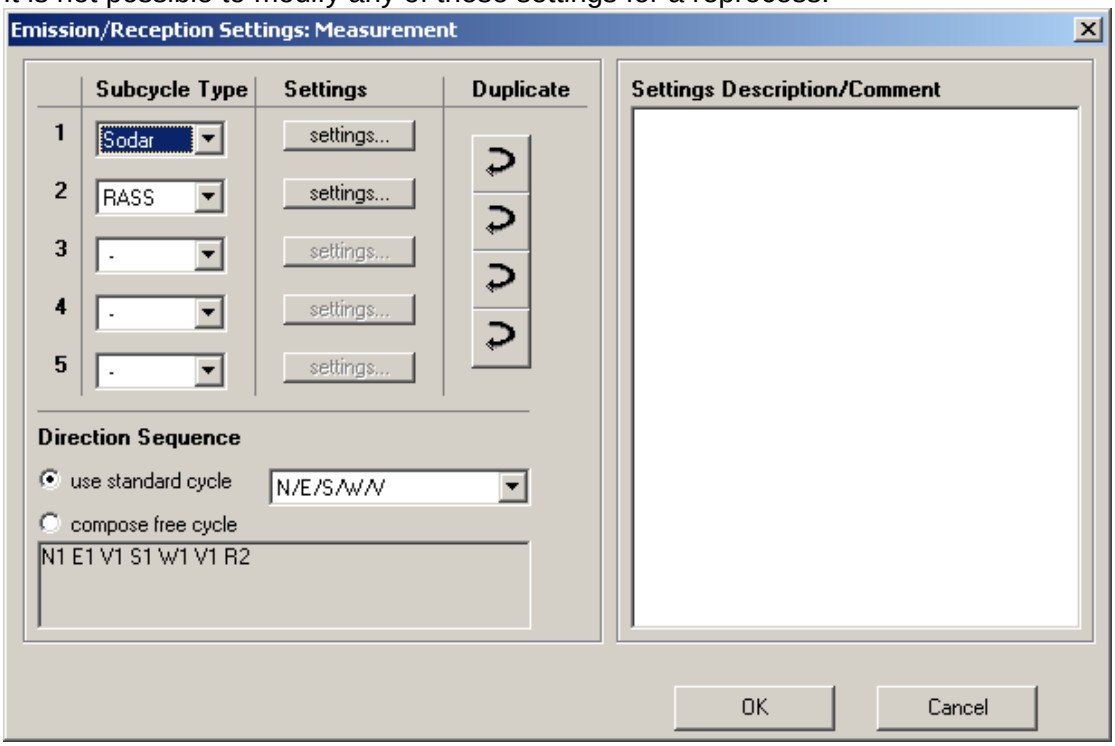
Wind + Temperature (Sodar/windRASS) – Optimize vertical wind measurement for sigma W
If this option is chosen, horizontal wind is measured normally and during vertical wind measurement the raw spectra are individually stored and processed. This increases the precision of standard deviation sigma W, but increases measurement time and the size of raw data files.

Output and Averaging Intervals
Choose output and averaging intervals that meet the requirements of your application. If the averaging interval is larger than the output interval, a running average will be calculated that partly includes data from previous output intervals. For data quality and availability it is most important to choose an averaging interval as long as possible. A recommended minimum value is displayed which is based on the currently set maximum height. Larger measurement heights require longer averaging intervals. Please avoid any averaging intervals below this recommended minimum to keep the data quality high.

5.5.2 Advanced: Emission/Reception

This dialog is intended for the advanced and experienced user, only.
The Emission/Reception Settings define the complete emission and reception cycle, including the emitted pulse sequences, the sequence of measurement directions, the number of averages per direction and the number of received height gates, what limits the maximum measurement height.

When utilizing the Primary Settings creator, APRun automatically creates Emission/Reception settings according to your needs – and thus overwrites any modifications that you may have set manually, before.
It is not possible to modify any of these settings for a reprocess.



You may configure up to five different subcycles.

Subcycle Type
Choose from Sodar, RASS, windRASS or none to specify the type of measurement for the selected subcycle.

Subcycle Settings
Configure each subcycle independently by pressing the settings... button.

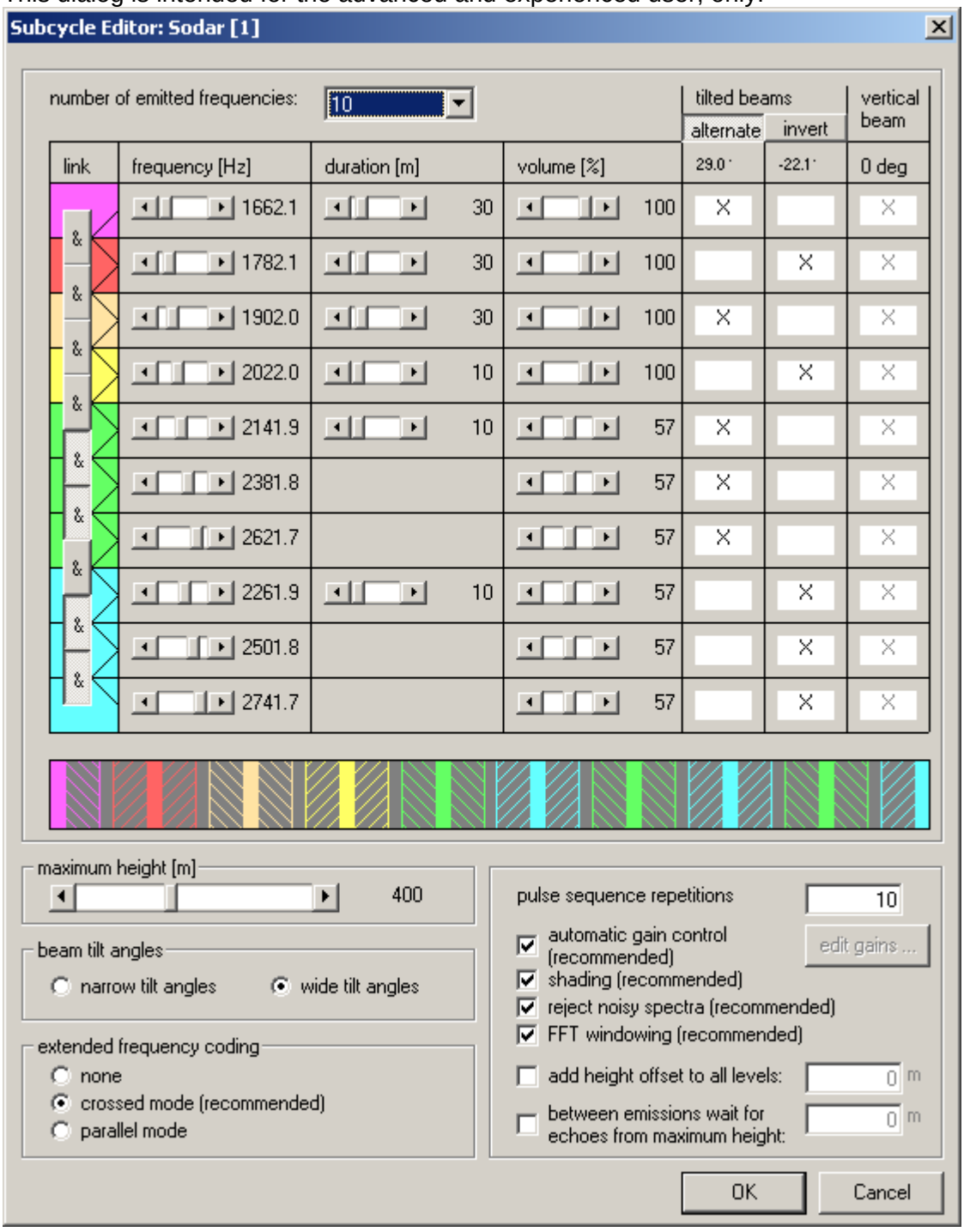
Duplicate
This command copies the settings from the subcycle above to the subcycle below. This may be particularly useful when comparing the performance of subcycles with minimal modifications.

Direction Sequence
You may individually compose the sequence of directions and subcycles or accept one of the standard cycle recommendations. The letter indicates the measurement direction (N – North, E – East, S – South, W – West, V – Vertical, R – RASS), the number indicates the subcycle.

Description
Enter any comment or text that may help you to identify and remember your settings.

5.5.2.1 Advanced: Sodar Subcycle Settings

This dialog is intended for the advanced and experienced user, only.



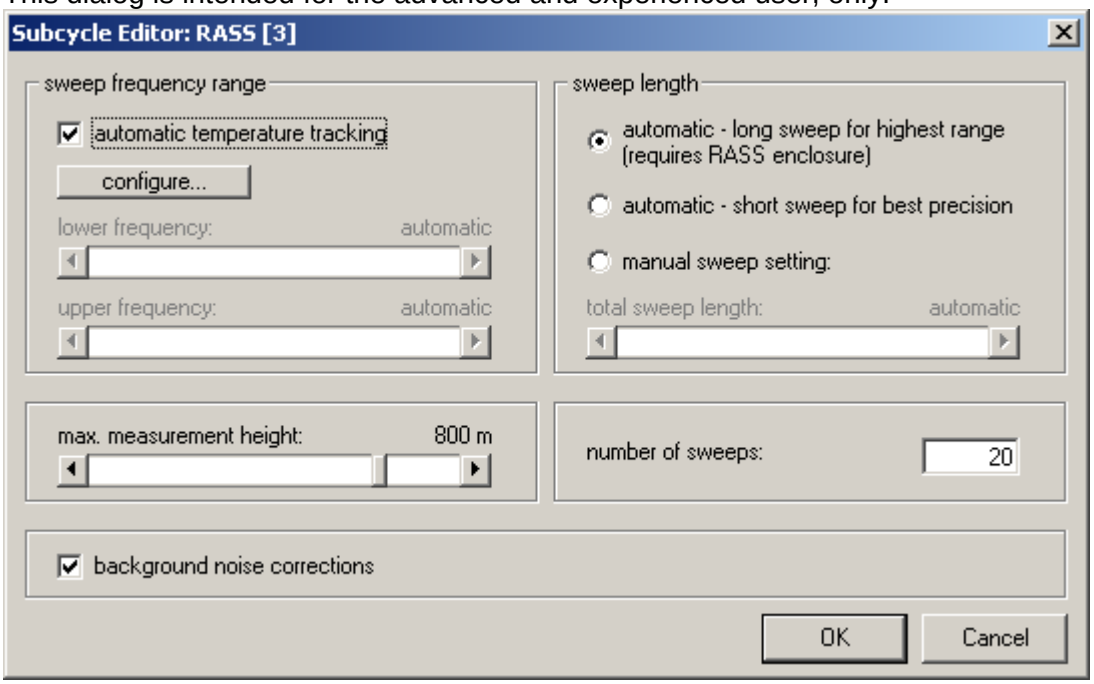
NUMBER OF EMITTED FREQUENCIES	Specifies the total number of pulses within a pulse sequence.
link	If pressed, the two pulses above and below will be emitted simultaneously, producing a polyphonic pulse.
frequency	The frequency of the selected pulse.
duration	The pulse duration is specified in meters, corresponding to the effective height resolution. The pulse duration in seconds is then given as $t = 2 \cdot d/340$.

volume	The pulse volume defines the amplitude with respect to the total sodar volume, which is set in the Sodar Power Schedule.
alternate tilted beams	If checked, half of the pulses will be emitted into the opposite direction – refered to as *mirrored beams* in the Concepts section of this manual.
invert tilted beams	This inverts the pulse directions.
maximum height	After emission of the pulse sequence the sodar will receive signals for a time period that allows all pulses to travel up to the selected maximum height and back to the antenna. Shorter values allow higher pulse repetition rates.
beam tilt angles	Narrow tilt angles reduce side emissions and make the measurement less sensitive to ground clutter errors at difficult Sodar sites, such as in the vicinity of buildings, masts or forests. However, narrow tilt angles may result in a stronger variability of horizontal wind speed measurements. Standard deviation of horizontal wind components SigmaU, SigmaV will not be calculated if the measurement runs with narrow tilt angles.
pulse sequence repetitions	The emission/reception sequence of each direction will be repeated for the specified number of times. The received power spectra will be averaged. We recommend a value of 10.
extended frequency coding	Extended frequency coding automatically varies emission frequencies between successive pulses. This reduces sensitivity to background noise and improves the quality of the measurement. In crossed mode the emission frequencies of the “mirror” beams at negative angles are shifted into the opposite directions than the frequencies emitted at positive angles. In parallel mode they are shifted synchronously. It is recommended to keep extended frequency coding activated in crossed mode.
automatic gain settings	Automatically adjusts gains for highest performance.
edit gains...	Permits to manually define gain values. This is only intended for diagnosis purposes.
shading	If checked, sidelobes that may be responsible for ground clutter, will be surpressed by utilizing the antennas integrated sidelobe tapering.
reject noisy spectra	If checked, noise events will be removed from the data at SPU level.
FFT windowing	If checked, a windowing function will be applied to the data before performing the fourier transform. This option should be generally checked.
add height offset to all levels	If checked, the specified height offset will be added to all output levels. Example: a value of 5 would mean that all output variables that are provided in tables, plots and files for nominal height levels 10m, 20m, 30m will be in fact measured at true height levels 15m, 25m, 35m.

between emissions wait for echoes from maximum height	This option adds an additional delay between successive measurements. This can be particularly useful to avoid data contamination by ground clutter from large obstacles. Choose a height that equals the maximum distance to the obstacle.

5.5.2.2 Advanced: RASS Subcycle Settings

This dialog is intended for the advanced and experienced user, only.

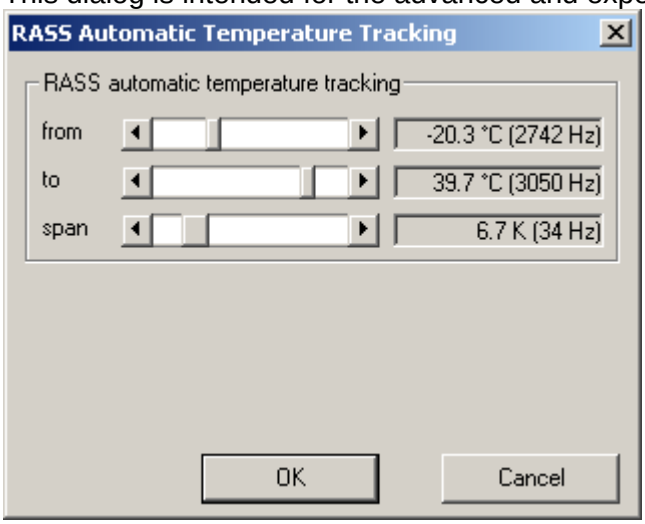


automatic temperature tracking	If checked, the RASS sweep frequency will be automatically set according to previous RASS measurement results. Press configure... to set the initial temperature range and the temperature span. We recommend to generally use this option in order to improve the pulse repetition rate and minimize power consumption.
lower/upper frequency	If automatic temperature tracking is not used, you may manually specify the temperature range for the RASS measurement.
sweep length	The sweep length should be automatically adapted except for diagnosis purposes. There are two different automatic modes: Long sweeps: This results in stronger RASS signals and therefore increases the vertical measurement range. However, in this mode the measurement is sensitive to crosstalk distortions. To reduce these a RASS enclosure should be installed around at least one RASS antenna. Short sweeps: This mode permits to effectively remove crosstalk distortions by emitting short sweeps, only. This setting gives highest precision in the lower measurement range and permits operation without RASS enclosures.
maximum measurement height	The maximum measurement height defines the total reception time for the RASS mode and provides the

	upper height limit for temperature measurements.
background noise corrections	If checked, background noise data is automatically sampled during measurement and used to correct the received RASS signals. This option improves the quality of RASS data.
number of sweeps	The emission and reception of the RASS signal will be repeated for the specified number of times. The received power spectra will be averaged. The recommend default value is 10.

5.5.2.3 Advanced: RASS Automatic Temperature Tracking

This dialog is intended for the advanced and experienced user, only.

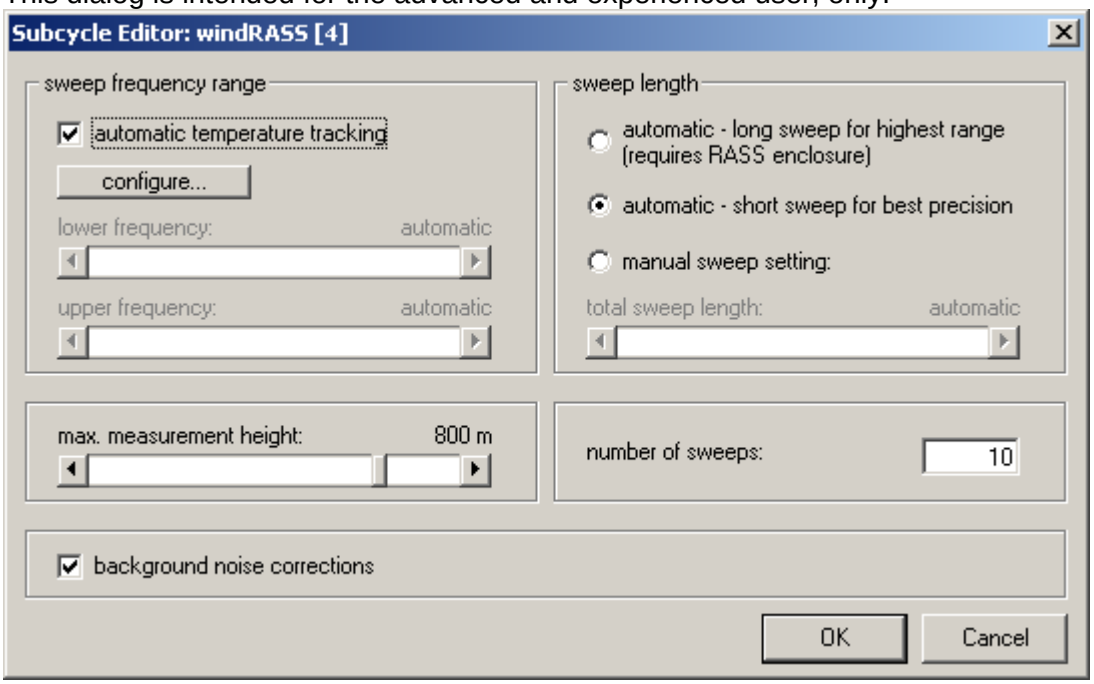


This window permits to set the initial temperature range and the temperature span for RASS Automatic Temperature Tracking. Bear in mind that the temperature will fall below the ground temperature with increasing height (typically -1°C per 100m).

lower and upper temperature	Choose a temperature range that fits your site.
temperature span	Choose the maximum permittable temperature span in Kelvin that a single measurement shall cover.

5.5.2.4 Advanced: windRASS Subcycle Settings

This dialog is intended for the advanced and experienced user, only.

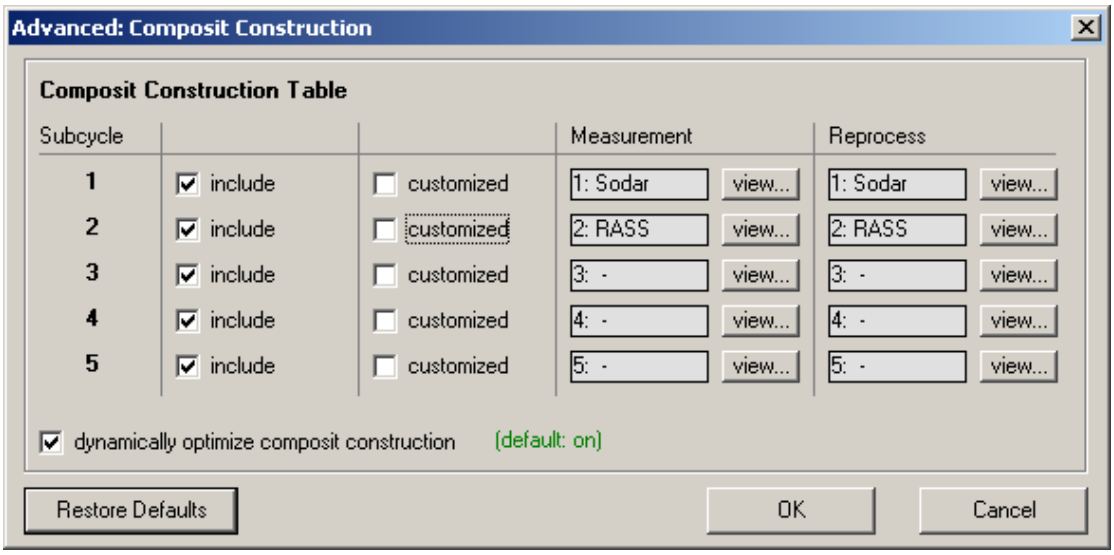


automatic temperature tracking	If checked, the windRASS sweep frequency will be automatically set according to previous measurement results. Press configure... to set the initial temperature range and the temperature span. We recommend to generally use this option in order to improve the pulse repetition rate and minimize power consumption.
lower/upper frequency	If automatic temperature tracking is not used, you may manually specify the temperature range for the windRASS measurement.
sweep length	The sweep length should be automatically adapted except for diagnosis purposes. There are two different automatic modes: Long sweeps: This results in stronger windRASS signals and therefore increases the vertical measurement range. However, in this mode the measurement is sensitive to crosstalk distortions. To reduce these two windRASS enclosures should be installed around the two windRASS transmission antennas. Short sweeps: This mode permits to effectively remove crosstalk distortions by emitting short sweeps, only. This setting gives highest precision in the lower measurement range and permits operation without additional windRASS enclosures.
maximum measurement height	The maximum measurement height defines the total reception time for the windRASS mode and provides

	the upper height limit for wind and temperature measurements.
background noise corrections	If checked, background noise data is automatically sampled during measurement and used to correct the received windRASS signals. This option improves the quality of windRASS data.
number of sweeps	The emission and reception of the windRASS signal will be repeated for the specified number of times. The received power spectra will be averaged. The recommend default value is 10.

5.5.3 Advanced: Composit Construction

This dialog is intended for the advanced and experienced user, only.
When utilizing the Primary Settings creator, APRun automatically creates Composit Construction settings according to your needs – and thus overwrites any modifications that you may have set manually, before.
You may modify any of these settings for a reprocess.



Typically the measurement results of one wind component is based on signals originating from a lot of different subcycles, directions and pulses.
The composit construction tables define what information shall be used and what information shall be discarded. This way the tables permit to manually adjust the composition of the signals.

You may discard the data of complete subcycles by unselecting the respective include check-boxes. If you want to exclude certain specific frequencies or directions within a subcycle, you may check customized and manually edit individual Composit Construction Tables.

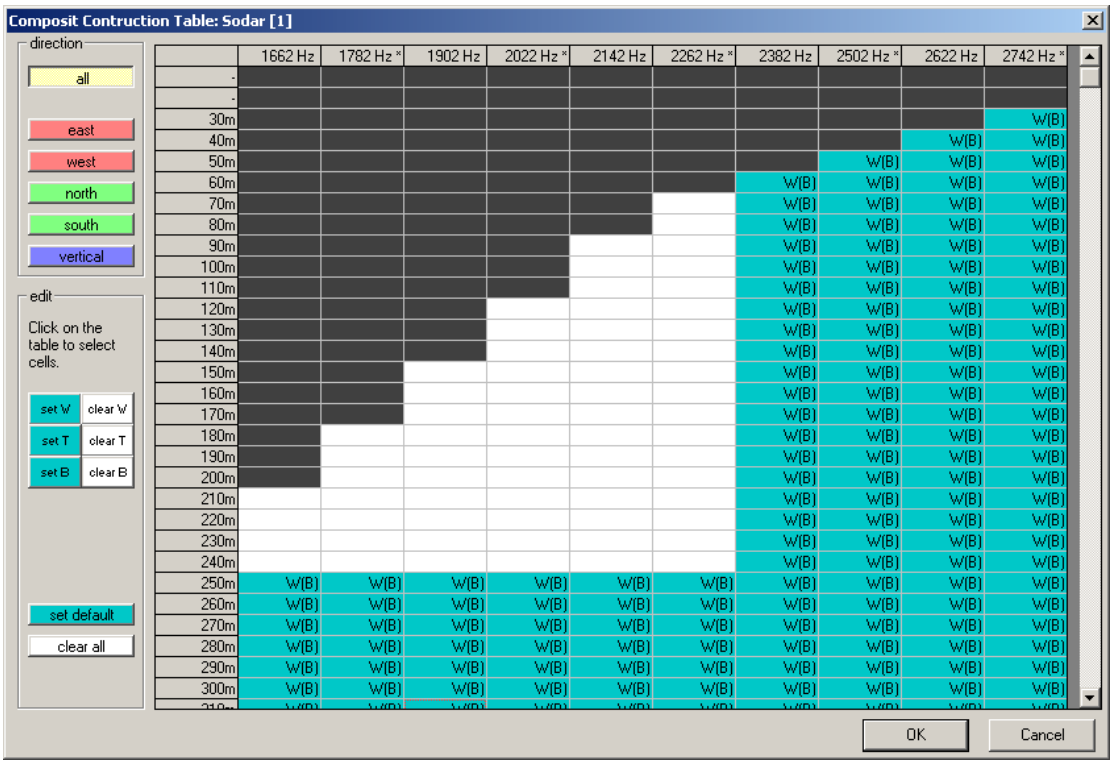
If all include options are checked and the tables are not customized, i.e. all customized check-boxes are unchecked, APRun will evaluate any data and information, that is available. This is the default setting.

Before editing the composit construction table of a subcycle, you must decide whether you wish to adjust the table based on the currently set Emission/Reception settings (Measurement) or based on the Emission/Reception settings that have been restored from a raw data file, that is currently selected for a raw data reprocess (Reprocess).

If dynamically optimize composit construction is checked, the different signals will be weighted according to their individual signal-to-noise-ratio.

5.5.3.1 Advanced: Composit Construction Table

This dialog is intended for the advanced and experienced user, only.



Choose an individual direction from the direction frame or select all to use the same composit construction table entries for all directions of the selected subcycle. To modify the usage of a certain frequency in a certain height level, highlight the respective cell in the table and utilize the commands from the edit frame.

The letters possess the following meanings:

W	Use for wind derivation.
T	Use for temperature derivation.
B	Use for backscatter derivation.

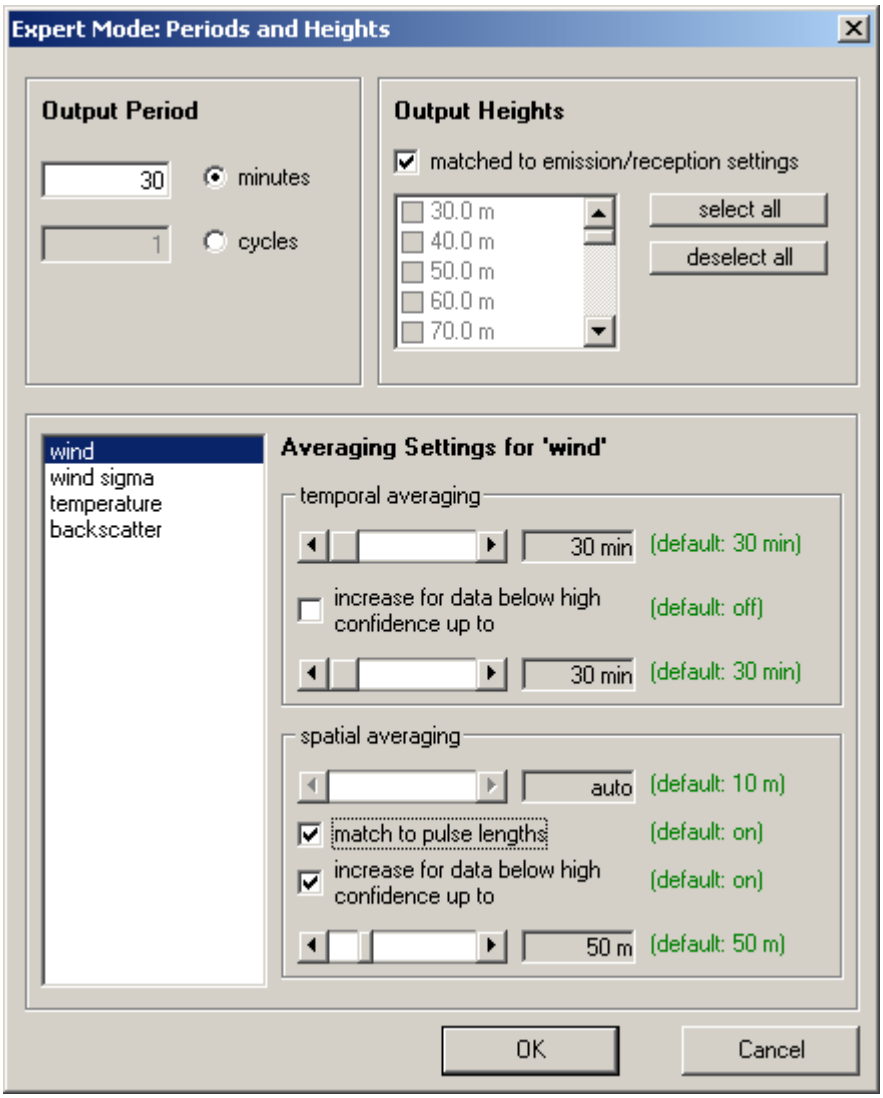
A letter that is enclosed in parenthesis means that this letter is currently set for at least one but not all directions.

The dark cells cannot contribute to the measurement results at all and thus their usage settings have no effect on the data. This mask of dark cells is based on the Emission/Reception settings that you have chosen to use (Reprocess or Measurement).

Please note, that any adjustments to the composit construction tables may become invalid as soon as you modify the Emission/Reception Settings.

5.5.4 Advanced: Periods and Heights

This dialog is intended for the advanced and experienced user, only.
When utilizing the Primary Settings creator, APRun automatically creates Periods and Heights settings according to your needs – and thus overwrites any modifications that you may have set manually, before.
You may modify any of these settings for a reprocess.



The Periods and Heights dialog contains settings to define the spatial and temporal output resolution as well as settings that permit additional spatial and temporal averaging that may be required to increase data quality.

Output Period	This period defines when new Main Data sets will be calculated and written to the Main Data file.
Output Heights	The height levels that are included in a Main Data set. If you choose matched to emission/reception settings, all output levels will be included up to the maximum measurement height that has been defined in the Primary Settings Creator or in the Emission/Reception settings.

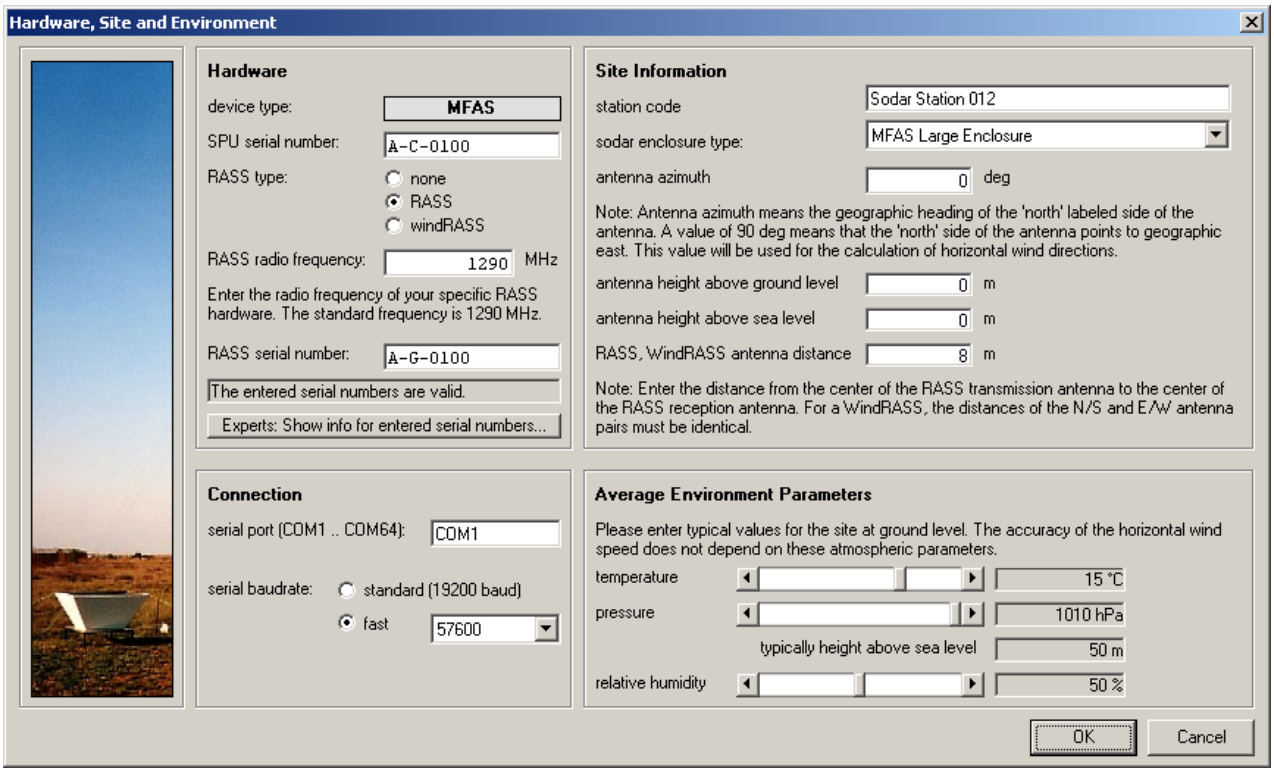
You may individually specify Averaging Settings for different types of output variables: wind, wind sigma, temperature and backscatter.

temporal averaging	The averaging interval must be an integer multiple of the output interval. If it is larger than the Output Interval, APRun provides a running average of the selected output variable.
spatial averaging	The spatial averaging must be an odd multiple of the basic resolution steps. For wind results we recommend to use the option matched to pulse lengths in order to adjust the spatial averaging to the effective height resolution that is defined by the pulse lengths.

If the respective checkboxes are set, the spatial and temporal averaging may be automatically extended in the case of insufficient signal quality up to the specified limits.

5.6 Menu Other Settings

5.6.1 Hardware, Site and Environment Settings



device type	The current sodar device type is displayed. For an existing workspace the device cannot be changed anymore.
serial number	Enter the unique serial number of your sodar Processing Unit. *Entering the correct serial-number is important to let the software manage the compatibility issues for your instrument.*
RASS type	Select the type of RASS (Radio Acoustic Sounding System) extension hardware that is available and connected.
RASS radio frequency	Enter the radio frequency of your specific RASS hardware. The standard frequency is 1290 MHz. Customized RASS hardware versions may be equipped for a different radio frequency.
RASS serial number	Enter the serial number of your RASS components. *Entering the correct serial-number is important to let the software manage the compatibility issues for your instrument.*
serial port	The COM port where the Sodar SPU is connected to.
serial baudrate	The baudrate that shall be used for communications, choose fast - 57600 baud if you are using a serial cable (RS232) not longer than 10m, standard otherwise.
station code	The station code is a label to identify the measurement site. The station code is stored with all data files and displayed on all data plots.

sodar enclosure type	Select the type of sodar enclosure that is installed. This setting is used for beam diffraction corrections. An incorrect setting may reduce the precision of wind speed measurements.
sodar antenna azimuth	Geographic heading of the "north" labeled side of the Sodar antenna. An angle of 0, 90, 180, 270 deg would mean that the "north" labeled side of the antenna points towards geographic north, east, south, west.
antenna height above ground level	Height of the antenna above ground level. Depending on the height unit selection, this offset is taken into account for data plots.
antenna height above sea level	Height of the antenna above sea level. Depending on the height unit selection, this offset is taken into account for data plots.
RASS, windRASS antenna distance	RASS: Distance from the center of the RASS transmission antenna to the center of the RASS reception antenna. windRASS: Distance from the center of the windRASS N/S transmission antenna to the center of the windRASS N/S reception antenna. The distance from the center of the windRASS E/W transmission antenna to the windRASS E/W reception antenna must be identical.
Temperature	The average temperature at ground level.
Pressure	The average pressure at ground level – the corresponding height above sea level is displayed below.
Relative Humidity	An estimate for the typical relative humidity at ground level.

The atmospheric properties permit minor adjustments and corrections for some output variables. The following table lists the affected output variables and an estimated error that is imposed for deviations between the configured values and the true atmospheric properties.

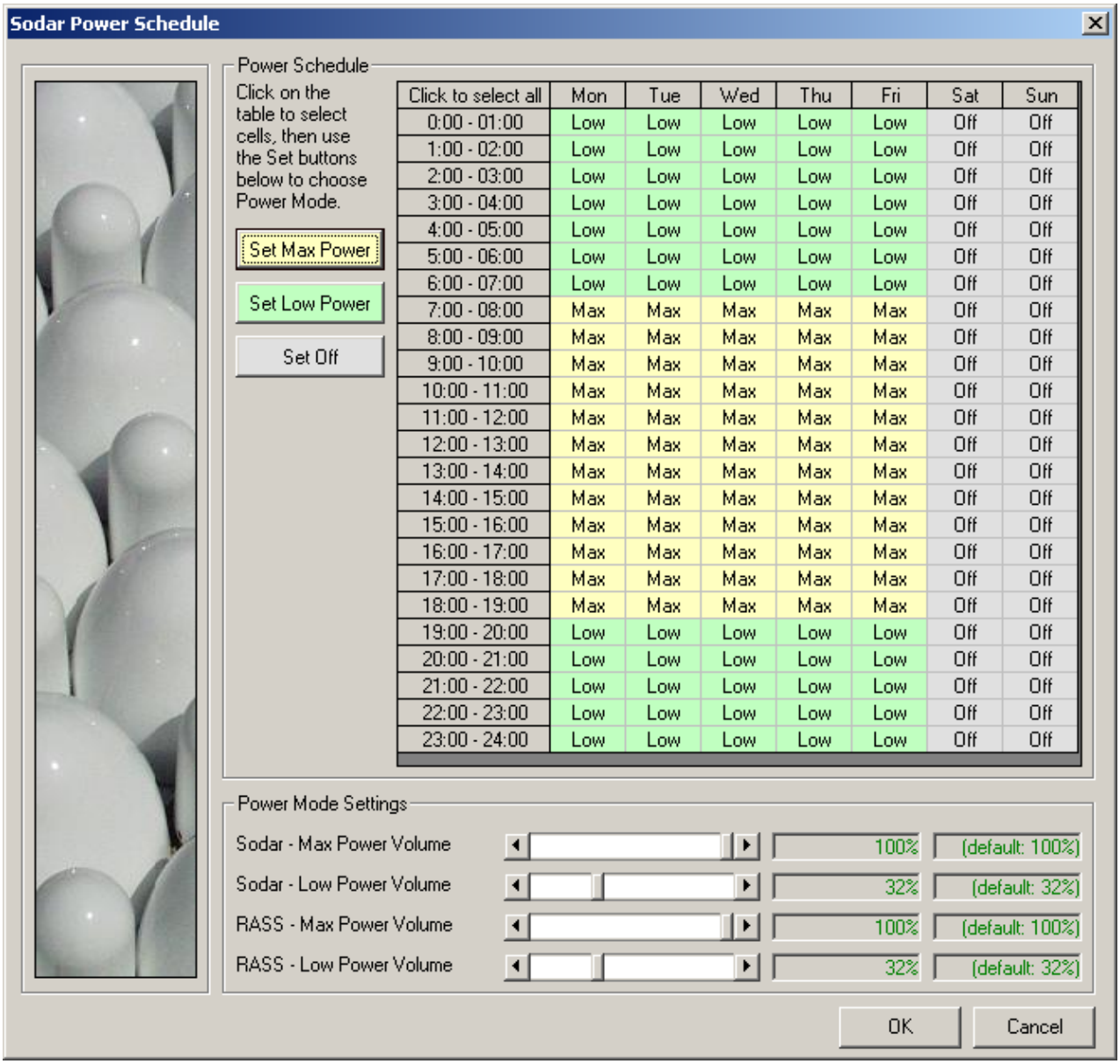
The results for the horizontal wind speed (wind speed, wind direction, wind U, wind V) do not depend on temperature, pressure or humidity – there is no error due to incorrect assumptions for the environment parameters. This results from the special design of Scintec Flat Array Sodars and is not given for other types of Sodars.[1]

Output Variable	**Environment Parameter**	**Error Estimate** (deviation of environment parameter ~ error in output variable)	**Notes**
horizontal wind	temperature	(none)	The accuracy of the the

[1] Scintec Sodars are phased array sodars that emit tilted beams by introducing a fixed time delay into the emission signal of adjacent speakers. The resulting tilt angles vary with the acoustic wavelength and therefore depend on the sound speed (which depends on environmental parameters). The acoustic echoes that are received by the sodar are doppler shifted in frequency by an amount proportional to the ratio between wind speed and sound speed (which depends on environmental parameters). In case of tilted beam measurements the two effects compensate each other and the resulting horizontal wind speed measurement becomes independent of pressure, temperature and humidity variations.

(wind speed, wind direction, wind U, wind V)	pressure	(none)	horizontal wind does not depend on any environment parameters.
	humidity	(none)	
vertical wind (wind W, sigma W)	temperature	5 K ~ 1 %	Online RASS temperature results are used, if available.
	pressure	(none)	
	humidity	(none)	
temperature	temperature	(none)	If the humidity is set to 0% the output variable 'temperature' will correspond to the 'virtual temperature' and the error due to an incorrect setting of the pressure vanishes completely.
	pressure	100 hPa ~ 0.01 K	
	humidity	10 % ~ -0.1 K	

5.6.2 Sodar Power Schedule



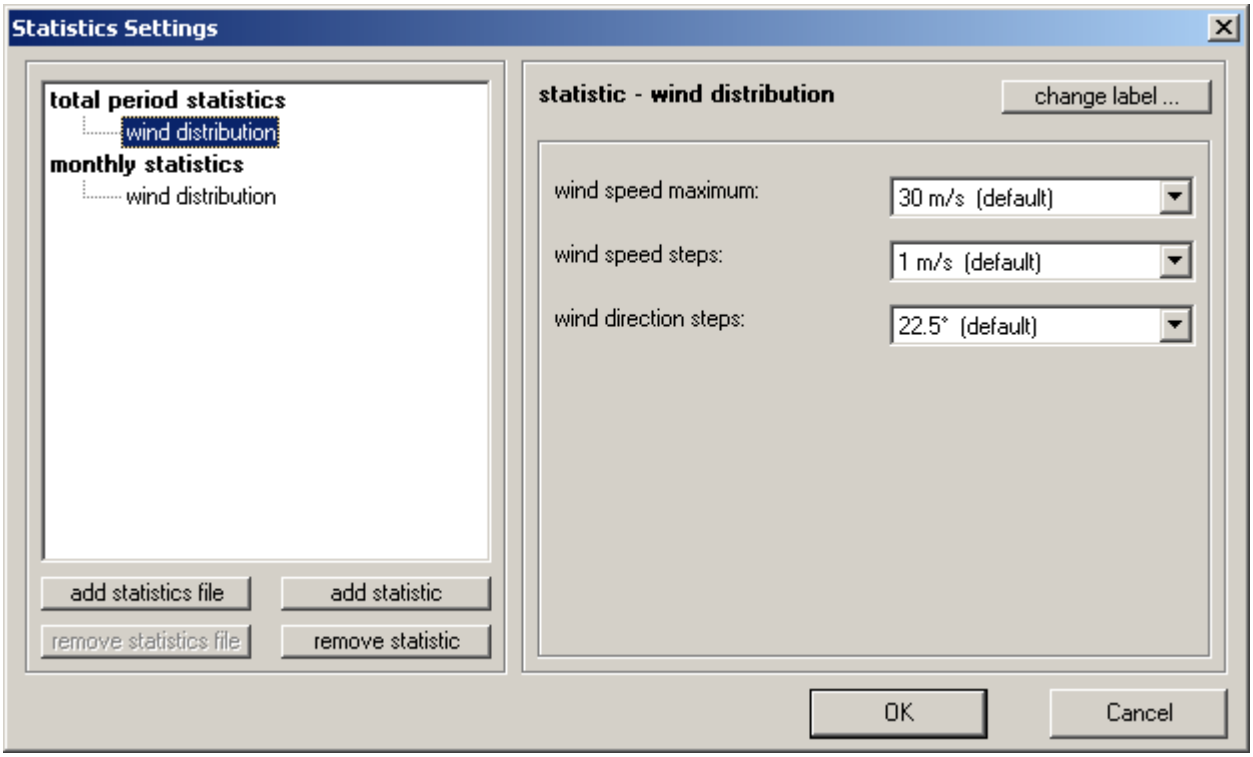
On some measurement sites it might be required to reduce the night volume – or switch off the Sodar completely at night - to avoid disturbing the residents' sleep. Normally there is no need to reduce the day volume. You may operate the system in different modes depending on weekday and time of day:

- The Max Power Mode is the default measurement mode operating at maximum volume for highest data quality and maximum range.

- The Low Power Mode operates at a reduced volume reducing noise emissions and also reducing electrical power consumption. However, the maximum measurement range will be lower in this mode.

- In Off Mode the sodar does not perform any measurements.

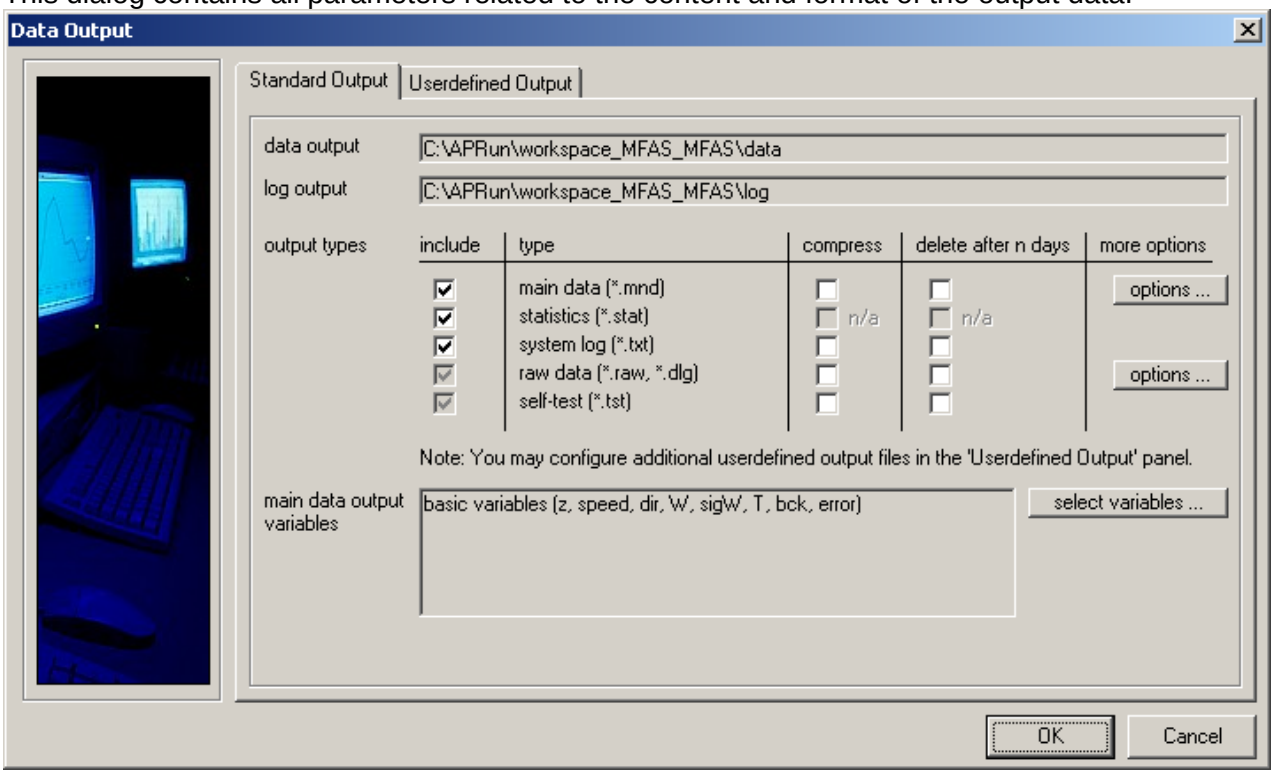
5.6.3 Statistics Settings



This window permits you to configure the types and settings of any statistics that shall be automatically computed.

5.6.4 Output Settings

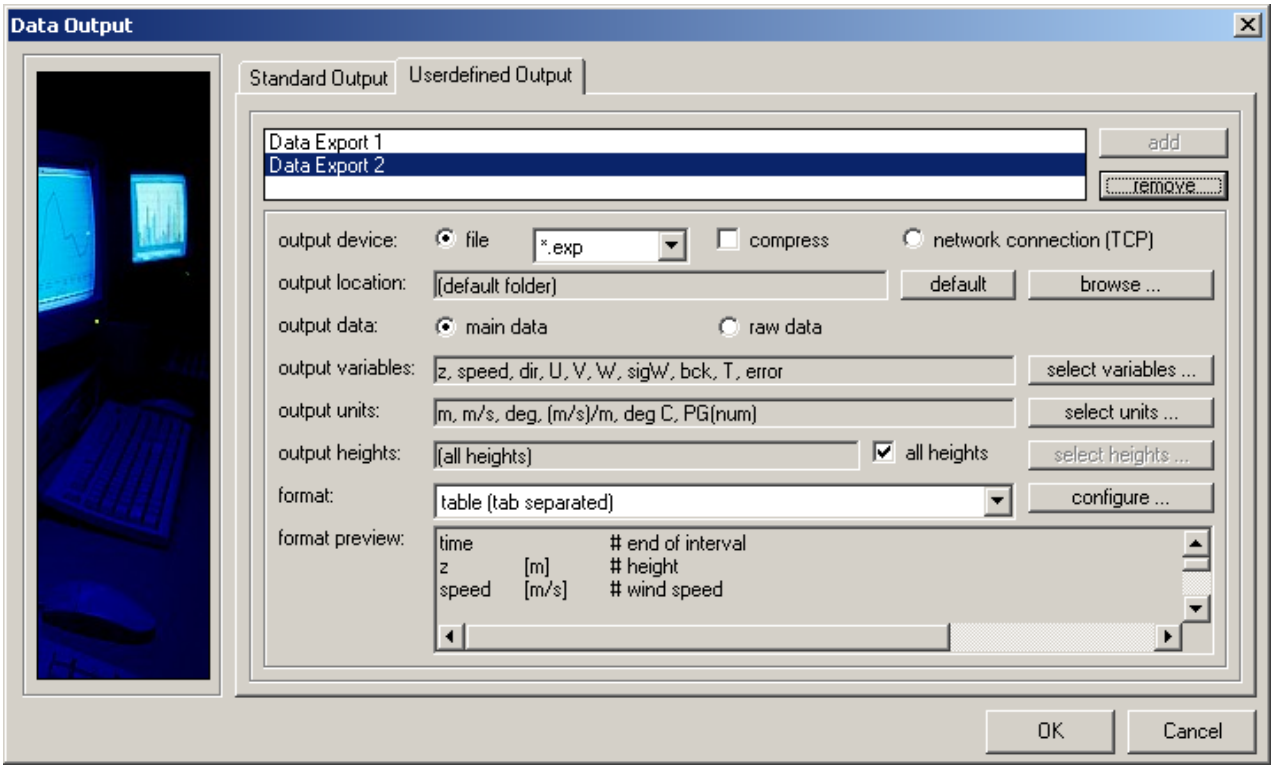
This dialog contains all parameters related to the content and format of the output data.



The Standard Output consists of the data files that APRun stores automatically during measurement. These files can be accessed through the APRun Recorded Data plots.

The data output folder and log output folder of the Standard Output cannot be modified. In order to store a copy of the data at another location (e.g. for realtime data processing), you should configure a Userdefined Output.

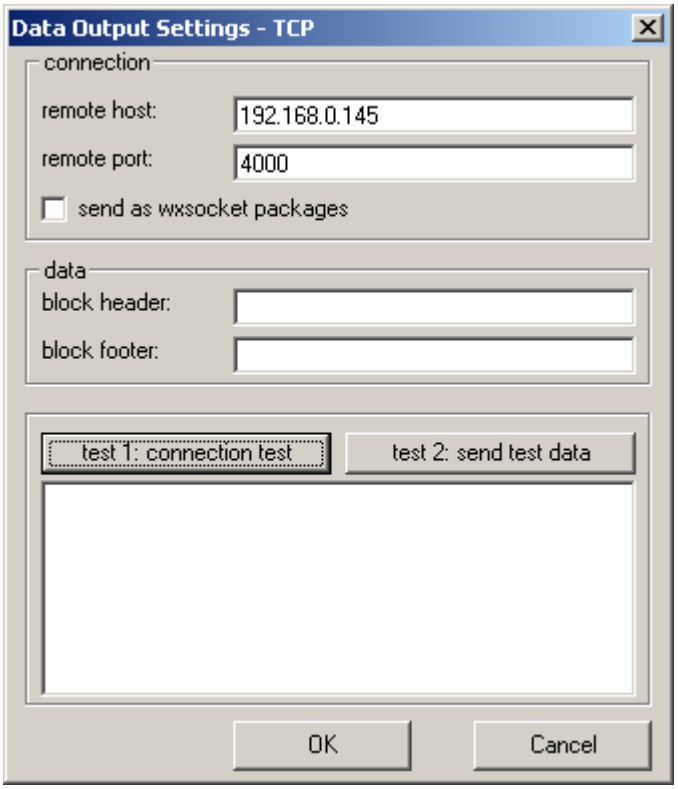
include	The data files of the checked types will be stored. Data files of types that are not checked will not be stored.
compress	The data files of the checked types will be automatically compressed if they are older than a day.
delete after n days	The checked output files will be automatically erased if they are older than the specified number of days.
select variables	Choose output variables that shall be included.
options...	See a later section for details.



You may configure the variables, that shall be included in the data of a Userdefined Output individually and independent from the main data files that are stored locally in the Standard Output.

output device – file	Write data to files with the specified file extension.
output location	The output folder for these data files.
output location – default	If default folder is selected as output location the data is always stored in the same folder as the corresponding Main Data files (*.mnd).
output device – network	Send data via network to another PC (as TCP packages).
output location (network)	The host PC. Press the configure ... button to set the connection parameters (see a later section).
output data – main data	If selected, output occurs at the end of each output interval and the data includes the Main Data variables that are selected below.
output data - raw data	If selected, output occurs after each emission/reception sequence block and contains the Raw Data.
output variables	Choose output variables that shall be included.
output units	Choose the physical units that shall be used.
output heights	Choose the output height levels for which data shall be included. If you check all heights all output levels up to the configured maximum measurement height will be provided – just like in the Standard Output Main Data files.
format	Choose a predefined data formats or select userdefined, to define a customized format.
format preview	A preview of how the data will be formatted.

5.6.4.1 Output Settings – TCP



As soon as an output interval is over APRun will initiate a TCP connection to the remote host onto the specified remote port. After the data is transfered the TCP connection will be automatically closed.

To test your connection parameters, simply click the send test data button. A connection will be initiated, but no data transfered.

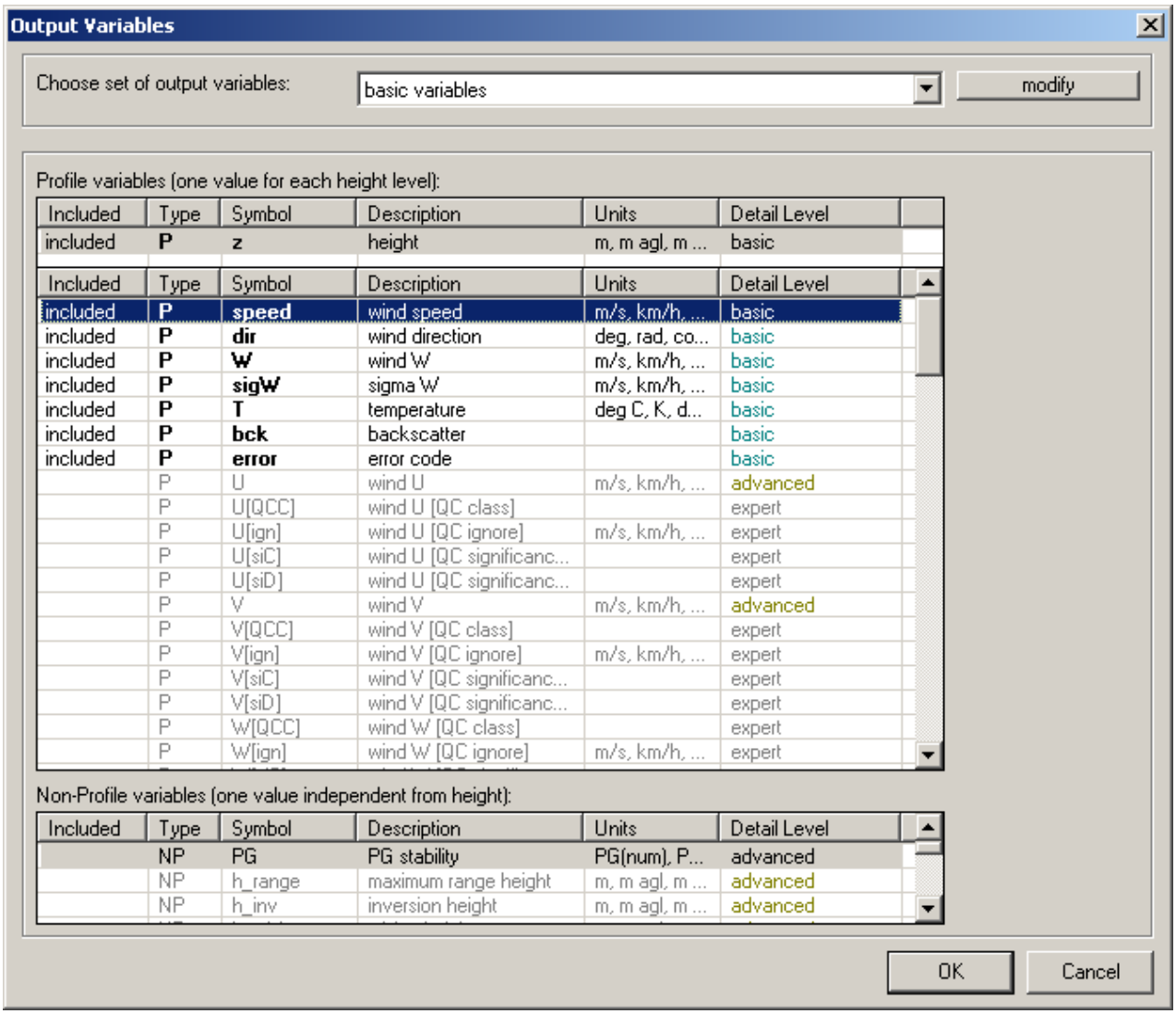
If you want to send a test data package, use send test data. A dummy data package will then be sent to the configured host.

A sample application that listens on a TCP-port and accepts incoming data sets is provided in source code (VisualBasic 6.0) at the installation CD.

remote host	IP address or host name of the PC where the data shall be sent to.
remote port	The TCP port that the target application is listening on.
send as wxsocket packages	If set, the data packages will be formatted for a wxsocket based client.
block header	A text string that shall prefix the data packets.
block footer	A text string that shall suffix the data packets.

5.6.4.2 Output Settings – Output Variables

Use this dialog to specify the output variables that shall be used for Standard Output and Userdefined Output respectively.



The list contains all output variables that are available. The Included column tells you if the variable is in the current selection of output variables, so far.

For each output variable the table displays
- the symbol, i.e. the short description that is visible in the plots,
- a more detailed description,
- the physical unit of the output values and
- a detail level.

The following detail levels are defined:

basic	output variables that are required for most applications
advanced	output variables that are intended for special applications, only
expert	output variables that are used very rarely and in very special applications

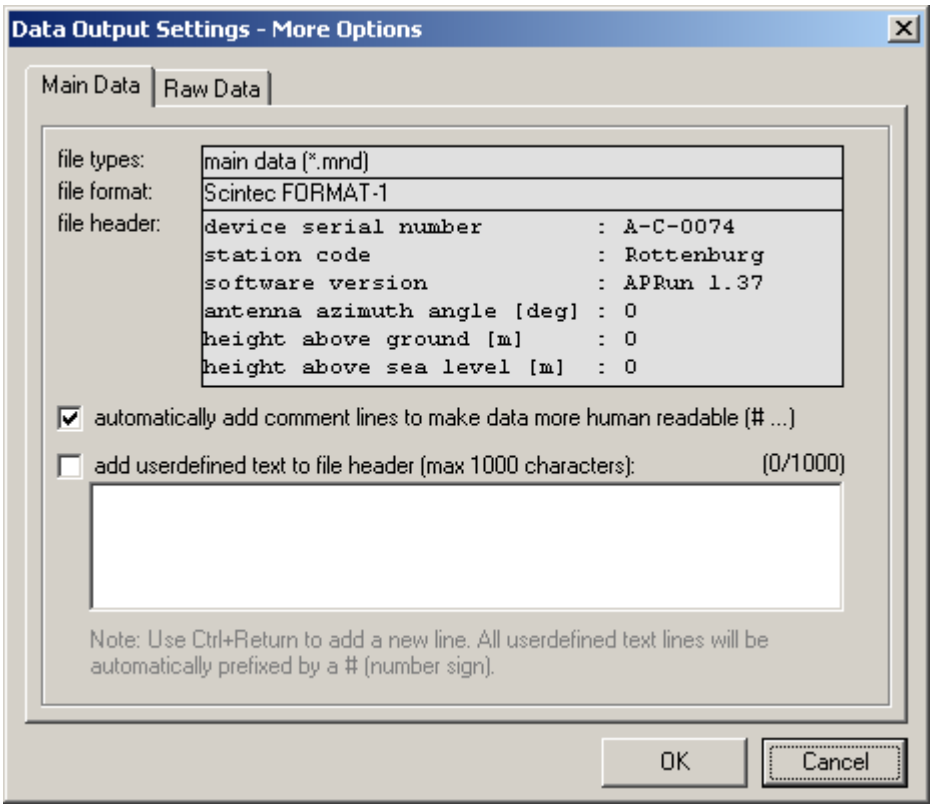
You may choose one of the preconfigured variable sets or press modify in order to manually edit the list of output variables.

To add an output variable to the selection, simply highlight the respective row(s) in the list and press the include button. To remove one or more variables from the selection, highlight them in the list and press the remove button.

To highlight all output variables that are classified for a certain detail level or below, press the respective button beside the list.

In order to change the sequence of variables highlight one variable at a time and change its position by pressing the move up and move down buttons.

5.6.4.3 Output Settings – More Options



Options for Main Data files:

automaticall add comment lines	If set, additional comment lines (prefixed by number signs) will be automatically included into the data files in order to make the files more human-readable.
add userdefined text to file header	Specify a userdefined text that will be added to all file headers. Userdefined text lines will be automatically prefixed by a number sign.

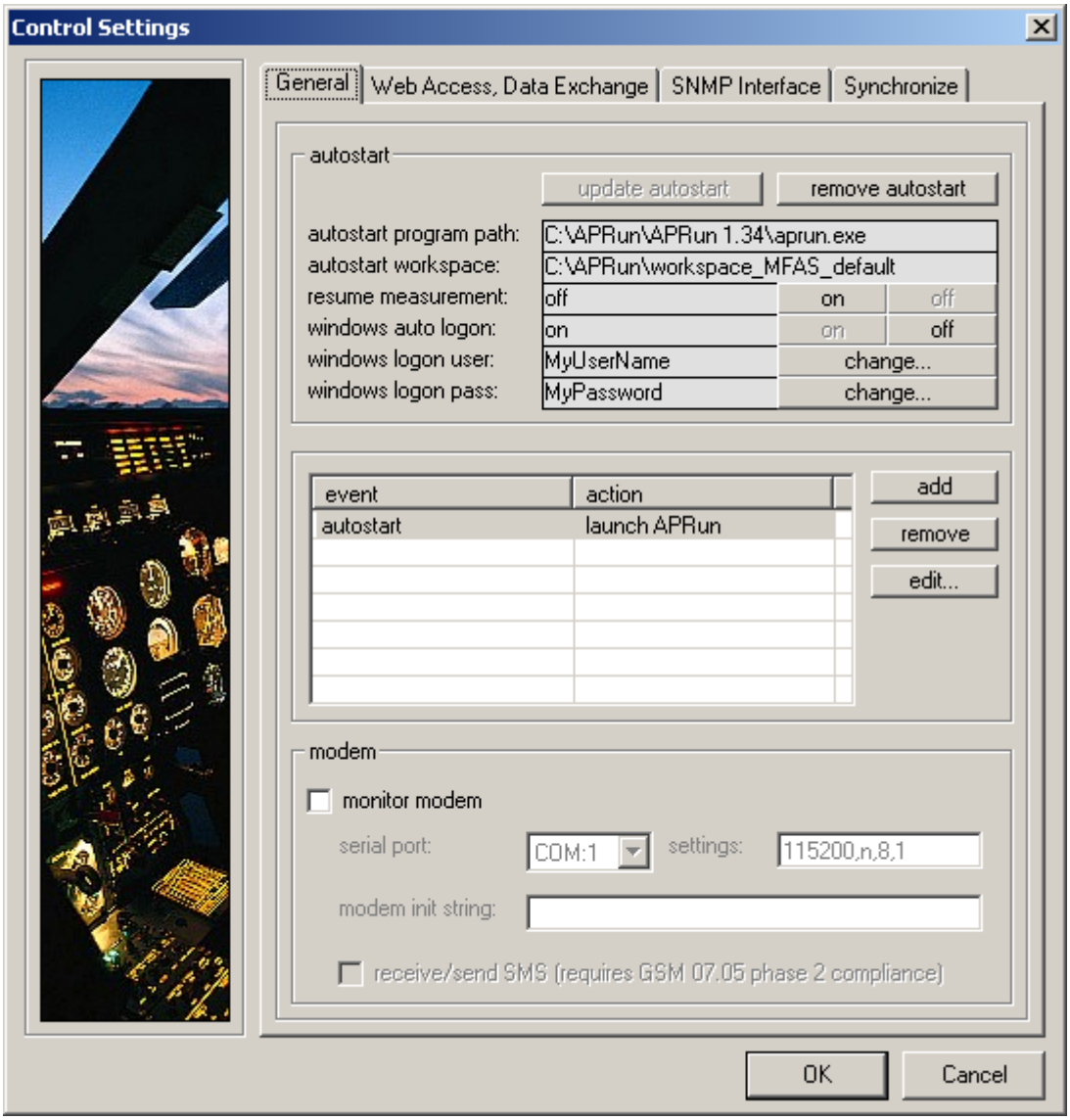
Options for Raw Data files:

raw data size limit	If the size of a raw data file reaches this limit, the file will be splitted. This option is useful, if you plan to copy the raw data files onto a medium with a capacity that is smaller than the normal size of each individual raw data file. Typically, Sodar raw data file sizes are in the range from 20 MB to 150 MB.

5.6.5 Control Settings

The Control Settings cover all remote access settings, settings for unattended operation and synchronization between multiple Sodars.

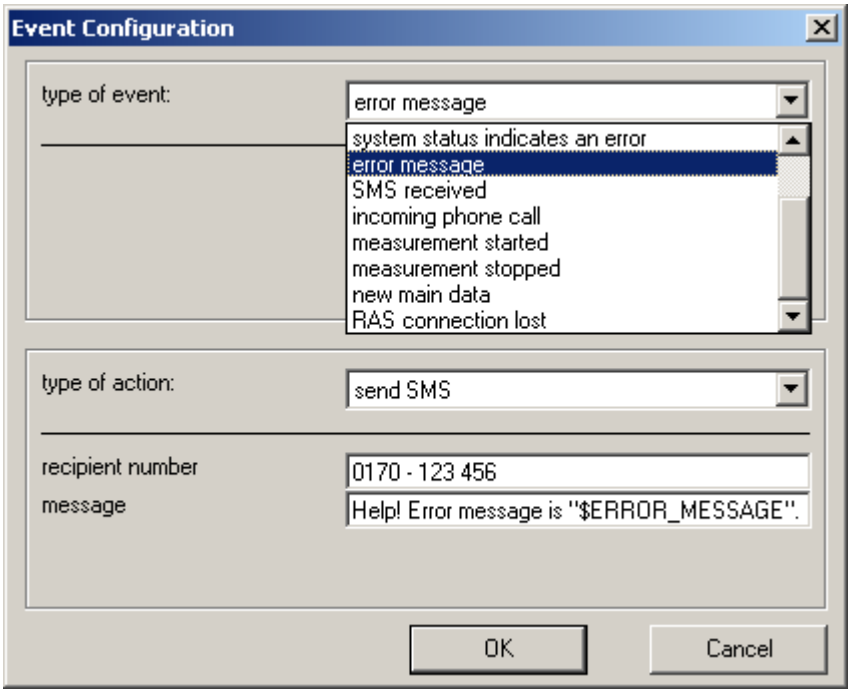
5.6.5.1 Control Settings – General



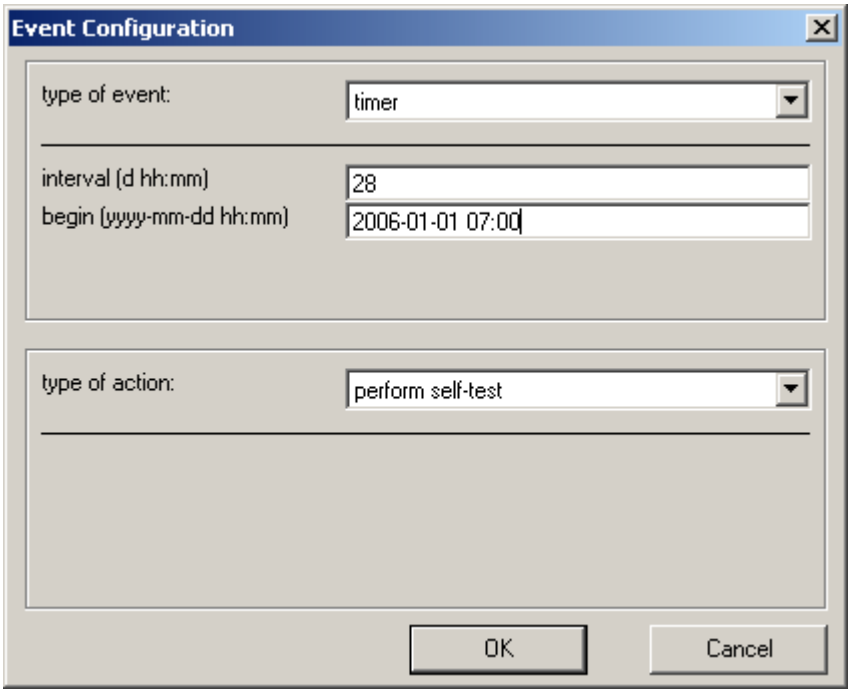
autostart	If autostart is set, APRun is launched automatically after Windows has started and the user has logged in. For this purpose APRun will add a registry entry into `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run`.
windows auto logon	If windows auto logon is set, Windows will automatically logon with the provided username and password when the PC is started.
resume measurement	If APRun is started and this option is active, the previous measurement will be automatically resumed or

	– if this is not possible – a new measurement will be started.
events	Use the add and remove buttons to add new events or remove existing events. Press edit to configure an existing event (see next section). The maximum number of events is limited to 20.
monitor modem	This option must be set if an incoming call- event is configured in the event list or if the SMS functionality shall be used. IMPORTANT NOTE: It is only possible to monitor a modem if it is not in use by another application. In particular, it is not possible to let APRun monitor a modem, while Windows is configured to accept incoming connections on the same modem.
modem – serial port	The serial port to which the modem is connected – this may also be a virtual serial port that is assigned to an USB modem.
modem – serial settings	Serial connection settings of the modem in the form 'baudrate, parity, data bits, stop bits', e.g. '115200,n,8,1'.
modem – init string	An AT command that shall be sent to the modem after the connection to the modem is established. This may be some initialization command or a command to send the PIN number to a GSM modem.
modem – receive/send SMS	Activates SMS functionality for the configured modem. This option should work with any modem that is compliant to the GSM 07.05 phase 2 standard. SMS functionality must be activated if the event incoming SMS or the action send SMS is used in the event configurations (see there).

5.6.5.2 Control Settings – Events



APRun supports a simple user configurable event model: “on *event* do *action*”. Each time a certain *event* is triggered by APRun, a userdefined *action* is performed. Please use this dialog to configure an individual *event* – *action* pair.



One of the most important events is the timer. The timer permits you to define actions that shall be performed periodically, e.g. every hour or every 4 weeks. By specifying a begin time you may choose a time when the desired action shall be performed for the first time. An interval of 0 (zero) means that the action shall be performed only once at the specified begin time and it shall not be repeated.

Some typical examples:

- Perform an automatic self-test every 28 days.
- Send an SMS to a preconfigured mobile phone if the system state indicates a severe error.
- Send an SMS with a daily status report to a preconfigured mobile phone.
- Call an external process and pass the filepath of the latest main data file as an command-line argument - each time a new main data set is available.
- Re-establish an internet dial-up connection every 30 min and register the local IP at Scintec DynamicIP Service to allow remote access.
- Start or stop the measurement using preconfigured SMS commands.

List of all available events:

Initialization of APRun	Event is triggered, when APRun is started and when the Workspace is changed.
termination of APRun	Event is triggered, when APRun is terminated.
timer	The selected action will be repeated periodically. The interval must be specified in the format ‘d hh:mm’.Some examples: 00:30 - every 30 minutes 12:00 - every 12 hours

	1 12:00 - every 36 hours 7 - every 7 days 100 - every 100 days
userdefined button in web interface	Event is triggered, when the user clicks a button in APRun Web Interface. Userdefined buttons are automatically inserted into the Web Interface control panel. The web user must have 'control' permissions.
system status indicates an error	Event is triggered, if one of the System Status indicators gets red (e.g. if the SPU connection lost or the harddisk is full).
error message	Event is triggered, if an error message is displayed in the System Log (error message are listed in red color). Note: Use the string '$ERROR_MESSAGE' in an *action* parameter to include the error message text.
SMS received	Event is triggered, when a SMS is received that contains the preconfigured command string (SMS commands are case insensitive.) This event requires that the options monitor modem and send/receive SMS are active.
incoming phone call	Event is triggered, when an incoming phone call is detected at the monitored modem.
measurement started	Event is triggered, each time a measurement is started.
measurement stopped	Event is triggered, each time a measurement is stopped by the user.
new main data	Event is triggered when an output interval is completed and a new main data set is calculated. Note: Use the string '$MND_FILENAME' in an *action* parameter to include the filepath of the updated main data file.
RAS connection lost	Event is triggered, when the selected RAS connection is lost.

Available actions:

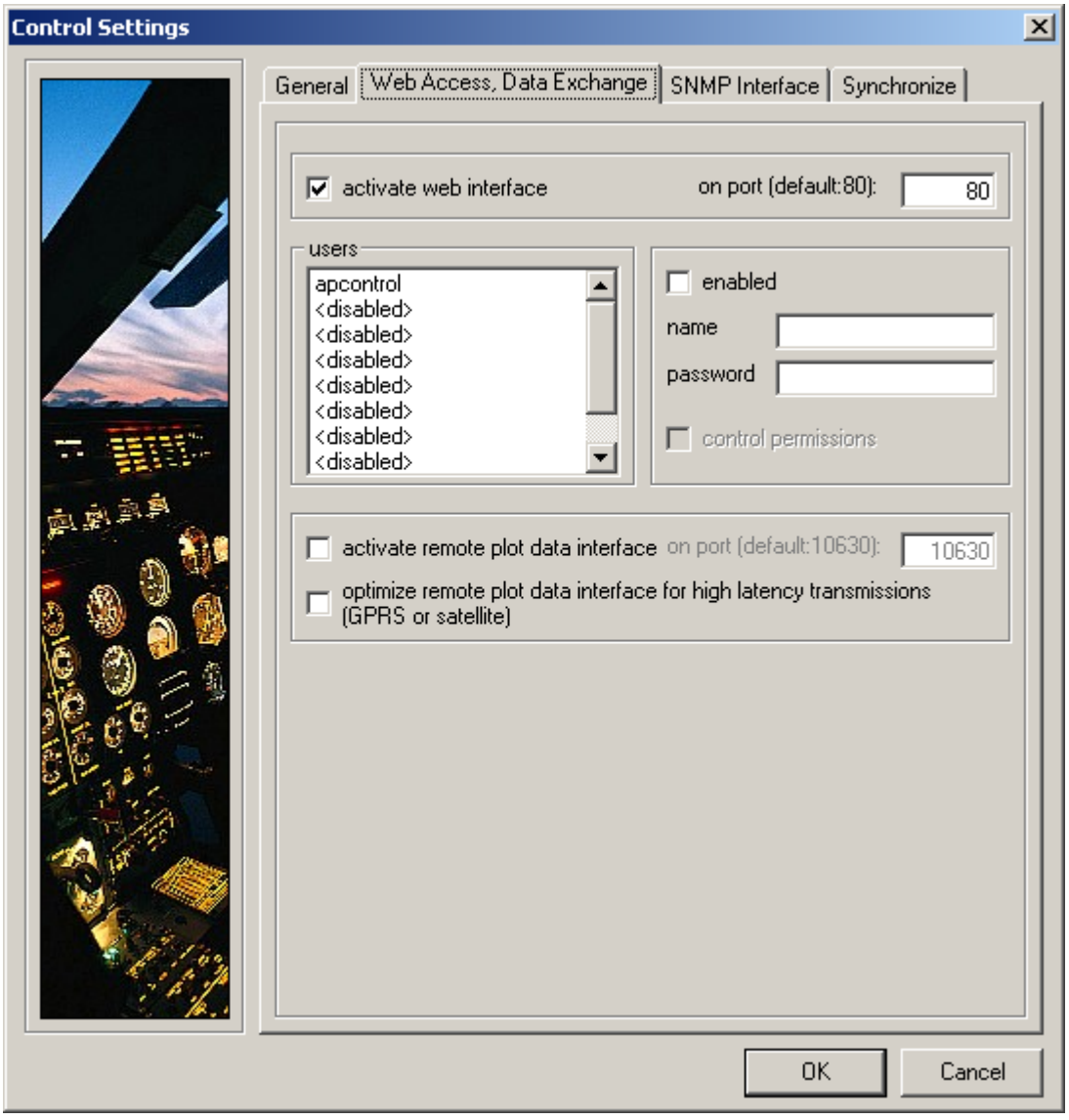
call external process	The specified external process is called, passing the specified command-line argument.
open RAS connection	Dials or initiates the specified Windows RAS (Remote Access Service) connection, such as dial-up connections and virtual private networks.
close RAS connection	Closes the specified Windows RAS connection, if active.
start measurement	If possible the latest measurement is resumed, otherwise a new measurement ist started.
stop measurement	A running measurement is stopped.
perform self-test	A self-test is performed. If this happens while a measurement is running, the measurement is interrupted, a self-test is performed and the measurement is resumed automatically afterwards.
send SMS	Send a SMS to the specified mobile phone number with the specified message text. If the text is too long, it is splitted into multiple (up to 10)

	SMS.
restart web interface	Restarts the APRun web interface. This action should be called if local IP addresses have changed.
shutdown computer	The PC is shut down.
reboot computer	The PC is rebooted.
quit APRun	APRun is terminated in a controlled way.

Available placeholders for action parameters:

$SYSTEM_STATUS	Holds a copy of the current System Status in abbreviated form (suitable for SMS messages)
$ERROR_MESSAGE	Holds the latest error message text.
$MND_FILENAME	Holds the filepath of the most recent main data file.

5.6.5.3 Control Settings – Web Interface, Data Exchange



This dialog covers the configuration of the built-in web server and permits you to enable the remote plot data interface.

The remote plot data interface permits other instances of APRun to retrieve online and recorded plot data over a network connection. You may additionally choose to optimize connection time-outs for slower connection types like if you are using satellite or GPRS connections.

If the web interface is enabled, you may access it by entering the IP address and the used TCP port (in the case that you are not using the default port 80) into the address bar of Internet Explorer or any other web browser.

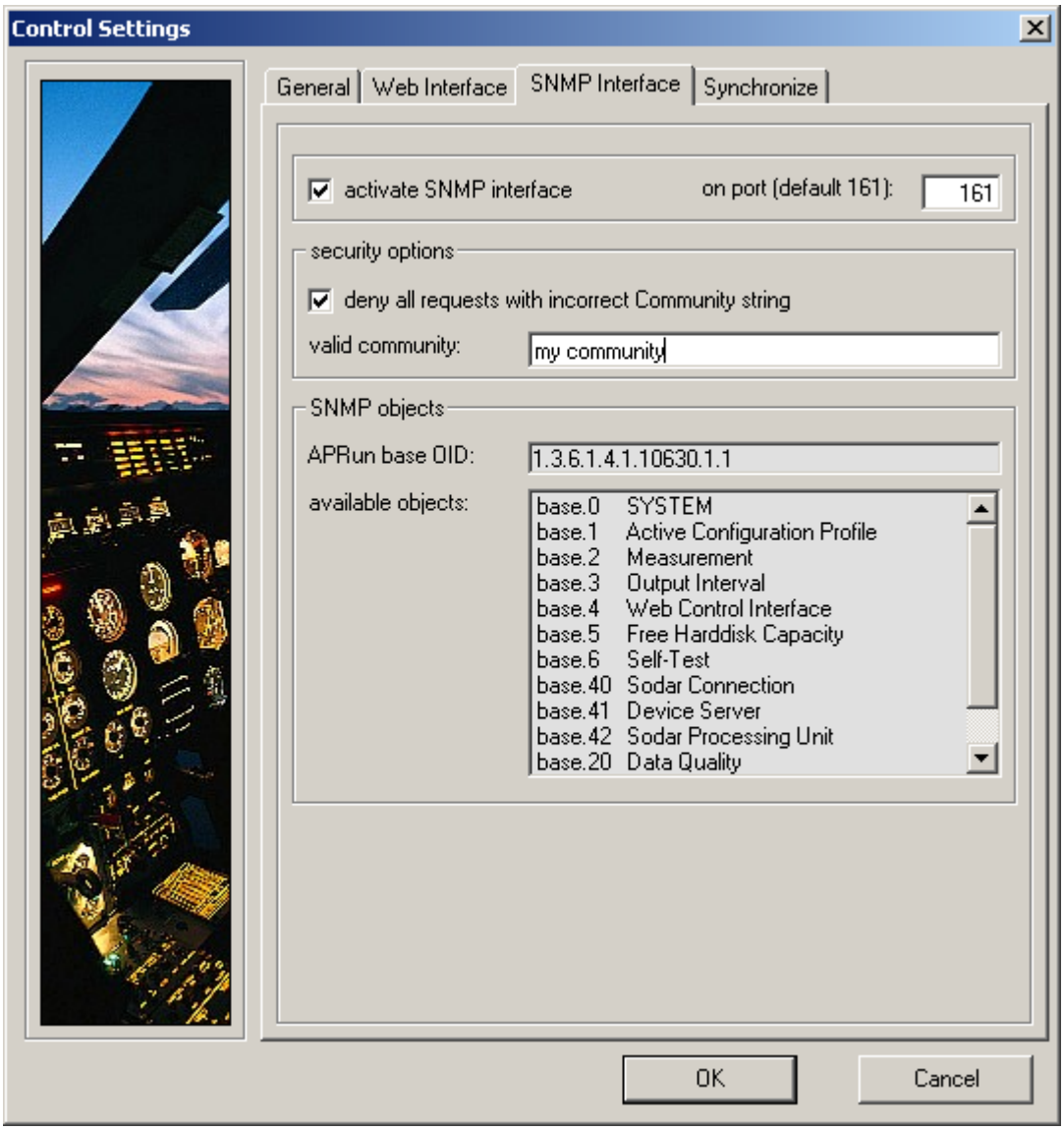
Example:
Lets assume that the web interface is enabled on port 15000 on a PC with the IP address 192.168.129.73. Then you would have to enter the following address:

Important notes:

- In order to access the web interface there must be an active network connection to the PC (either WAN or LAN) that permits TCP/IP communications.
- Make sure to configure your firewall (if present) to allow TCP connections to APRun on the selected port.
- Enabling the web interface on a PC that is directly accessible from the internet without further precautions may comprise a potential security risk.

activate web interface	This option must be checked in order to allow any remote access via a web browser.
on port	This is the TCP port on which the APRun web interface will be accessible. The default port for HTTP is 80. You should choose a different port number if port 80 is already in use by another application (e.g. another web server running on the same PC).
user enabled	To add a new user, select a <disabled> entry of the users list and check the enabled checkbox. To remove the highlighted user uncheck the enabled checkbox.
user name	Enter a user name for web interface authentication.
user password	Enter a user password for web interface authentication.
user control permissions	If checked, the highlighted user will be granted control permissions, i.e. the user will be allowed to - start a measurement - stop a measurement - modify any settings - perform a self-test - shut down or reboot the PC

5.6.5.4 Control Settings – SNMP Interface



The APRun SNMP interface is intended to help with the integration into systems and networks that are monitored via SNMP – the Simple Network Management Protocol. However, for most users the SNMP interface will not be required at all.

A file containing the SNMP MIB (Management Information Base) for all objects provided by APRun is available from Scintec on request.

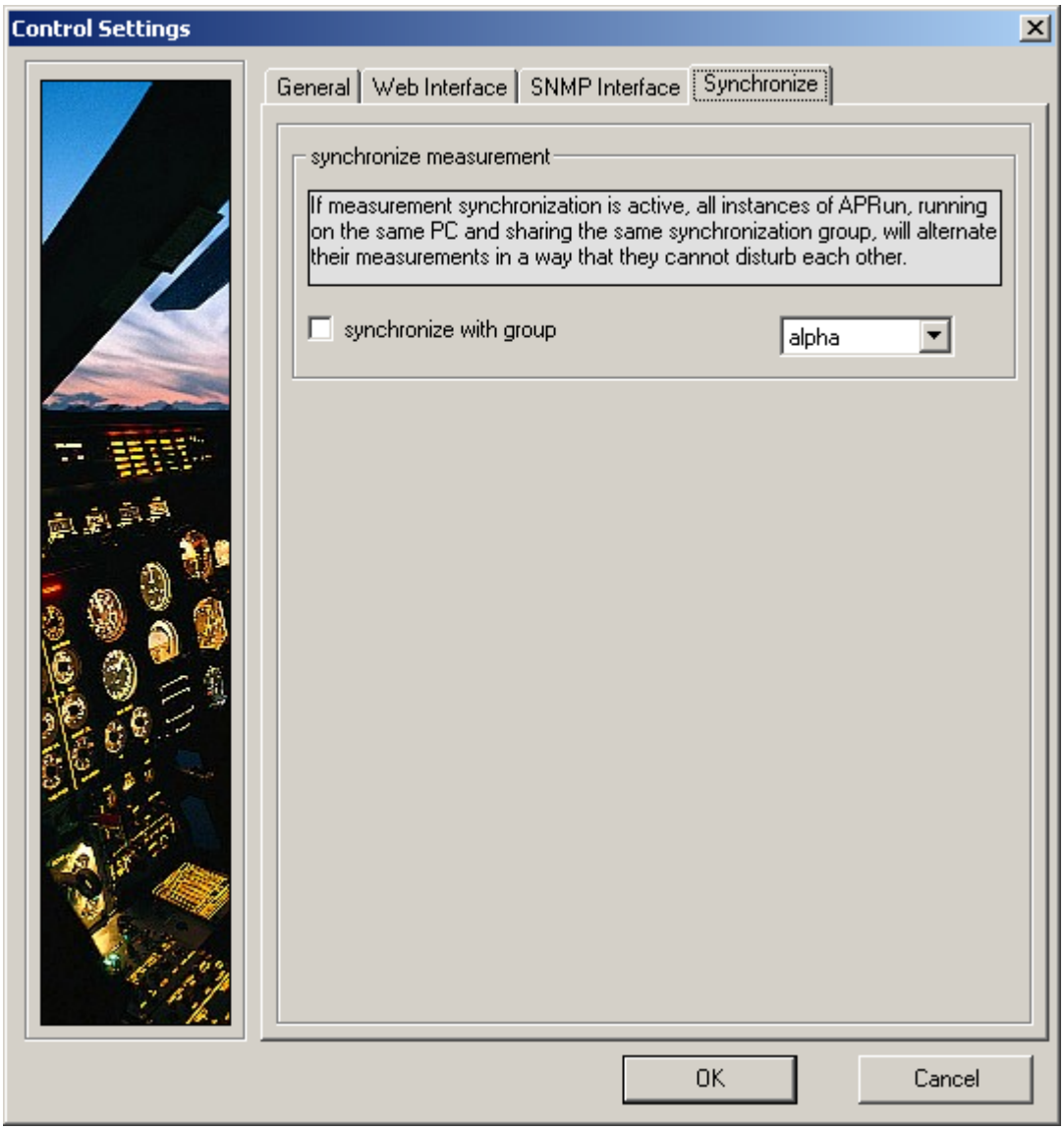
Important note:

- On most systems Windows is running its own SNMP Service in the background. It is not possible to use the Windows SNMP Service and the APRun SNMP Interface at the same time on the same port. Either the Windows SNMP Service must be stopped or APRun must be configured to use a different SNMP port (not 161) to avoid conflicts.

activate SNMP interface	Enables the built-in SNMP agent.
on port	The TCP port that shall to answer SNMP requests.
deny all requests with incorrect community string	If checked, the community string will be used as a kind of password allowing APRun to respond to authorized

	SNMP requests, only.
valid community	Community string (see above).
base OID	(cannot be changed) This it the globally unique object ID (OID) that is assigned to the Scintec APRun software by the IANA – (Internet Assigned Number Authority).
available objects	A list of all objects that can be requested via SNMP.

5.6.5.5 Control Settings – Synchronize



Under some circumstances the operation of multiple Sodars should be synchronized to avoid that they disturb each other. Normally, any two Sodars that are situated in hearing distance to each other should be synchronized only...

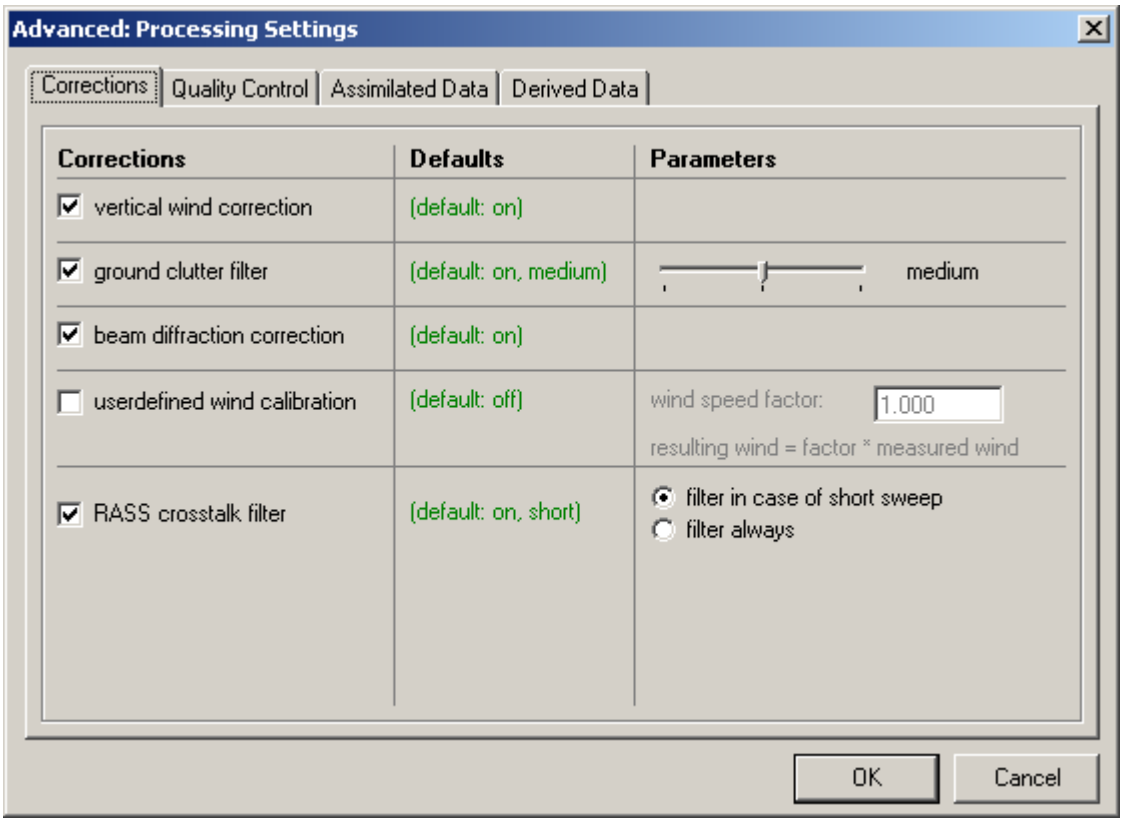
- if they are of the same device type (both SFAS, both MFAS or both XFAS) or
- if they are of different device types, but situated very closely together, i.e. less than 100 m or
- if they are of different device types and the sound level generated by one Sodar reaches 50 dba - measured at the location of the other Sodar or
- if one of the Sodars is an SFAS and the other one is equipped with a RASS extension.

synchronize with group	Enables synchronization for this instance of APRun with all other instances of APRun, - that are running on the same PC and - that have also enabled synchronization and - that share the same synchronization group.
synchronization group	See above.

5.6.6 Advanced: Processing Settings

This dialog is intended for the advanced and experienced user, only.
You may modify any settings for a reprocess.

5.6.6.1 Advanced: Processing Settings – Corrections



The vertical wind correction corrects for the projection of the vertical wind component onto the horizontal wind measurements. This is particularly important in the case of strong vertical wind components.

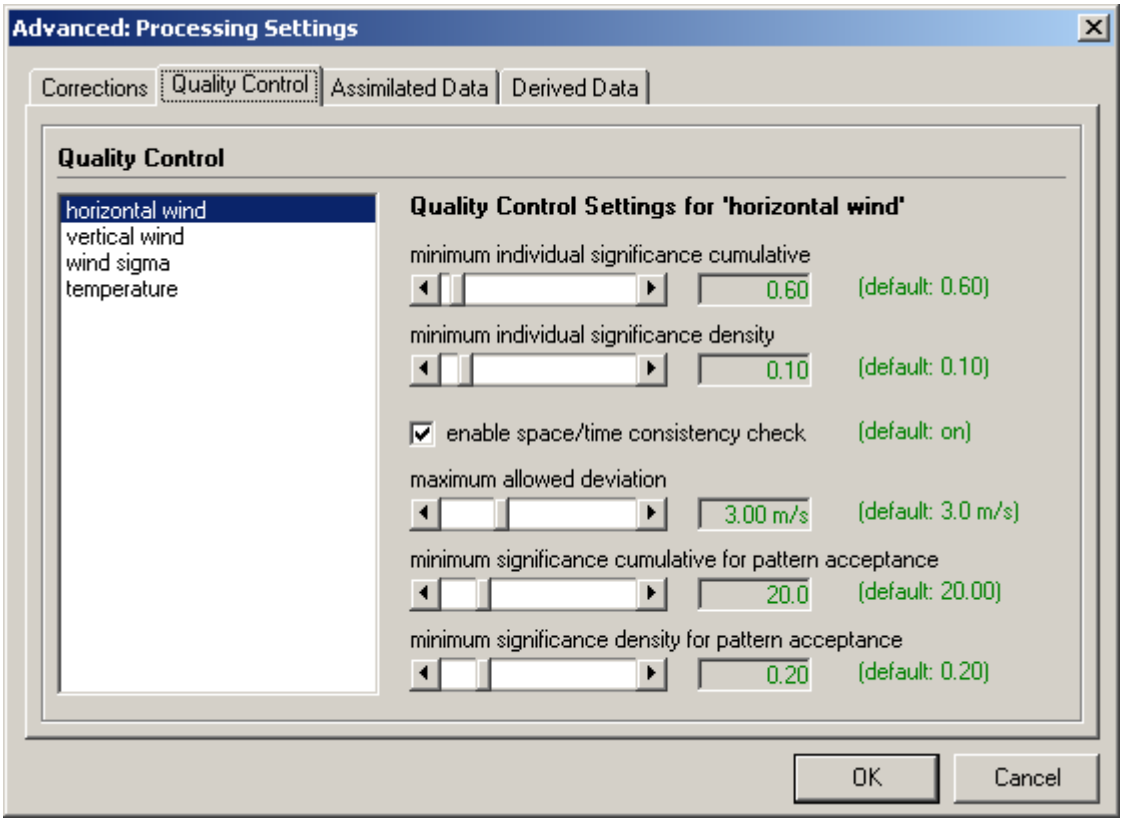
The ground clutter filter identifies and removes ground clutter from the data. You may choose the sensitivity of the ground clutter filter from tolerant over medium to strict.

The beam diffraction correction numerically compensates for acoustic diffraction at the sodar enclosure and takes into account the amplitude shaping and speaker beam patterns of the respective sodar antenna. This correction is applied individually to the raw signals of each frequency and transmission angle. It is generally recommended to have this correction enabled in order to maintain highest precision of horizontal wind speed results.

The userdefined wind calibration option permits to apply an additional external wind speed calibration to horizontal wind data. If enabled, it will increase (factor > 1) or decrease (factor < 1) the horizontal wind speed and horizontal wind speed components by the specified factor.

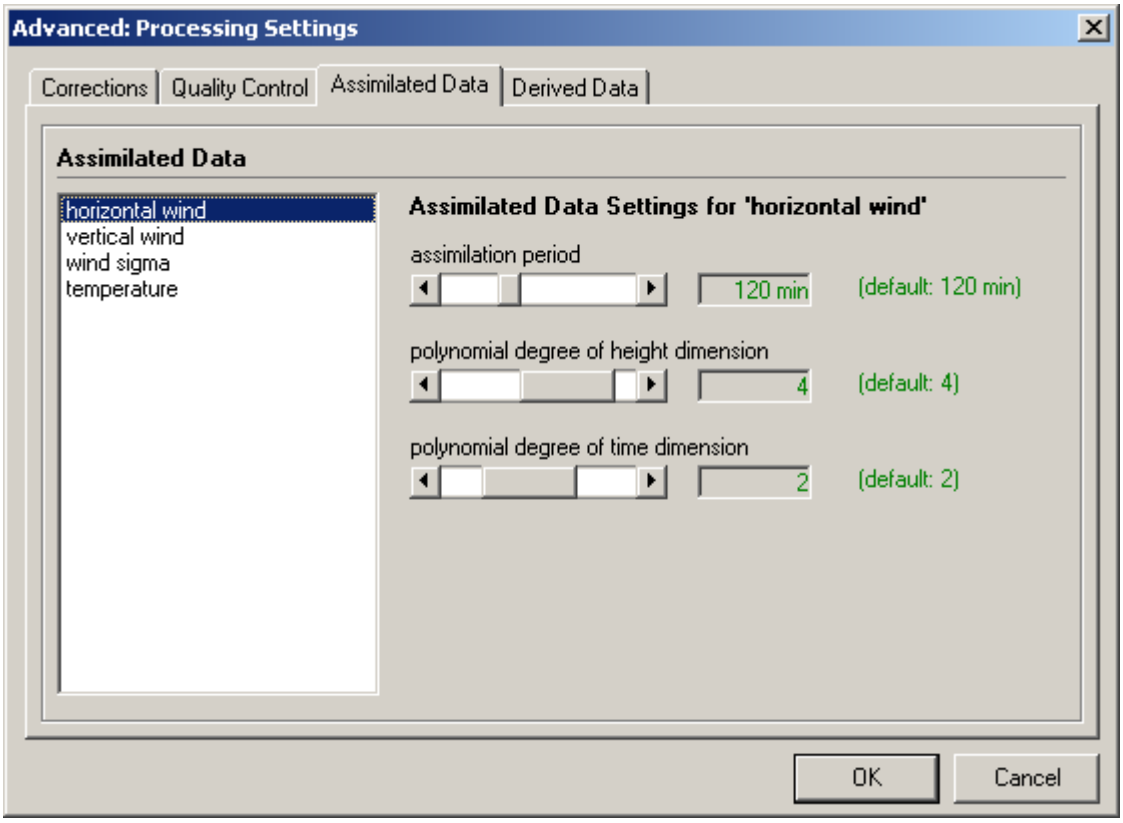
The RASS crosstalk filter removes RASS data that is recorded during RASS sound emission periods to effectively remove RASS crosstalk distortions. Crosstalk distortions are avoided by setting up enclosures around RASS or windRASS transmission antennas.

5.6.6.2 Advanced: Processing Settings – Quality Control



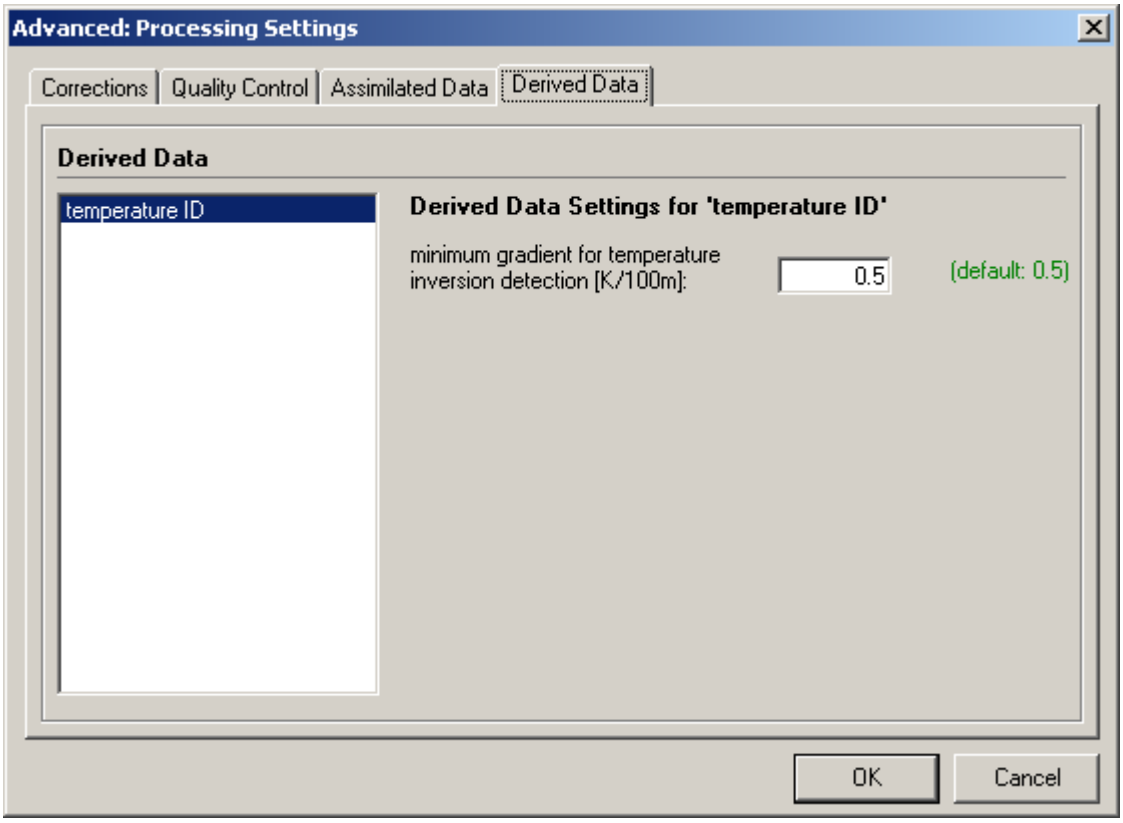
The signal quality thresholds involved in quality control checks are individually configurable.
If enabled, the time/space consistency filter removes inconsistent wind and temperature results.

5.6.6.3 Advanced: Processing Settings – Assimilated Data



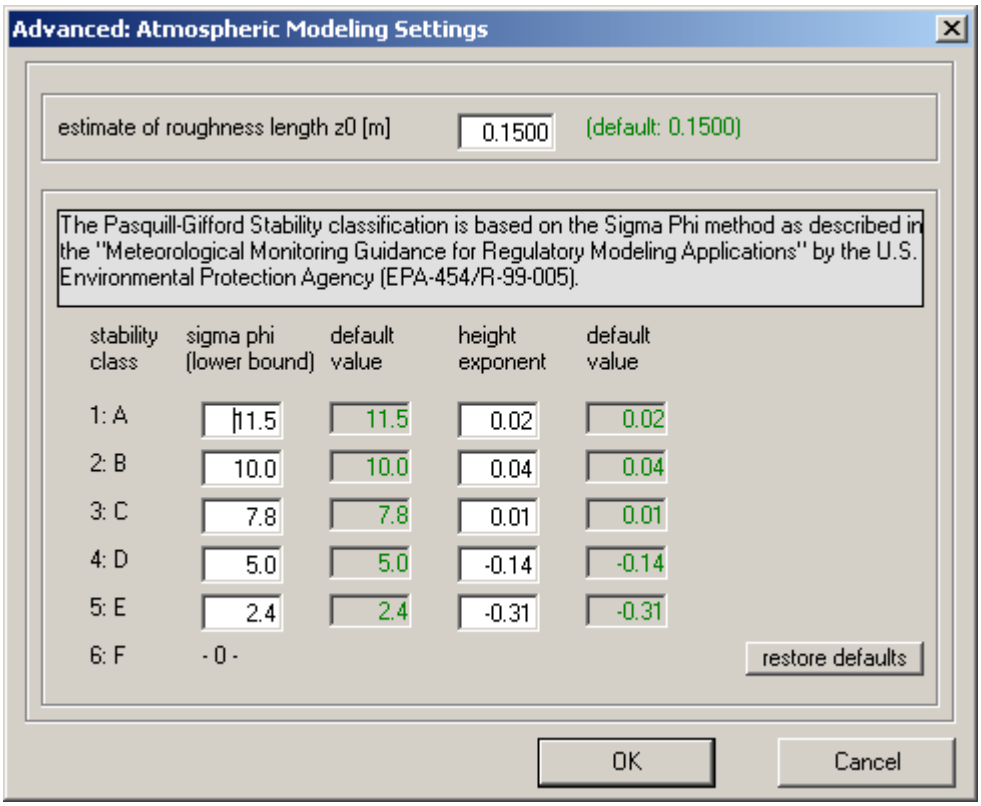
During calculation of the assimilated data the values are approximated by a two-dimensional polynomial fit. You may choose the assimilation period that defines how far the fit shall extend over past results and the polynomial degrees in height and time dimension. This way you may control how quickly the assimilated data adapts to environmental changes and how strong temporal and spatial variations are permitted.

5.6.6.4 Advanced: Processing Settings – Derived Data



The temperature gradient threshold for temperature inversion detection may be adjusted.

5.6.7 Advanced: Atmospheric Modeling



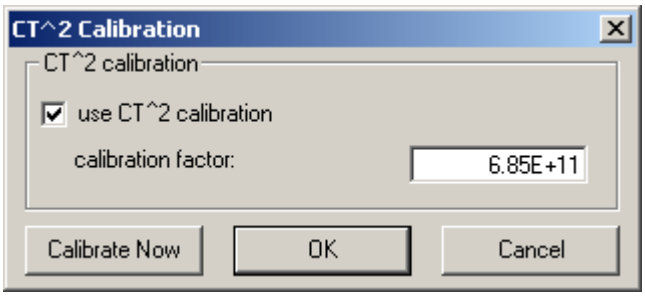
The calculation of Pasquill-Gifford stability class, surface heat flux, friction velocity and Monin-Obukhov length require an estimate of the surface roughness length z0.

Additionally, this dialog permits the adjustment of threshold values for the Pasquill-Gifford determination. The preconfigured defaults can be restored by pressing the restore defaults button - for most sites they should provide a good starting points.

The Pasquill-Gifford Stability classification is based on the Sigma Phi method as described in the *"Meteorological Monitoring Guidance for Regulatory Modeling Applications"* by the U.S. Environmental Protection Agency (EPA-454/R-99-005).

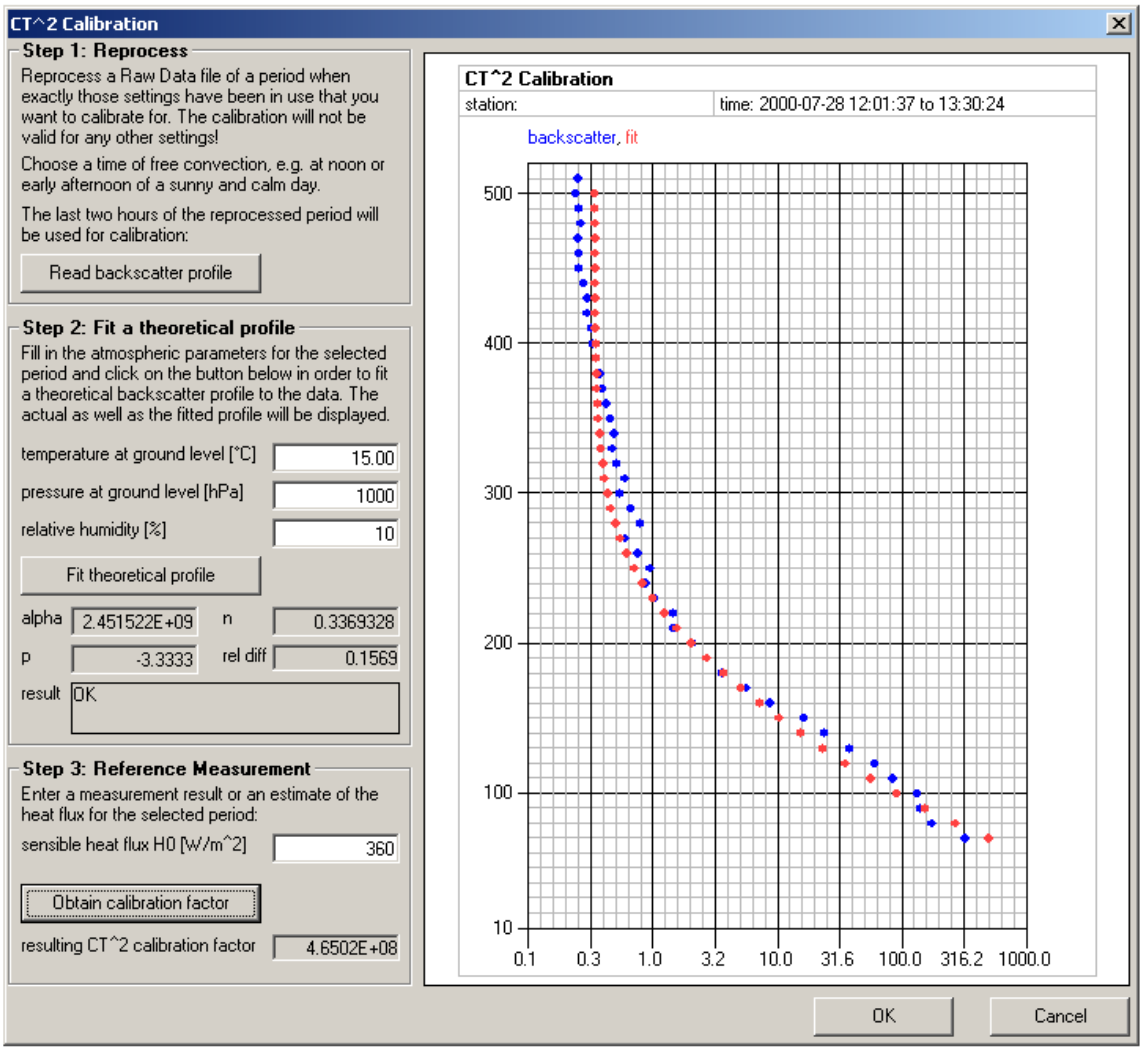
For more information and a detailed description of the parameters see there. The document is available in electronic form on request.

5.6.8 Advanced: CT^2 Calibration



use CT^2 calibration	activates the calculation of CT^2 from backscatter data
CT^2 calibration factor	calibration factor for CT^2 calculation This factor should not be entered directly but be derived by pressing the calibrate ... button as described in a later section.

In order to permit APRun to calculate CT^2 values from the uncalibrated backscatter data, a CT^2 calibration must be done before.
The calibration does not affect any other output variable than CT^2 and there is no need to do a calibration if your application does not rely on the CT^2 results.



To do the calibration, please follow the instructions at the left bar of the calibration window. The resulting calibration factor will be applied to the current Environment Settings when you press the OK button.

Some notes on CT^2 calibration:

- *The CT^2 calibration will be valid as long as you do not modify neither the* Measurement Settings *nor the* Emission/Reception *settings – otherwise you must repeat the calibration procedure with a new data set that is measured with the modified settings.*

- Before doing the calibration for the first time you should be familiar with the concept of data reprocess.

- In some cases it will be necessary to try the calibration with several data sets of different days in order to find a data set that is suitable for the calibration.

End Of Document