SWR TRUE
Antenna Analyzer
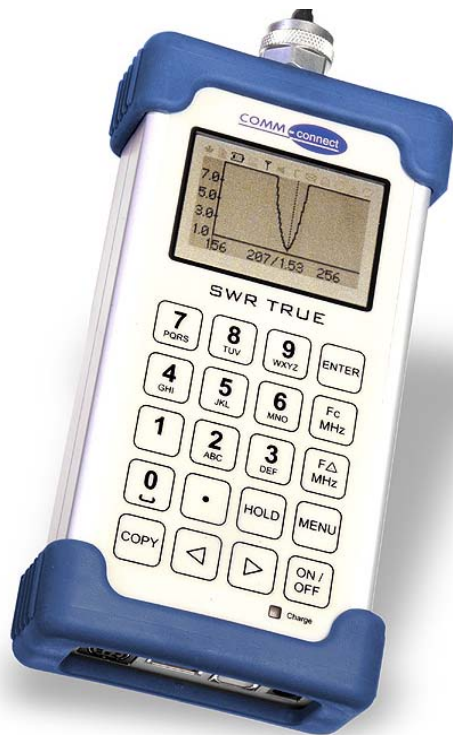
Operators Manual

LBA® **COMM - connect**

EDITION NOTICE:

This publication applies to COMM-connect A/S SWR True type 3013 SWR Analyzer product hardware release "1A"and software release 3013 suffix 3B.

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GENERAL SAFETY:

SWR TRUE should only be used for its intended purpose and never be con- nected to cables carrying hazardous voltages.

When handling NiMh batteries great care should be observed preventing polarity reversal and short circuit as the batteries may explode or catch fire

GENERAL INFORMATION.

Description:

The SWR TRUE instrument is an Antenna Analyzer for analyzing Antennas and feeder cable VSWR or Return loss. The instrument measure the return loss by using a Wheatstone RF bridge, a detector and a RF Generator. The control of the entire instrument is by a microprocessor. The microprocessor is running in a MOP (Micro Operating Program) environment. The MOP schedule and execute all tasks required to handle the LCD Screen, the Key- board, The RF generator, USB interface, serial interface, time of day clock and measurement calculations.

The RF generator covers the frequency range from 30MHz to 2700MHz by using two PLL generator covering 650MHz to 1450MHz and 1450MHz to 2700MHz. The low frequency range from 30MHz to 650MHz is covered by mixing the two PLL generators.

The instrument has a built in time of day clock. This clock is used to identify the output files going to either USB or serial interface.

Options:

The XML Data option, this option will allow the user to enter specific data into the instrument regarding Operator name, Location of Object, Type of Object. The feature will have an XML file viewer or the data could be used in all PC programs supporting XML data format (Microsoft, LINUX etc.)

Remote Control, this option will allow the instrument to be controlled by the USB B type serial interface. The setup going to the instrument and the measurement data coming from the instrument can be a part of a large test system.

Options continued:

Accessory Kit, this kit contains a Soft carrying bag, adaptors from the "N" female on the instrument into "BNC" female, "TNC" Female, Mini "UHF", "FME" male and a 7.5Volt regulated Cigarette Lighter Charger.

Battery and Charging:

The batteries used are NiMh. There are four 1.2Volt cells. In order to charge the batteries there is a built in constant current circuit, the time needed for a full charge is approximately 14 hours. The 6Volt regulated charger supplied will allow the instrument being operated directly from the charger and at the same time charge the batteries when plugged in. Also the cigarette lighter supplied in the accessory kit can run and charge the instrument from your 12Volt car battery at the same time.

Warranty:

The SWR TRUE has a 1 year total warranty covering parts and labor as long as the instrument has been used according to the instructions in this manual, and has not been subject to any abuse. Warranty will cover the return shipment after repairs.

Connections:

Mini Din
Programming and RS232
Pin 1 RX Data
Pin 2 TX Data
Pin 3 Pgm Clock
Pin 4 Pgm Data
Pin 5 Pgm Control

USB A Busy
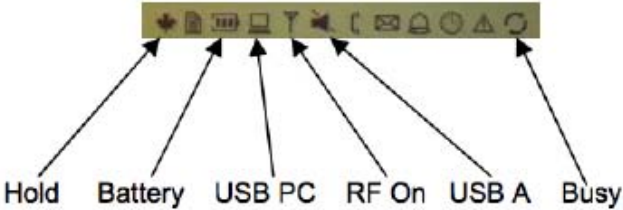USB A Memory Stick
USB B PC Serial Device
DC 7.5Volt regulated Charger @ 700mA + on center pin

Mini Din   USB A   USB B   DC

OPERATING

The Front Panel:

Test Connector

Graphic Display

Icon Line

Keys

Charge indicator

Icons

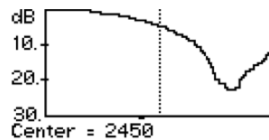Hold   Battery   USB PC   RF On   USB A   Busy

Power On/Off

Pressing the ON/OFF button will switch on the instrument. A welcome screen will appear like this:

The instrument will run for the duration of the auto power off period.

Center Frequency

Pressing the Fc button on the keyboard will give a screen with an entry field Center = pressing the numeric keys you can enter any frequency from 30MHz to 2700MHz. To correct entry you can use the arrow keys. Press the enter key to change the center frequency.

Note that the Center frequency will have priority over the Frequency span (FΔ) making automatic adjust to fit inside instrument range.

Frequency Span
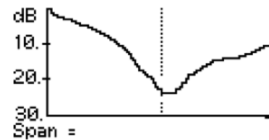
Pressing the FΔ button on the keyboard will give a screen with an entry field Span = pressing the numeric keys, you can enter any frequency span from 0MHz to 2670MHz. To correct entry you can use the arrow keys. Press the enter key to change the frequency span.

Note that the frequency span will be adjusted automatic to fit within the range boundaries and the actual center frequency.

Marker
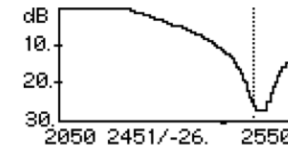
The marker functions are controlled by the arrow keys when the instrument is in sweep mode. By pressing the left or right arrow the marker line moves across the screen. When the key is held pressed, a mini cursor will be seen moving across the screen and when the key is released, the marker will appear in the new position. The marker will display the frequency and the measured value of the marker position on the bottom line. If you press the "ENTER" key, the marker position will move to the center of the screen and adjust the frequency span symmetrical on both side of the new center fre- quency.

Hold and Copy
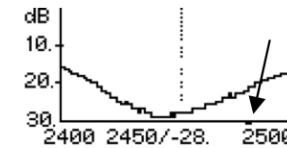
When "HOLD" is pressed, the sweep position indicator stops at the current position and freezes the screen. In "HOLD" mode the frequency sweep is stopped and depending on the setting of Oscillator, the RF is either On or Off. (see menus)

The "COPY" key will write the screen contents to the USB Memory stick or to the USB Serial Device. The "COPY" function will create a Directory with the date as directory name YYYYMMDD e.g. 20080826. In the directory the screen files are written as .BMP with the time stamp as file name HHMMSS e.g. 164852.BMP . During write to USB the busy icon is on, when busy goes off, it is safe to remove the USB device.

MENUS

Main:

```
            Main Menu
      1 Light On
      2 Y Scale
      3 X Scale
      4 Date/ Time
      5 Info
      6 Settings
```

1 Light On will change the setting On/Off of the back light when activated.

2. Y Scale:

```
          2    Y Scale
      1 0-15 dB
      2 0-30 dB
      3 Auto dB
      4 SWR 5-1
      5 SWR 9-1
      6 SWR Auto
```

The vertical scale can be chosen between return loss in dB and as a nu- meric VSWR value, in each group you may choose the scale that fits your need or the auto scale function.

3. X Scale:

```
          3    X Scale
      1 Ends Cur/va
      2 Span Cur/va
      3 Cent Cur/val
      4 Center Span
```

The Horizontal scale can be chosen to have different layout.
X1 will have start frequency, curser frequency with value and stop fre- quency.
Settings 2 the contrast of the LCD screen can be adjusted, you may adjust from 50 to 99. Factory default is 70.
X2 will display FΔ and curser frequency with value. X3 will display Fc and curser frequency with value. X4 will display Fc and FΔ frequencies.
Settings 3 the file system may be selected where 1 is the time/date format and 2 is the XML format selectable, if the XML Feature is installed.
Settings 4 is the choice of having the RF generator stopped or running dur- ing "HOLD" mode.

4. Date and Time:

```
          4    Date/ Time
      1 Day       26
      2 Month     8
      3 Year      2008
      4 Hour      17
      5 Minute    13
```

The date and time can be entered and will run real time as long as the SWR True is charged and have battery voltage to sustain operation.

MENUS (CONT.)

5. Info:

```
          5    Info
      1 Operator   BILL C
      2 Address    W DC
      3 Device Id  2400 03
      4 Device Typ GP
      5 SerialNo   1
```

In this menu Data to be used with the XML Feature can be entered; data is stored with the time stamp and screen copy in XML format.

6. Settings:

```
          6    Settings
      1 Power Min  5
      2 Contrast   70
      3 File sys   1
      4 Hold Osc OFF
```

Settings 1 you set the time to auto power off function will switch off and save battery power. The time to power off can be set from 1 to 127minutes. If the power off time is set to 0 the automatic power save function is dis- abled.

Settings 2 the contrast of the LCD screen can be adjusted, you may adjust from 50 to 99. Factory default is 70.

Settings 3 the file system may be selected where 1 is the time/date format and 2 is the XML format selectable, if the XML Feature is installed.

Settings 4 is the choice of having the RF generator stopped or running dur- ing "HOLD" mode.

MAKING MEASUREMENT

Connecting antennas:

Observe the utmost care when connecting antennas via cables , as these cables can be connected to transmitters and /or power sources! Make sure you have chosen the antenna you intend to test!! Connection to transmitters and/or other sources can destroy the instrument or cause hazardous electri- cal conditions.

When connecting to the "N" female connector on the instrument make sure you are using either "N" male antenna or cable connector.

If antenna or cable is fitted with another type of connector use appropriate adapter. Please observe that the use of adapters and cable connections of poor quality may influence the SWR and give higher readings than the ac- tual antenna SWR. Once the antenna has been connected to the instrument you switch the SWR True on and select the relevant frequency band by using the Fc and FΔ. By sweeping the frequencies of interest while observ- ing the graphs on the screen you should see VSWR or Return Loss curve. Antennas are usually designed to have a SWR below a given value within the band for which it is designed. As an example a GSM 900 antenna could have the follow-ing specifications: Range 890 - 960 MHz SWR less than 2.0:1 typical 1.5:1.

Nearby objects:

When testing SWR on low gain antennas (Gain <3dBd) the influence from nearby objects is small when the objects are more than $1/2\lambda$ away (15 cm at GSM900). When testing high gain antennas (e.g. Yagi's and panel's) you should avoid objects in the direction of radiation.

Strong RF fields:

When testing SWR on antennas located in strong RF fields, the reading you will get on the SWR meter may be incorrect, because the strong RF field pres-ent will be indicated as reflected power coming from the antenna. If a precise reading is needed, you must switch off the disturbing source of RF or move the antenna under test out of the RF field.

Bandwidth:

Some antennas may need tuning by adjusting the length of an element or by other means in order to cover the entire band of interest, please refer to antenna manu-facturers instructions for details.

Duplex operation:

When checking antennas to be used for duplex operation, make sure the antenna SWR is adjusted for the lowest possible SWR in both receive and transmit band.

General hints:

Always refer to antenna manufacturers specification! Antennas may have more than one resonance frequency! A very narrow resonance frequency may indicate resonance of cable instead of antenna resonance (Cable bro- ken or shorted)!

KEEP CONNECTORS CLEAN AND TIGHT!

SPECIFICATIONS

Model	SWR TRUE Type 3013
Application	Measurement of SWR in 50 Ω transmission lines
Frequency range	30->2700 MHz entered as centre and span
Center Frequency	30 to 2700 MHz.
Span	0 to 2670 MHz.
Frequency stability	±20ppm
Measurement range	1.0<SWR<9.9, 0<dB<-30dB
Impedance	Nom. 50 Ω
Generator output	Approx. -4dBm
Max. input on test terminal	100 mW
Tolerance on SWR reading	30-1000MHz)± 5%; 1000-1600MHz ± 10%; and 1600-2700MHz ±15%
Operating temperature range	0° C-> + 50° C
Storage temperature range	-30°C -> + 50° C
Connectors	"N"-female RF test connector. USB A type for memory key. USB B type for serial PC communication. Mini DIN for RS232 communication up to 38400 Baud
Power supply	4 NiMH type AA rechargeable batteries (Batteries, NiMH rechargeable and 110VAC/7.5VDC charger supplied)
Auto Power off	For battery economy, SWR TRUE automatically turns off 3 min. after last entry
Normal operating use	Fully charged: More than 10 hours.
Colour	Silver/blue
Width	82 mm
Depth	31 mm
Height	165 mm
Weight	500 gram (incl. Batteries)
EMC	Complies with directive 89/336EEC as amended by 92/31EEC and 93/68/EEC
Standards	Emissions: EN 61000-6-4: 2001 Immunity: EN 61000-6-2: 2005

XML FEATURE:

In order to use the XML feature this must be installed. When the feature is installed You can take advantage of the info menu 5 where operator , address, device and types can be entered.
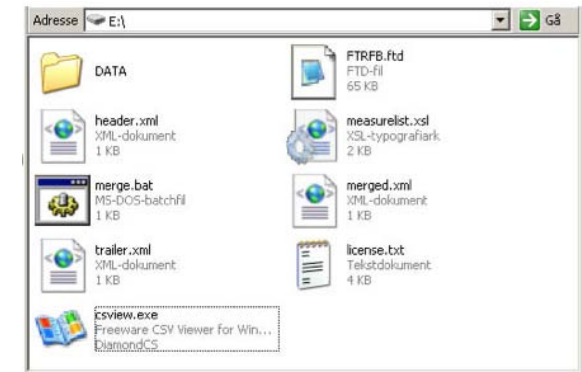
Also you can choose between the stan- dard .bmp picture copy (File sys 1)or the XML type where all info is copied onto the USB memory stick (File sys 2)

Along with the XML Feature is a USB Memory Stick with program files:

After inserting the USB memory stick into the SWR True and pressing "COPY" the Screen is copied to the USB memory stick along with Info data, time of day, date and table data for each of the 101 data points on screen.

Taking the USB memory stick to your PC you can execute the "merge.bat" program which will give you all stored data in the following format:

XML FEATURE CONTINUED:

On the USB memory stick is a directory called Data, this directory will hold your stored data including spread sheet data and bmp files.

The bmp files can be viewed using any picture viewer and from the viewer it can be zoomed and printed.
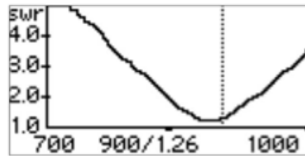
The spread sheet files xxxxy- yyy.csv are files where the name is xxxx Serial of the in- strument yyyy is the sequential file number. In the files are the measurement data for each point on the screen sepa- rated by commas. Each data entry is the frequency, reflection coeffi- cient RHO, Return loss in dB and the VSWR.

The spread sheet files can be viewed with the program CSVIEW located onto the mem- ory stick

Data in these spread sheets files can be imported and used for making all kind of drawings, statistics and calculations by standard spreadsheet programs.

OPTIONAL ACCESSORIES KIT:

Automobile cigarette lighter regulated 7.5Volt charger. With lighter jack and 5.5 mm DC plug.

Coaxial adapters to fit "N" at the Test port:
N male / FME male
N male / BNC female
N male / TNC female
N male / miniUHF female
Soft canvas case

CONVERSION TABLE:

Teturn Loss In dB	Reflection Coefficient, r	VSWR
1	0.891	17.4
2	0.794	8.72
3	0.707	5.85
4	0.631	4.42
5	0.562	3.57
6	0.501	3.01
7	0.447	2.61
8	0.398	2.32
9	0.355	2.10
10	0.316	1.92
12	0.251	1.67
14	0.199	1.50
16	0.158	1.38
18	0.126	1.29
20	0.100	1.22
25	0.056	1.12
30	0.032	1.07
35	0.018	1.04
40	0.010	1.02

ABBREVIATIONS

SWR, VSWR	(Voltage) Standing Wave Ratio
RF	Radio Frequency
MHz	Mega Hertz
GaAs	Gallium Arsenide
MMIC	Monolithic Microwave Integrated Circuit
SMPS	Switched Mode Power Supply
GSM	Global System for Mobile
dBm	deciBell referenced to 1 milli Watt
dBd	deciBell referenced to half wave dipole
ppm	parts per million
LCD	Liquid Crystal Display
AC	Alternating Current
NiMH	Nickel Metal Hydride

LBA® COMM - connect

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