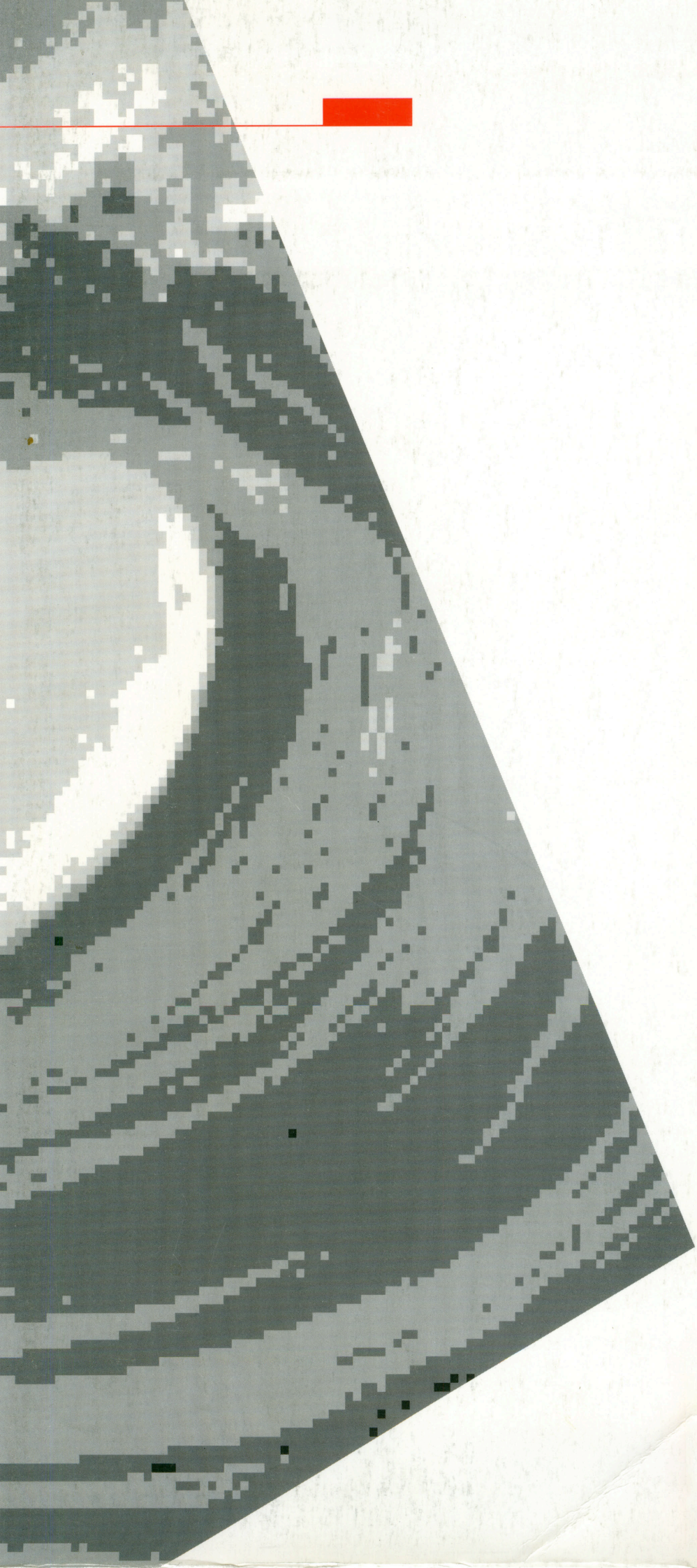

RE 331
RDS Decoder
Operator and Service Manual

Volume I

Operator and Service Manual
RE 331 RDS Decoder

Version 2.3

May, 1993
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SAFETY PRECAUTIONS FOR LINE-POWERED EQUIPMENT

All line-powered equipment can be dangerous. Therefore, certain basic rules and precautions must be observed to ensure the best possible safety for users, service personnel, as well as third parties.
At RE TECHNOLOGY AS we have taken great care during the design and production of our equipment. However, safety may be impaired by incorrect installation, handling, or intervention.

WARNING

Ensure that the line cable, connectors, and power outlet all have the correct configuration, to establish a protective earth.
Disconnecting the protective earth conductor, inside or outside the equipment, may potentially be hazardous to the operator.
Removing the covers may expose parts carrying potentially dangerous voltages.

INSTALLATION

This is a Safety Class I instrument which requires protective earthing via the IEC power inlet.
Before switching on, the instrument must be connected via the third wire in the power cable to a protective earth contact in the mains socket. The protective action must not be negated by using an extension cord (power cable) without a protective conductor (protective earth). Grounding one conductor of a two-conductor outlet is not sufficient protection.
Ensure that the line fuse has the correct value according to the voltage and power consumption.
If the equipment requires separate signal grounding, through external connections to the equipment chassis, do not disconnect the protective earth.

SERVICE

Only trained service personnel should attempt to dismantle and repair the equipment.
Take great care during the installation and service of equipment, especially when adjusting or measuring an open piece of equipment under voltage.
Before removing any covers, switch off the equipment and remove the line cable from the power outlet.
Capacitors inside the equipment may hold dangerous charges for a considerable time after the equipment has been switched off.
If it is necessary to replace components in the line connected partition or area, use only new parts of the correct and approved type. Take special care to maintain or re-establish the protective earthing. The conductivity must be measured after the service or repair is finished.
Do not remove any warning labels. Replace any damaged or illegible labels with new labels.

SAFETY SYMBOLS

The product will be marked with this symbol when it is necessary for the user to refer to the manual in order to protect against damage to the product.

Ground terminal (sometimes used in the manual to indicate circuit common connected to chassis).

Warning lable for laser radiation. The product is marked with this symbol if it is necessary to protect against laser radiation which is invisible and can cause permanent damage to the human eye.

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LIST OF CIRCUIT BOARDS

Name	Code No.	Diagram
Digital Motherboard	906-131	985-325
CPU Board	901-874	985-394
Communication/Sync Board	901-875	985-319
Power Supply	906-137	985-323
Analog Motherboard	901-882	985-326
Demodulator Board	901-877	985-321
Level Measuring Board	901-880	985-324
Phase Measuring Board	902-010	985-362
Remote and Alarm Board	901-878	985-322
Keyboard	902-239	985-328
Front Panel Board	901-883	985-327
Rear Panel Board	901-876	985-320
MPX Scanner	902-018	985-369
RF Scanner	902-061	985-411

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1. INTRODUCTION

1.1 Introduction

The RE 331 is a modular RDS Decoder used for checking an RDS signal according to EBU Doc. Tech. 3244 "Specifications of the Radio Data System RDS for VHF/FM Sound Broadcasting". Also the RE 331 is able to check a VRF signal, if present.

The RE 331 fulfils the requirements of EBU Doc. Tech. 3244 and Pflichtenhefts 5/1.0, 5/3.7 and 5/3.9. Moreover the RE 331 complies with the American RBDS standard.

The RE 331 consists of a basic unit which may be delivered with or without a keyboard and display. Typically, the basic units without a display are installed as "re-broadcast" decoders, or as test decoders on unmanned transmitter sites. Optionally, a Measuring Unit may be installed in the RE 331 enabling it to test level and phase of the RDS and VRF signals.

Mainly, the RE 331 is used to:

* Demodulate the RDS signal and display the RDS information
* Check received RDS information against stored references
* Test the stability of the RDS information
* Supervise the transmission link by measuring the block error rate
* Selectively re-broadcast information via any of three RS-232 interfaces
* Measure RDS level, VRF (SK, BK and DK) level and frequencies and phase relationship between the 19 kHz Pilot and the RDS and/or VRF signals.

The RE 331 RDS Decoder is constructed to fulfill all standards relating to the RDS and VRF systems and at the same time a number of enhancements have been included. Thus the RE 331:

- Checks a total of 11 parameters against two sets of limits: An A and a B limit, where B limits should be used as warnings while A limits are set up as errors.
- Collects RDS information in an Information Memory that may be inspected by pressing the [DISP 2] key - alternatively, the information may be inspected as it is received by pressing [DISP 1].

- Constantly calibrates the Measuring Unit to ensure correct phase and level measurements over time. Optimized filtering enables the RE 331 to be very insensitive to noise in the MPX signal.

- Synchronizes and demodulates RDS information using a Digital Signal Processor (DSP). Using digital filters, the DSP is also used for measuring frequencies and levels of the RDS and VRF signals thus ensuring that these measurements are stable over time.

- Is able to store all settings and reference records in a non-volatile EEPROM, thus ensuring that the decoder loses no data even if the built-in battery fails.

- Uses a VFI display capable of displaying two lines each consisting of 40 characters. This display may easily be read even under the most difficult ambient light conditions.

- Is able to display *all* 253 characters of the complete Latin-based repertoire given in EBU Doc. Tech. 3244 fig. 21.

- Has a built-in real-time clock that allows the RE 331 to store all errors and warnings with time information that allows the user to correlate the errors with other events (linetests, thunderstorms).

- Has a Menu system operating much like the system found in the RE 531 RDS Coder. This means that the different levels of the Menu system are easy to access as every level has its own menu key.

- May be switched between German and English version.

1.2 The Menus

The RE 331 may be adapted to any specific application using 7 menus:

* **SETUP** Menu
* **ADJUST** Menu
* **REF.** Menu
* **LIMITS** Menu
* **V.24** Menu
* **SELECT** Menu
* **AUX** Menu

In the SETUP Menu you can control the error correction/detection capabilities of the RE 331. Also this menu determines which Data Record receives RDS information when the RE 331 operates as a re-broadcast (Ball) decoder.

Using the ADJUST Menu you can enter correction values for RDS and VRF level and phase. Using these correction values, the RE 331 takes known level or phase errors into account during measurements. If the RE 331 is also used to check the performance of the VRF system, the ADJUST menu is used to enter reference BK frequency and BK and DK modulation indexes. The VRF monitoring may also be enabled or disabled from the ADJUST Menu.

The REF. Menu contains the 8 Reference Records that are used to check incoming RDS information (PI, PS and TP).

Using the LIMITS Menu you can set up information and all limits that the RE 331 uses during tests of RDS/VRF parameters.

Using the V.24 Menu you can set up all five RS-232 interfaces of the RE 331, that is baud rate, number of data bits and parity. At the same time you can, by using this Menu enable or disable the information transfer via the three RS-232 interfaces on the rear panel.

In order to act as re-broadcast RDS decoder, the RE 331 allows the user to select which information to be re-broadcasted via any of three RS-232 interfaces. Information is selected from the SELECT Menu.

Using the AUX Menu you can control several other parameters of the RE 331, that is Display modes, Accept/Cancel key on/off, IEEE address, and Real-Time Clock setting.

The display of RDS information, measurement results and errors are controlled using 4 Menus:

* **RDS** Menu
* **ON** Menu
* **MEAS** Menu
* **ERROR** Menu

where

- The RDS Menu displays RDS information from the main transmitter.
- The ON Menu displays information from Enhanced Other Networks (EON).
- The MEAS Menu displays all measurement results, that is, RDS and VRF phase, RDS and VRF level and block errors.
- The ERROR Menu displays A and B type errors that have occurred.

Finally, the TEST Menu checks the correct operation of the RE 331 as it offers a wide range of tests to be performed using various very simple tools.

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2. INSTALLATION

This section contains general instructions for the installation and operation of the RE 331 RDS Decoder. Information in this section is a prerequisite for all other sections of the manual.

2.1 Installation

When unpacking the RE 331, the instrument, the accessories and the packing material should be inspected for any physical damage. Should any item be damaged, please notify the carrier and your local RE TECHNOLOGY representative, or the factory. The packing material should be retained for inspection by the carrier in case of complaint.

The following equipment and accessories should be found when unpacking the RE 331 RDS Decoder:

Code	Type	Description
391-046	RE 331 Silver grey	RDS Decoder, rackmount, or
391-053	RE 331 Silver grey	RDS Decoder, desk top, or
391-052	RE 331 Light grey	RDS Decoder, rackmount, or
391-054	RE 331 Light grey	RDS Decoder, desk top
450-020	1 A	Fuse, slow blow
450-123	2 A	Fuse, slow blow
615-303	230 V	Line Cord
615-403	115 V	Line Cord
983-400		Operator and Service Manual. German text, or
983-405		Operator and Service Manual. English text.

Table 2.1 - Standard Equipment and Accessories

2.1.1 Power Requirements

The RE 331 operates on either 115 V or 230 AC voltage supply. The required line voltage is selected using a code plug that is built into the line adapter at the rear of the decoder.

To change the line voltage, pull out the code plug and re-install it so that the correct text (110-120/220-240 V) is read at the lower part of the code plug. Make sure that the installed fuse has the correct value before installing the code plug:

Nominal Voltage	Voltage Selector	Line Fuse	Order No.
115 V	110-120 VAC	250 V, 2.0 A, slow blow (T)	450-123
230 V	220-240 VAC	250 V, 1.0 A, slow blow (T)	450-020

C A U T I O N

Always make sure that the line voltage selector is set to the correct position and that a fuse with the correct rating is installed in the fuse holder **before** connecting the RE 331 to any AC source.

2.1.2 Power Application

The following procedure should be used when applying power for the first time:

1. Remove the code plug in the AC line filter and check that the correct fuse has been installed.
2. Install the code plug so that the correct voltage is seen on the lower part of the code plug.
3. Connect the power cord supplied with the instrument between the power connector and an AC power socket equipped with a ground connection.
4. Switch on.

N O T E

According to international safety regulations, the RE 331 **MUST** be connected, by means of the third wire in the power cord, to a protective earth contact provided by the mains socket. The protection must not be negated by use of a power cord without a protective conductor.

2.1.3 Battery Back-up

Data and settings in the non-volatile memory of RE 331 are protected from power failure by a Lithium battery on the CPU board (the board carrying the IEEE connector). This battery also supplies the real-time clock circuit on the COM/SYNC board. Thus, removing the CPU and/or the COM/SYNC board, means that the real-time clock must be initialized following assembly.

If data loss occurs during power down this battery should be checked and replaced if necessary. In order to allow the RE 331 to continue operation even in cases where the battery needs to be replaced, all important data and settings may be saved in non-volatile EEPROM by means of the SAVE command.

2.1.4 Setting of Control Switches

Currently, only five of the 8 switches on the CPU board are used (S1, S2, S3, S4 and S6). S1 switches the commands and messages between German and English language. If S1 is closed the RE 331 uses German: Order a Keyboard/Display modification kit 906-165 if a RE 331 should be modified from a German version to an English version. This kit contains a display front plate and 7 key caps. In countries where the VRF system has not been implemented, S2 may be used to disable the VRF part of the RE 331 completely. S2 closed means that the VRF part has been enabled. The S3 switch is used to set the RE 331 to be a blackbox model or to use the keyboard (S3 closed enables the use of the keyboard). S4 is used with the scanner option (S4 closed means that no scanner is present). S6 indicates the presence or absense of the RDDS feature (S6 closed means that the RDDS in not available).

2.2 Self-test during Power Up

During power up, the RE 331 performs a self-test on internal circuits: All segments of the VFI display and all LEDs should light for a short while. Any errors found, are signalled by the ERROR LED. Messages placed in the error list may be inspected by pressing the [ERROR MENU] key. Error messages may be removed by pressing the [ACCEPT] key if the LEDs of the [ACCEPT] or [CANCEL] keys are blinking. If the error is still there (SUM B and/or SUM A LEDs blinking) the message can not be removed.

2.3 Tutorial

To demonstrate the use of the keyboard of the RE 331 when altering settings, we will use the SETUP and LIMITS Menus :

1. If the red LED in the [LOCAL] key is not lit, press the[LOCAL] key to allow settings to be changed. Press the [ACCEPT] key in case the LEDs of the [ACCEPT] or [CANCEL] keys start blinking.

2. Enter the LIMITS MENU by pressing the [LIMITS MENU] key. Note that the LED in the [LIMITS MENU] key is now lit to indicate an *active* menu.

3. Turn the cursor wheel and watch the display - the Functions of the LIMITS MENU appear cyclically:

```
A POWER FAIL
Time:  30sec
```

...

```
A DK MODULATION INDEX TOLERANCE
Limit:  6%          Time: 30min
```

The Functions of a menu are written on the first line in capital letters, whereas the Values are written on line two using lower case.

4. Turn the cursor wheel until the function B POWER FAIL appears in the display.

5. To modify the time limit for the B power fail alarm just enter a number between 1 and 30, and press the [ENTER] key:

   A cursor ("__") appears below the number, and the LEDs in the [ACCEPT] and [CANCEL] keys immediately start blinking to inform you that the value will not be accepted by the RE 331 before the ACCEPT key has been pressed. This way the decoder ensures that no values are modified unintentionally. (This extra step may be disabled using the AUX MENU).

6. Press the [ACCEPT] key and watch the display value be updated, that is the cursor disappears.

7. Try to enter an illegal value (40): The RE 331 immediately displays the message

   * Error *

   indicating that the input could not be accepted by the decoder. After a short delay, the RE 331 displays the previous value and function, ready for another input.

8. Press a cursor key ([<] or [>]) to use the cursor wheel to modify settings. A cursor appears below the record number.

9. Turn the cursor wheel and the LEDs of the ACCEPT/CANCEL keys start blinking.

10. Press [ACCEPT] to allow modifications to take place. The cursor starts to blink to show you that the cursor wheel is now used to modify the setting.

11. Turn the cursor wheel and watch the value change.

12. To end the operation, press a cursor key until the blinking cursor disappears from the display or press the [ENTER] key.

13. Now turn the cursor wheel until the function "B INFORMATION CHANGES" appears: This function has two values that may be modified from the keyboard.

14. Press the [>] key to allow the cursor wheel to modify the leftmost value. Try modifying the value as indicated above. Now press the [>] key again to allow the cursor wheel to modify the rightmost value.

15. Try "jumping" between the rightmost and leftmost values by means of the [<] and [>] keys. Note that you only have to press the [ACCEPT] key if you want to modify a setting and not to move the cursor around in the display.

2.4 Installing RE 331

The SETUP menus (the two leftmost rows of keys on the RE 331) are used to install the RE 331 on a transmitter site (Refer to section 5, Manual Operation, for details of the menus):

1. Enter the V.24 MENU and use the TERMINAL function to set the common communication parameters for the rear and front TERMINAL interfaces (Baud rate, Parity and No. of Data bits) to match those of your PC or terminal. This way you can communicate with the RE 331 via the

terminal interfaces.

Attach an RS-232 terminal to the TERMINAL connector and send the string

? CR LF*

The RE 331 responds by displaying the following information:

RE 331 RDS DECODER
SOFTWARE VERSION x-y YYMMDD
followed by a list of options installed

x-y is the software version installed in the RE 331, YY is the year, MM the month and DD the day the software was released.

2. Enter the SETUP MENU and check that the function BLOCK ERRORS is set up correctly (Correct or Detect).

3. The Reference Records used by the RE 331 to check for correct PI, PS and TP may be initialized in two ways:

3a Connect the RDS signal to be supervised to the RE 331 and press the [STORE] key. The RE 331 now allows you to select all or parts of the received PI, PS and TP information and store it in any or all of the Reference Records. If you want "don't cares" as part of the Reference Record (positions that are not tested by the RE 331), enter the REF. MENU where PI, PS and TP contents may be selectively masked using the cursor keys and the cursor wheel.

3b Use the RS-232 terminal to issue the REF command: Enter REF followed by ENTER and the RE 331 will prompt you for the Reference Record number. Enter the number of the Reference Record that should be loaded and the RE 331 responds by displaying the current contents of the Reference Record. To enter PI = 1234, PS = NDR 2 and TP = 1, the following string must be sent to the RE 331:

```
1234,NDR 2    ,1
```

* CR: Carriage Return LF: Line Feed

Note that exactly 8 characters are used for PS. If " " (space character) must be used as first character(s), it should be entered as "/ " (forward slash + space), that is to center the PS from above, the following response should be given:

```
1234,/ / NDR 2 ,1
```

The last prompt from the RE 331 should be answered by "Y". This activates the Reference Record.

Enter the REF. MENU and inspect the Reference Record to check that your input has been accepted by the RE 331.

4. Enter the LIMITS MENU to initialize all the limits that will be used by the RE 331 during tests on RDS/VRF signals and information.

   The RE 331 allows you to enter two limits per test. A B-limit and an A-limit. B-limits should be set up so that B-alarms only indicate that the RDS/VRF signals have degraded so that a check should be performed to prevent an error from occurring. A-limits should be set up to indicate situations where the RDS/VRF signals are in error. The value may also be set to OFF, indicating that no error should be reported.

5. Enter the AUX MENU to set the clock, the IEEE address and control the way the RE 331 uses the keyboard and display.

5a Initialize the built-in real-time clock by using the function RTC; YYYY-MM-DD HH.MM.SS. You may use the cursor wheel or alternatively enter the information from the keyboard (separated by "-" and ".").

5b To use the IEEE interface, the IEEE address should be entered using the function IEEE ADDRESS.

5c If the RE 331 is installed on an unmanned transmitter site, the function DISPLAY CONTROL should be set to "yes": The RE 331 then powers down the display 5 minutes following the last keyboard entry.

2.5 Setting up RE 331 for RDS Re-broadcast

Follow the instructions 1 - 5 from above and proceed with the following steps:

6. Use the SETUP MENU to identify the record in the attached RDS coder (LINE B) which is to be target record for re-broadcast RDS information (function INFO TRANSFER). Note that only if you select 0 (current record), X (all records) or the correct record number the new data is transferred to the coder's transmit memory.

7. The SELECT MENU should be used to determine the information to be sent on to the RDS coder: Currently there are 45 different types of information that must be controlled which means that a "compressed" display has been used. A typical display looks like the one below

```
INHIBIT PI  PS  AF  TP  TA  DI  MS  PTY
LINE    BCD BCD BCD BCD BCD BCD BCD BCD
```

To stop blocking PI via line B, the cursor should be placed below the "B" found below the PI. Turn the cursor wheel until a "-" appears and PI will be allowed to be re-transmitted via Line B. The display now looks like this:

```
INHIBIT PI  PS  AF  TP  TA  DI  MS  PTY
LINE    -CD BCD BCD BCD BCD BCD BCD BCD
```

To make life a little easier, the RE 331 has built-in status displays for every interface. Use the function STATUS B to see which information will be transmitted via LINE B.

8. Now use the function WAIT FOR ACKNOWLEDGE; in the AUX. MENU to control whether or not the RE 331 should wait for acknowledge characters from the attached RDS coder before sending the next command.

9. Finally enter the V.24 MENU to set the communication parameters of LINE B to match those of the attached RDS CODER and to enable output via LINE B (function INTERFACE CONTROL). The LED DATA OFF will be switched off to indicate that data will now be transferred to the coder.

2.6 Setting up RE 331 with Measuring Option

Follow the steps 1 - 5 above (include steps 6 - 9 in case the decoder is also used as a re-broadcast decoder) and continue as follows:

10. Enter the ADJUST MENU and use the functions BK AREA, BK MODULATION INDEX, and DK MODULATION INDEX to set up the VRF parameters, BK frequency and BK and DK modulation. If these functions are not present, change the function VRF MONITORING to On. Note that switch S2 on the CPU board can disable the VRF part of the RE 331 completely. Use the functions RDS REFERENCE LEVEL, RDS LEVEL ADJUSTMENT, RDS PHASE ADJUSTMENT, SK REFERENCE LEVEL, and SK LEVEL ADJUSTMENT to set the reference level, the level correction factor and phase correction factor for the RDS signal as well as the reference level and level correction factor for the VRF signal.

11. Connect the RE 331 to the signal to be monitored and press [MEAS. MENU] to watch the results from the measurements on the RDS signal.

    If the incoming signal has got a level or phase error that should be ignored during the tests, the correction values may be entered directly in this menu (correction values found right to the results). Preferably the adjustment should be performed using the cursor wheel so that the results from the measurements may be used to determine when the correct adjustment value has been reached. These values may also be entered using the ADJUST MENU.

12. If the VRF signal should be monitored too, the VRF results should be inspected and an adjustment performed as well.

13. Finally, set up the B and A alarm limits for the level and phase measurements using the LIMITS MENU.

2.7 Installing the RE 331 with Scanning Option

2.7.1 Hardware Installation

The scanners are installed in the slot left of the connector box (seen from the rear). During installation and removal of the scanner you should remove the connector box - if you are installing a scanner in an RE 331 from series 1, a new connector box must be installed to allow the installation of the scanner option.

2.7.2 Hardware Programming the MPX Scanner

The MPX Scanner may be hardware-programmed to scan only the number of inputs necessary in a given configuration: next to the PAL (QD 2) you will find three solder points marked SP1, SP2 and SP3. If you need to scan all 8 inputs, all solder points should be open. If you need less than 8 inputs, the following solder connections should be made:

	SP3	SP2	SP1
1 Input	-	-	+
2 Inputs	-	+	-
3 Inputs	-	+	+
4 Inputs	+	-	-
5 Inputs	+	-	+
6 Inputs	+	+	-
7 Inputs	+	+	+
8 Inputs	-	-	-

Table 2.2 - Solder Connections

("+" meaning solder connection established, "-" means no solder connection established).

If 5 inputs have been enabled, the scanner uses the inputs 1 to 5.

2.7.3 Modifying the Switch Setting of the CPU Board

As soon as the scanner (and the connector box) have been installed, the CPU board (the board carrying the IEEE connector) should be removed and switch S4 switched to OPEN. This way the scanner is enabled - this of course also means that a scanner may be completely disabled by closing S4. Install the CPU board in the RE 331 following this operation.

3. FRONT AND REAR PANELS

3.1 The Front Panel

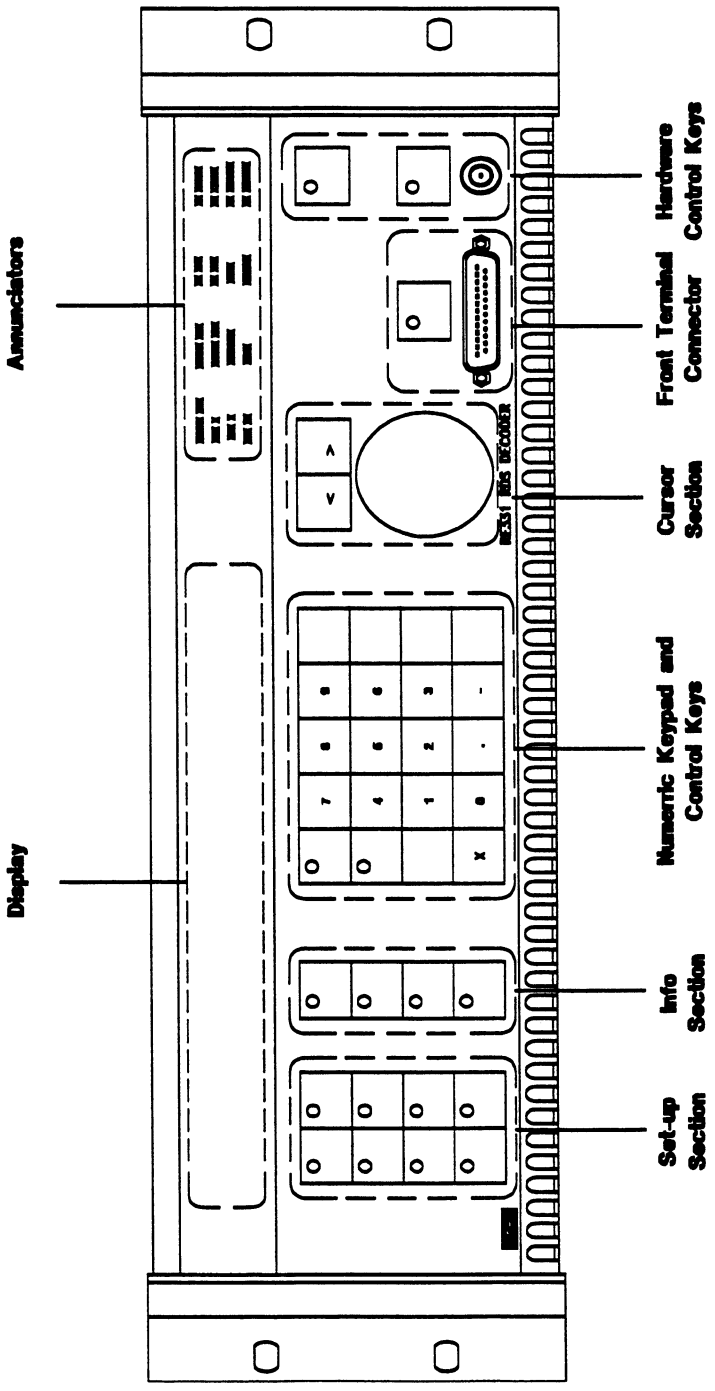


Fig.3.1 - Front Panel

The display of the RE 331 RDS Decoder has been split into two sections: The Alphanumeric Display section and the Annunciator section.

The Alphanumeric Display

The Alphanumeric Display can display 2 lines each consisting of 40 characters. To ensure full readability independent of ambient light conditions, the RE 331 uses a Vacuum Fluorescent Display (VFD) module with character size 3.3 mm x 5.05 mm (X x Y). The VFD module is used to display Menu choices, RDS data and measured values.

The Annunciators

The annunciators are used to indicate internal settings, RDS states, VRF states, and error states. These annunciators are also part of the basic RE 331 which is delivered without Keyboard/Display.

The 16 different annunciators are used to signal the following:

1.	DATA OFF	The data bridge output to the RDS Coder via RS-232 LINE B has been disabled.
2.	SUM A	One or more A errors have been detected - if the LED is blinking, the error is still present.
3.	SUM B	One or more B errors have been detected - if the LED is blinking, the error is still present.
4.	PTY 31	PTY = 31 (Alarm) is being received.
5.	REF.ON	One or more Reference Records have been activated.
6.	REF.OFF	The Reference Records are inactive.
7.	ERROR	The RE 331 has found an error - the reason for the error is found by inspecting the ERRORS MENU.
8.	SYNC	No synchronization to the RDS signal is possible.
9.	TP	The status of the TP information bit.
10.	TA	The status of the TA information bit.
11.	MONO	The status of the DI information (last bit).

12. STEREO The status of the DI information (last bit).

13. SK PHASE The phase between the 19 kHz pilot signal and the VRF carrier signal is outside limits.

14. SK LEVEL The level of the VRF carrier signal is outside limits.

15. BK ERROR BK modulation index or frequency is outside limits.

16. DK ERROR DK modulation index or frequency is outside limits.

The Keyboard

The keyboard may be divided into 5 sections:

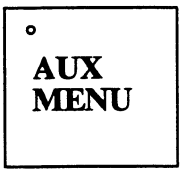
SETUP Section
INFO Section
Numerical Keypad with **Control Keys**
Cursor Control
Hardware Control keys

The SETUP Section Keys

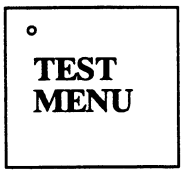
The SETUP Section keys are the 8 leftmost keys on the front panel marked as follows:

SETUP MENU
ADJUST MENU
REF. MENU
LIMITS MENU
V.24 MENU
SELECT MENU
AUX MENU
TEST MENU

o **SETUP MENU**	controls the error correction modes of the RE 331 and enters the number of the RDS record in an attached RDS coder that receives information when the RE 331 operates as an RDS re-broadcast decoder (Data bridge).
o **ADJUST MENU**	sets up level and phase reference values and correction factors for the RDS and VRF signals, and the modulation indexes for BK and DK in the VRF signal. Finally, the reference BK area code is set up using this menu.
o **REF. MENU**	displays, activates or deactivates any of the 8 Reference Records for PI, PS and TP.
o **LIMITS MENU**	is used to set up all the A and B surveillance limits of the RE 331 RDS Decoder.
o **V.24 MENU**	sets up the communication parameters of all the serial interfaces and enables/disables Lines B, C and D (RDS re-broadcast operation). The menu is also used for enabling/disabling the optional RDDS utility.
o **SELECT MENU**	selects and deselects the RDS information which is re-transmitted via the data bridge on any of the serial interfaces B, C and D.



sets up IEEE 488 address, sets the built-in real-time clock (RTC), controls display blanking and [ACCEPT] and [CANCEL] keys.

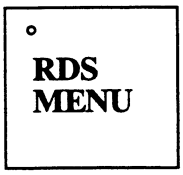


controls and initiates the built-in test routines.

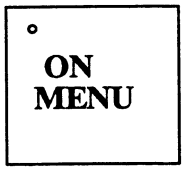
The INFO Section Keys

The INFO Section keys are marked as follows:

RDS MENU
ON MENU
MEAS. MENU
ERROR MENU

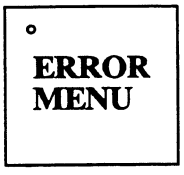


controls the display of main RDS information - the keys [DISP 1] and [DISP 2] determines whether the information is displayed as received or originates from the Information Memory.



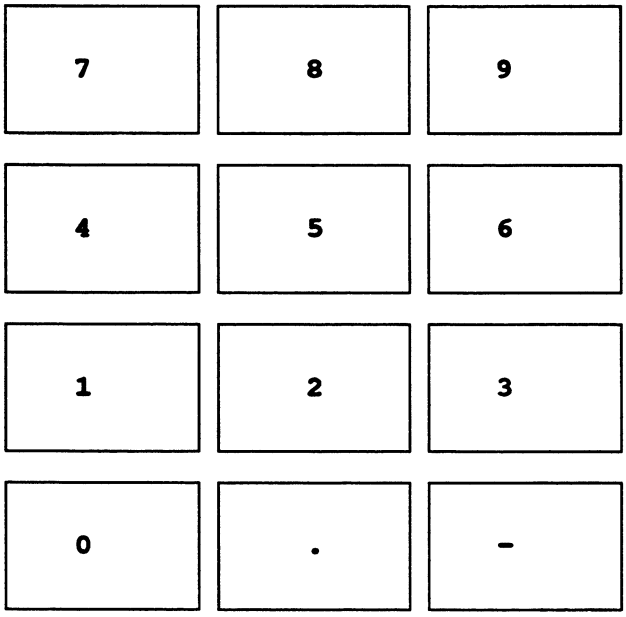
controls the display of EON RDS information - the keys [DISP 1] and [DISP 2] determine whether the information is displayed as received or originates from the Information Memory.

displays measured values and raw RDS data.



inspects error messages stored in the RE 331.

Numerical Keypad



The numerical keys shown above are used to enter numbers.

The Control Keys

○ **DISP 1**	When DISP 1 is active (the LED is on), data are displayed on the VFD display when received, as opposed information from the Information Memory.
○ **DISP 2**	When DISP 2 is active (the LED is on), the data being displayed on the VFD display originates from the Information Memory.
○ **STORE**	stores received RDS information (PI, PS and/or TP) in one or several Records. For a description of the function see section 5. Manual Operation.
X	indicates all records in the **SETUP MENU** or select scanning when a scanner option is installed.
CE	Clears Entries if an erroneous entry was made.
○ **ACCEPT**	ensures that modifications to the internal settings are secured against accidental modifications: Also used to clear entries in the ERROR MENU.
○ **CANCEL**	inhibits modifications of internal settings.
ENTER	indicates that an entry should be accepted by the RE 331

The Cursor Control Keys

<	moves the cursor to the left or to the rightmost parameter.
>	moves the cursor to the right or to the leftmost parameter.

The **Cursor Wheel** below the cursor keys is used to modify or select menu entries.

Hardware Control Keys

o **FRONT**	toggles between the terminal connector on the front panel and the one on the rear panel of the RE 331. When the LED is on, the RE 331 accepts input from the connector on the front panel. Front and rear terminal connectors have the same pin-out but are completely separate interfaces. When the RDDS option is installed, the key just sets the front terminal on or off. The rear terminal is always on.
o **MPX(0)**	toggles between the MPX input connector on the front and the rear panels of the RE 331. When the LED is on, the RE 331 uses the MPX input from the connector on the front. When a scanner option is installed, the key shifts between all the possible inputs. The LED is on only if the front connector is used.
o **LOCAL**	toggles between LOCAL and REMOTE mode. In LOCAL mode, the Remote Control Port on the rear of the instrument is disabled, but the corresponding commands are enabled from the keyboard and the terminal. In REMOTE mode, commands corresponding to Remote Control Port commands are disabled from the keyboard and the terminal, but the Remote Control Port is enabled.

3.2 The Rear Panel

Figure 3.2 shows the rear panel.

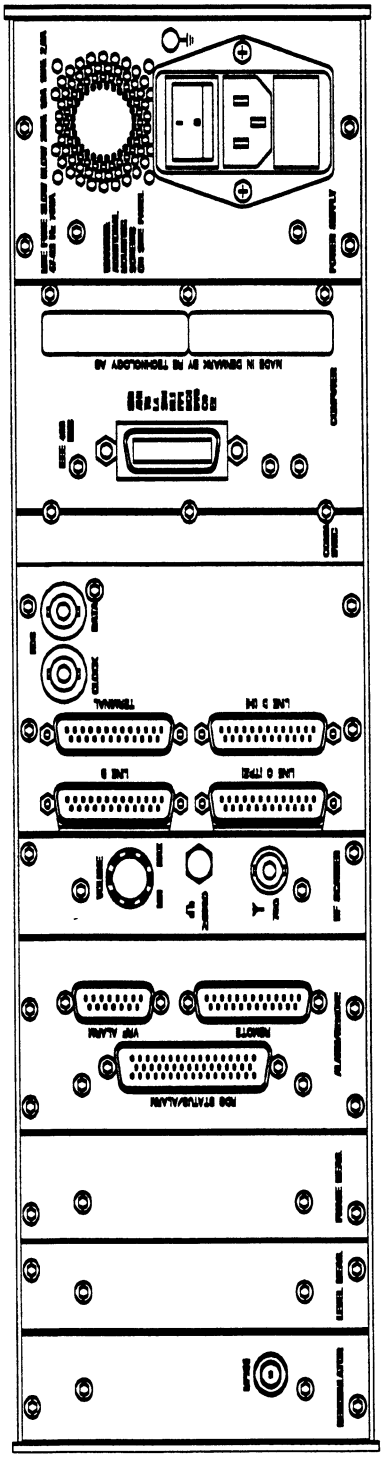


Fig. 3.2 - Rear Panel

SECTION 3 FRONT AND REAR PANELS

Apart from the power socket with the built-in fuse and voltage selector, the rear panel of the RE 331 carries 11 different connectors (special versions may have less)

MPX(1)	Rear MPX input (controlled by using the [MPX(0)] key). 3-pole LEMO TRIAX series 0. Female.
RDS STATUS/ALARM	All RDS alarms and status outputs. 50-pole Sub-D. Female.
VRF ALARM	All VRF alarms and status outputs. 15-pole Sub-D. Female.
REMOTE	Input for all remote control signals that are used to control the RE 331. 25-pole Sub-D. Female.
TERMINAL	Rear terminal interface (controlled using the [FRONT] key). 25-pole Sub-D. Female.
LINE B	RS-232 interface used to re-broadcast RDS information to an RDS Coder. 25-pole Sub-D. Male.
LINE C	RS-232 interface used with TPZ. 25-pole Sub-D: According to Pflichtenheft 5/3.9 the signal Messstart and RDS clock are included in this connector. Messstart is active upon reception of IH channel 31. Male.
LINE D	RS-232 interface used to re-broadcast IH information. 25-pole Sub-D. Male.
RDS CLOCK	TTL clock signals - BNC connector. Female.
RDS DATA	TTL data signals that should be accepted on the falling edge of RDS CLOCK. BNC connector. Female.
IEEE 488 BUS	IEEE 488 interface. 24-pole Champ connector. Receptacle type.

RDS STATUS/ALARM

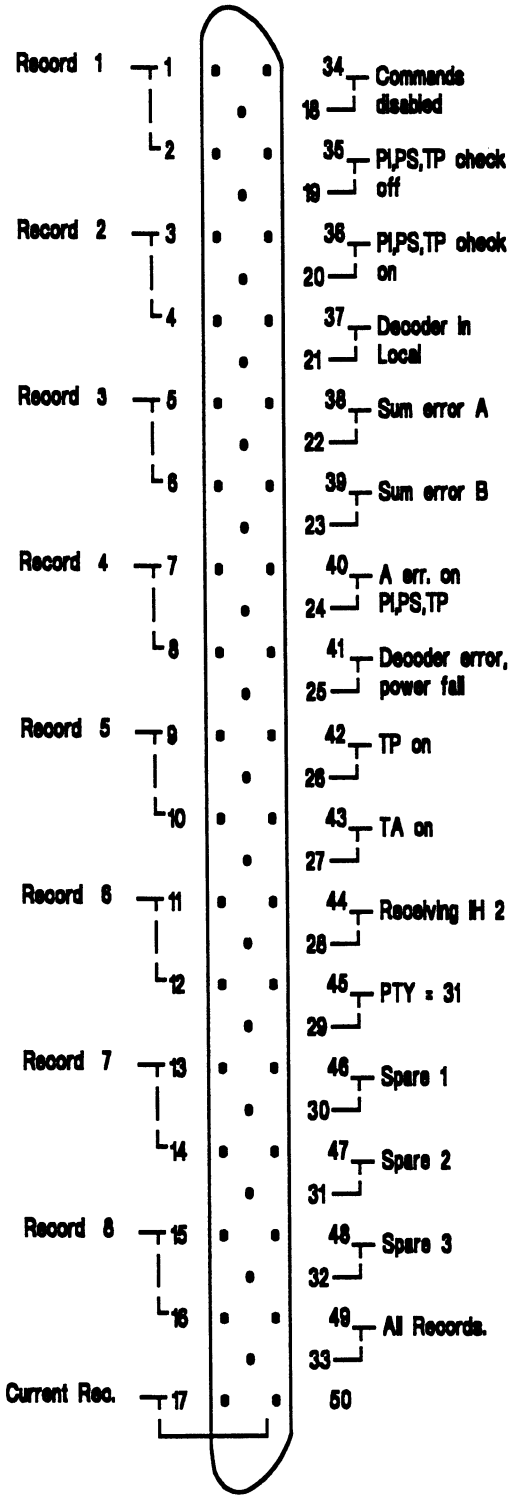


Fig. 3.3 - RDS STATUS/ALARM Connector

VRF ALARM

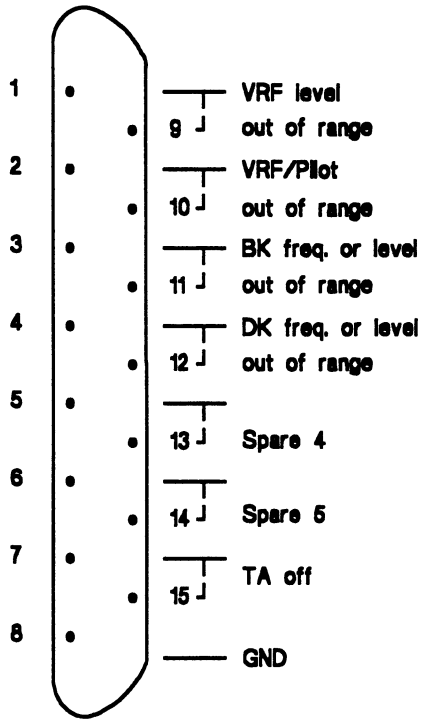


Fig. 3.4 - VRF ALARM Connector

REMOTE

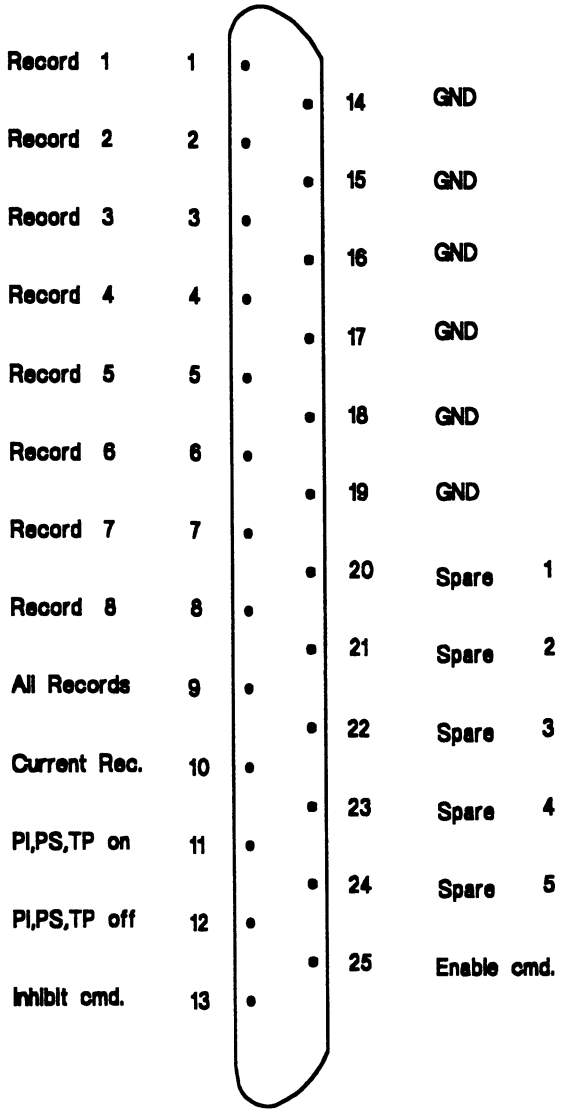


Fig. 3.5 - REMOTE Connector

TERMINAL

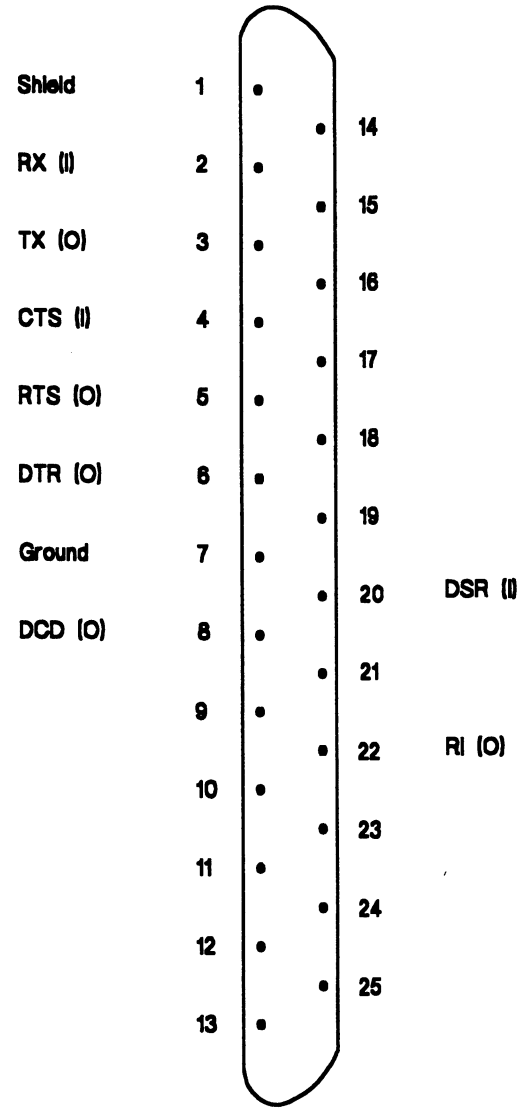


Fig. 3.6 - TERMINAL Connector

LINE B

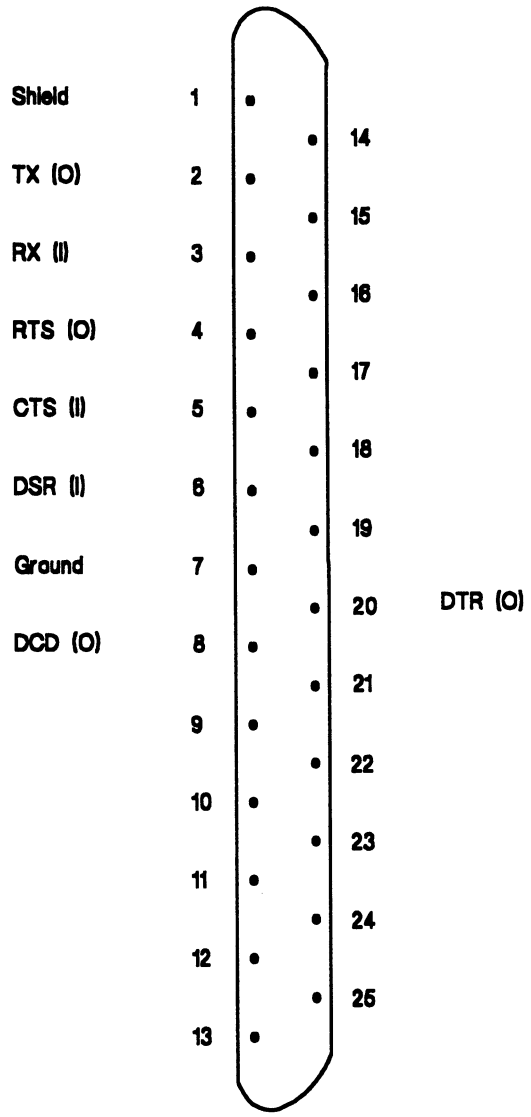


Fig. 3.7 - LINE B Connector

LINE C (TPZ)

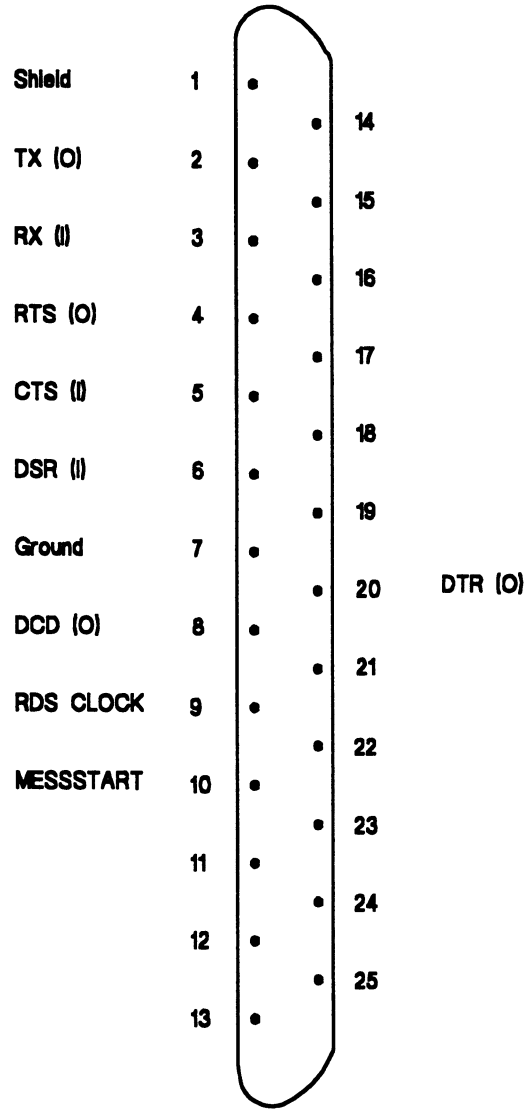


Fig. 3.8 - LINE C Connector

LINE D (IH)

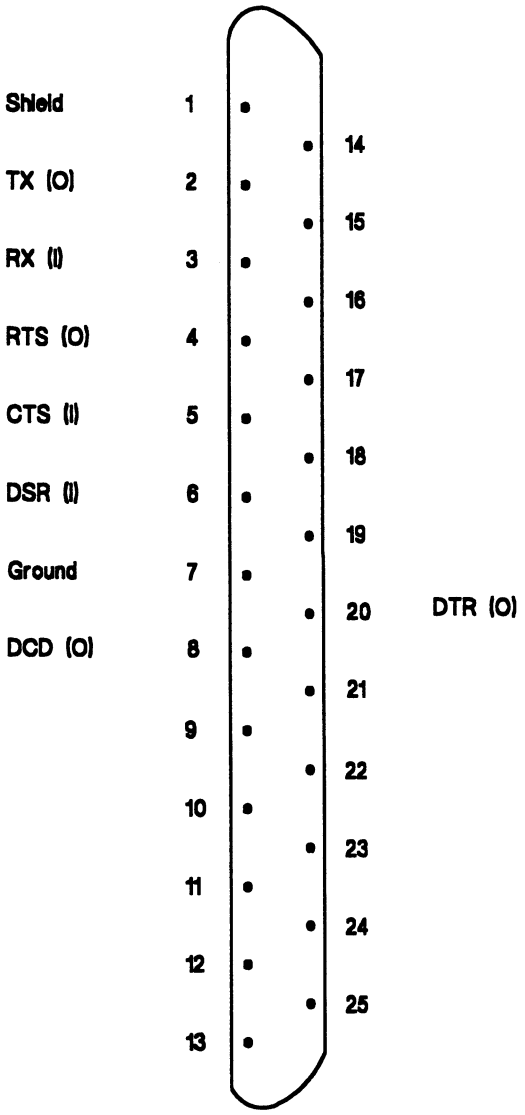


Fig. 3.9 - LINE D connector

IEEE 488 BUS

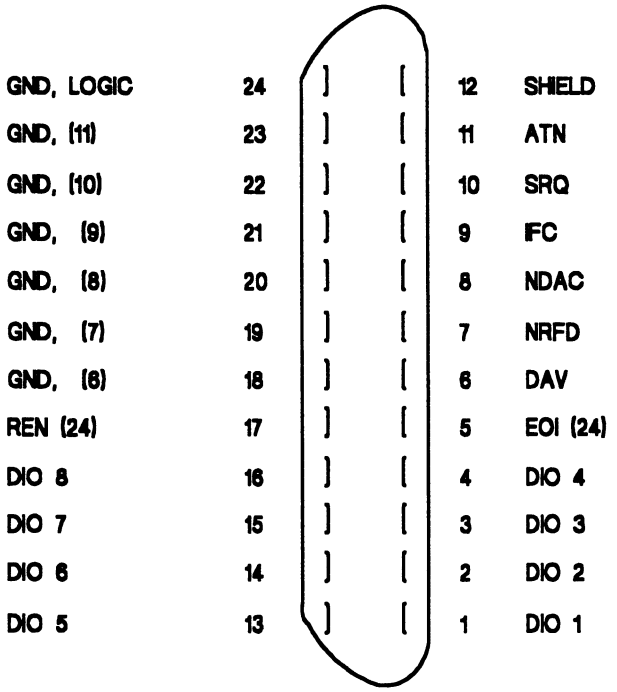


Fig. 3.10 - IEEE 488 Connector

3.3 The Alarm and Remote Connector when Scanner installed

As soon as the Scanner has been installed and S4 on the CPU board switched off, the RE 331 will sense the presence of the Scanner and enables a number of new menu items and Terminal/IEEE commands.

When a scanner is installed each scanner Input is assigned an error RELAY to be able to signal errors to a remote control center: Using the Data bridge ("Datenbrücke") with scanners does not make sense - therefore the RELAYS that normally are used to signal the target record in the RDS Coder are now used to signal errors on the scanner inputs, that is the relay marked "RECORD 1" (pins 1 and 2 in the RDS STATUS/ALARM connector) indicates an alarm connected to scanner input 1. The relay marked "Spare 1" is used to signal errors on the front input whereas the relay marked "Spare 2" signals errors on the rear input.

Finally the relay marked "All records" is activated as soon as the scanner has been activated: In this way it is possible to check that the scanner is operating.

The relay outputs marked "sumerror A" and "sumerror B" are activated at the same time - in this way it is still possible to know whether an error is a type A or a type B error.

The pins on the Remote connector marked Reserve 1 - 8 are used when spare units are present in the system. A low level indicates that the spare unit for that input is active. This is used in error messages to indicate if it is the ordinary (normal) unit or the spare (reserve) unit that caused the error.

The pins on the Remote connector marked Regional 1 - 3 are used to associate a selected input to a local or regional reference record, and so shift to the associated reference record. A low level on the pins indicates the regional state.

RDS STATUS/ALARM SCANNER

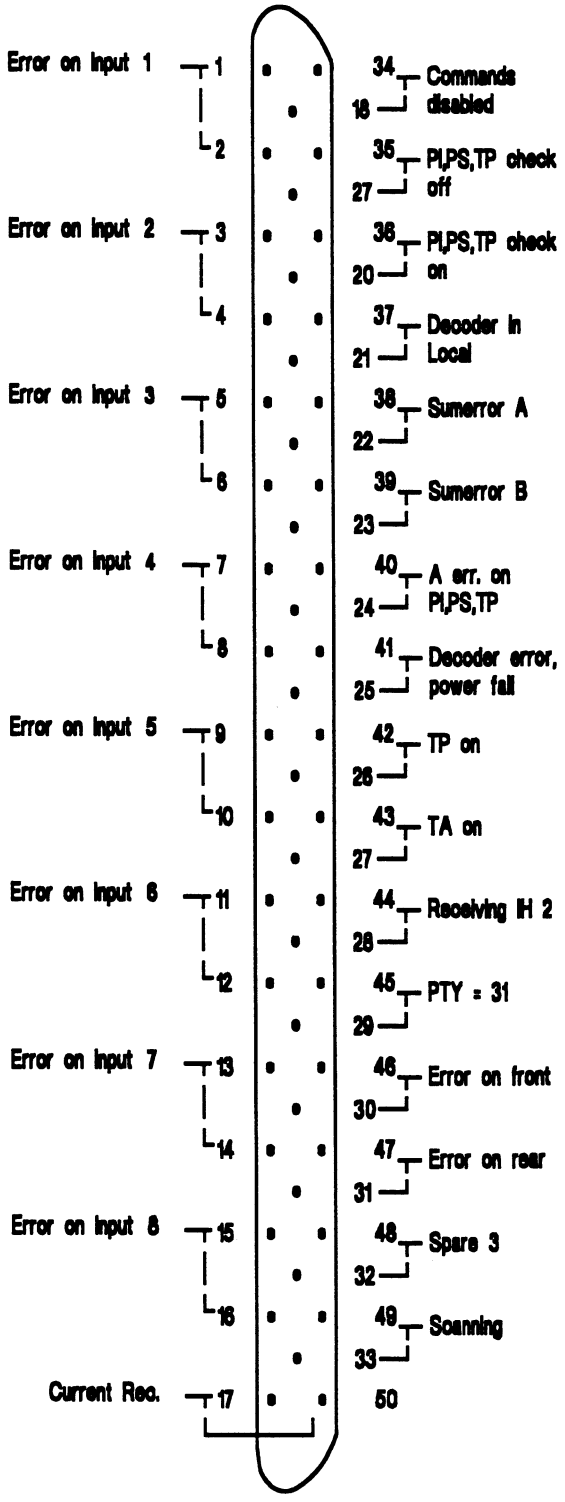


Fig. 3.11 - RDS STATUS/ALARM Connector when scanner is installed

REMOTE SCANNER

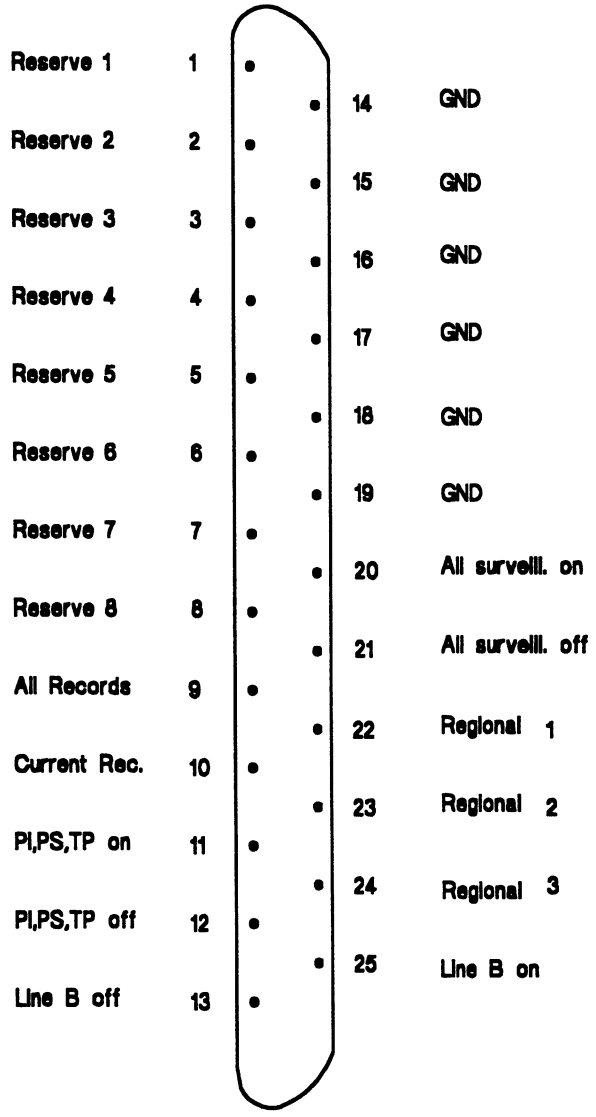


Fig. 3.12 - REMOTE Connector when a scanner is installed

3.3.1 MPX Scanner

The MPX scanner has a 37-pole Sub-D connector on the rear panel to allow up to 8 MPX inputs to be connected - to minimize interaction between the MPX inputs, each input is surrounded by connections to ground. The pinout of the 37-pole Sub-D is as follows:

MPX SCANNER

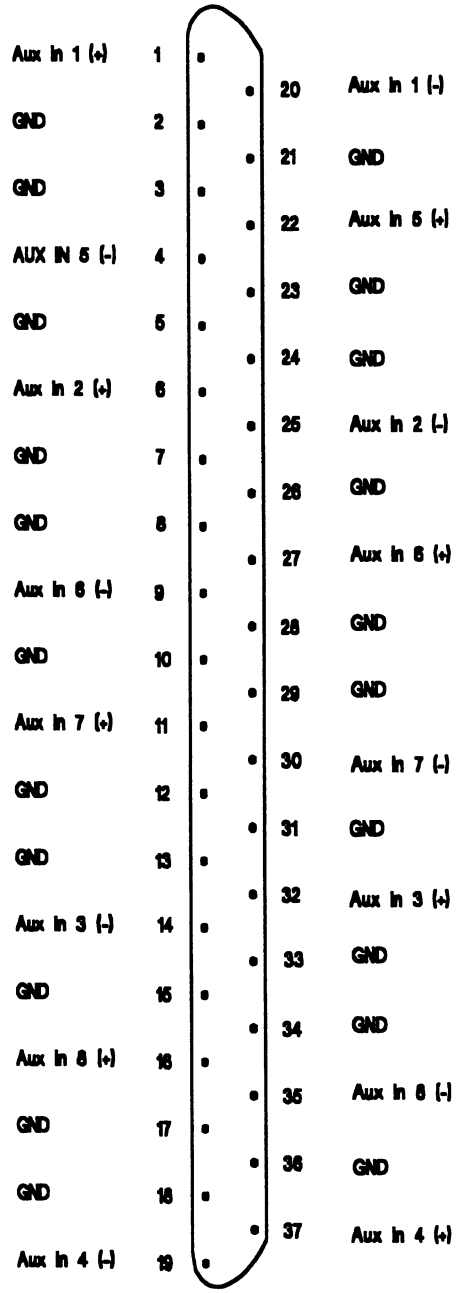


Fig. 3.13 - MPX Scanner Connector

As soon as the scanner has been installed and S4 on the CPU Board switched off the RE 331 will sense the presence of the scanner and enables a number of new menu items and Terminal/IEEE commands.

3.3.2 RF Scanner

The RF Scanner has two connectors on the rear panel:

1. A BNC Connector (Marked 75 Ω) for an FM antenna and

2. A Jack connector used for a stereo headphone (Impedance ≥ 600 Ω).

Finally, there is a volume control for the headphone on the rear panel.

3.4 Test Loopback Connectors

V24 LOOPBACK connector

This connector is a 25-pole Sub-D connector (male or female) used to test the V24 interfaces.

Connect:

pin 2 to pin 3
pin 4 to pin 5
pin 6 to pin 20

REMOTE LOOPBACK cable

This cable is used to test the remote/alarm board.

The cable connects a 50-pole Sub-D plug (RDS STATUS/ALARM) with a 25-pole Sub-D (REMOTE CONTROL) and a 15-pole Sub-D (VRF ALARM). All plugs are male types:

RDS ALARM	CONNECTS TO
pin 1	REMOTE CONTROL pin 1
pin 4	REMOTE CONTROL pin 2
pin 5	REMOTE CONTROL pin 3
pin 8	REMOTE CONTROL pin 4
pin 9	REMOTE CONTROL pin 5
pin 12	REMOTE CONTROL pin 6
pin 13	REMOTE CONTROL pin 7
pin 16	REMOTE CONTROL pin 8
pin 17	REMOTE CONTROL pin 9
pin 34	REMOTE CONTROL pin 10
pin 18	RDS ALARM pin 19
pin 20	RDS ALARM pin 21
pin 37	REMOTE CONTROL pin 11
pin 38	REMOTE CONTROL pin 12
pin 22	RDS ALARM pin 23
pin 24	RDS ALARM pin 25
pin 41	REMOTE CONTROL pin 13
pin 42	REMOTE CONTROL pin 20
pin 26	RDS ALARM pin 27
pin 28	RDS ALARM pin 29
pin 45	RDS ALARM pin 46
pin 30	RDS ALARM pin 31
pin 47	REMOTE CONTROL pin 21

RDS ALARM	CONNECTS TO
pin 32	RDS ALARM pin 33
pin 49	RDS ALARM pin 50
pins 2, 3, 6, 7, 10, 11, 14, 15, 35, 36, 39, 40, 43, 44, 48, 16	REMOTE CONTROL pin

VRF ALARM	CONNECTS TO
pin 1	REMOTE CONTROL pin 22
pin 9	VRF ALARM pin 10
pin 11	VRF ALARM pin 12
pin 4	REMOTE CONTROL pin 23
pin 5	REMOTE CONTROL pin 24
pin 13	VRF ALARM pin 14
pin 7	REMOTE CONTROL pin 25
pins 2, 3, 6, 8	VRF ALARM pin 15

4. PRINCIPLE OF OPERATION

4.1 General Description

This section provides an overall description of the capabilities of the RE 331 to make it easier for the operator to understand the overall concept of the RE 331.

The RE 331 has four main functions:

* Decode and show all kinds of RDS data.
* Survey RDS data content and change rate.
* Measure and survey all kinds of RDS and VRF signal parameters.
* Work in a re-braodcast data bridge.

The RE 331 fulfils the German Pflichtenheft 5/3.9 for RDS decoders.

Optionally, the capabilities of the RE 331 can be extended by installing an RF scanner or an MPX scanner to enable surveillance of more than one RDS/VRF signal.

Fig. 4.1 shows a simplified block diagram of the RE 331 RDS decoder.

The individual circuits of the instrument are described in detail in sections 9 to 22 inclusive.

Mechanically, the RE 331 is divided into two sections: an open frame structure holding the analog circuitries including the power supplies, and a shielded enclosure holding all digital circuitries.

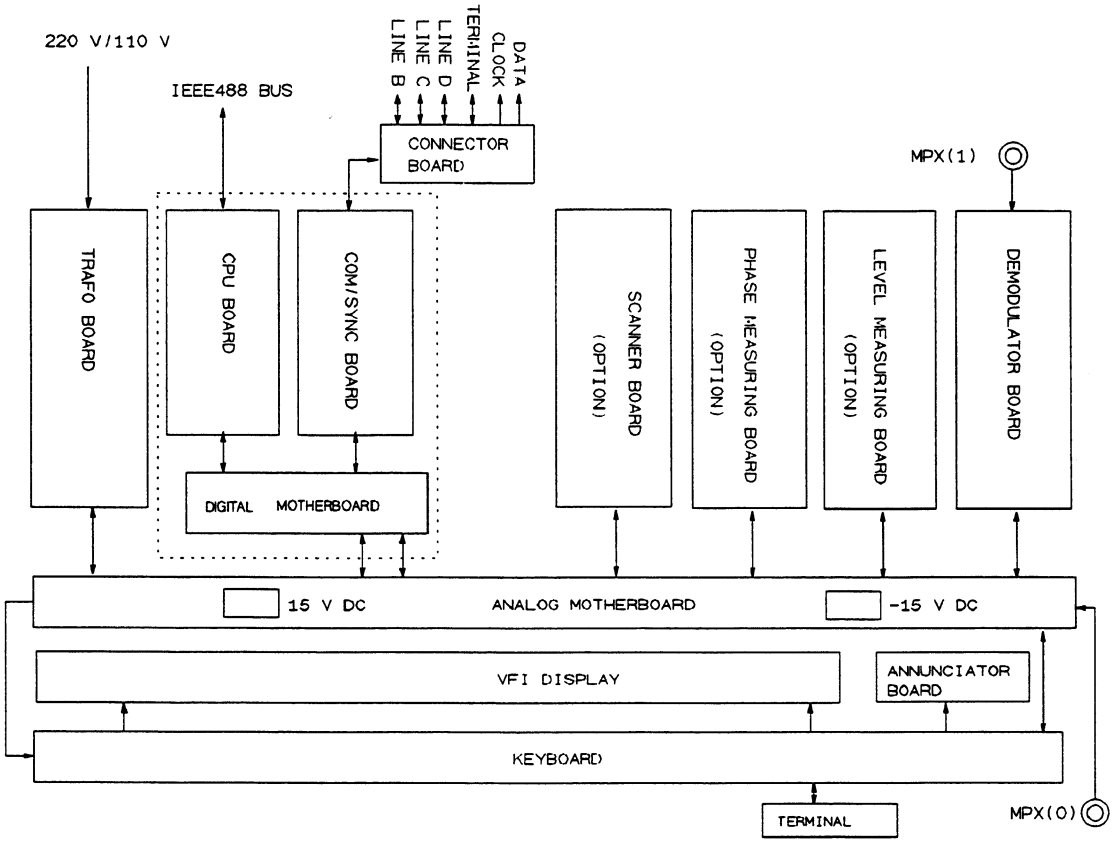


Fig. 4.1 - Block Diagram of the RE 331 RDS Decoder

4.2 Decode and Show RDS Data

The RDS data from the demodulator is sent to the signal analyzing processor, the TMS320. Here block synchronization and error detection or correction takes place. The RDS data is then sent, one block a time, to the main CPU. Here RDS data is decoded, organized and sent to the front panel display or to the terminal interfaces if requested.

The RDS data is saved in memory and can be recalled again. You can clear the information memory from the front panel or from the terminals. The information memory is also cleared after a power down lasting longer than the A power down limit. See section 5.1.4 Limits Menu.

On the terminals, most of the RDS data commands show the RDS information as it is received, but the commands for showing all information and AF-lists will take information from the information memory.

There are two display modes on the front panel. DISP 1 mode shows RDS data as it is received. DISP 2 mode shows RDS data from the information memory.

4.3 Survey RDS Data

The RE 331 can Survey the RDS data in three ways. Each data surveillance can be set to an A and a B level each causing an A and B error, respectively.

The PI, PS and TP data can be compared to one or more reference records with PI, PS and TP data. The data fields in the reference records can hold "don't-care" characters which are not tested.

The reference records can be active, inactive or connected. Connected means that the record is active if the commands on the data bridge are sent to the record with the same number. As an example, if the reference records are connected and the commands on the data bridge are sent to record number 5 in the coder, then reference record number 5 will be used. If more than one reference record is active, the RDS data must differ from all the active reference records, in order to cause a reference error.

The rate of change of PI, PS, TP, TA, PTY, DI and MS information can also be checked. An A and B error are found if one of the data items changes more than the specified number of times in the specified period. For example, you can set the A limit to 5 changes in 20 seconds. If you then within 20 seconds have 5 changes of TA, an A alarm will be triggered. Note that the alarm becomes inactive after 20 seconds from the first change plus 20 seconds where no changes take place. So if you have 5 quick changes of TA it will take 40 seconds from the first change before the alarm is inactive again.

Finally the RE 331 can survey the block error rate. The block error rate is the number of erroneous blocks in the last 100 blocks. The block error rate can be calculated before or after correction of the RDS data.

4.4 Survey RDS and VRF Signal Parameters

The RE 331 can measure and survey the following RDS and VRF signal parameters:

* RDS level.
* RDS to pilot phase.
* RDS to VRF phase.
* VRF level.
* VRF to pilot phase.
* VRF BK and DK modulation index.
* VRF BK area code.

Each surveillance can be set to an A and a B level each causing an A and B error respectively.

For the RDS level, VRF level, VRF BK and DK modulation indices, and VRF BK area code reference values can be given from the terminal interfaces or from the front panel. The RDS to pilot phase reference value can be selected to 90° or 0° with switch number 2 on the CPU board. The 0° reference value will also cause all VRF related measurement and surveillance to stop. The RDS to VRF phase and the VRF phase are always set to 90° and 0° respectively.

For the RDS level, VRF level and RDS phase measurements correction factors can be applied, if you have loss, gain or phase turning in your signal path.

4.5 Rebroadcast with Data Bridge

When working in a so called data bridge, the RE 331 can send commands to an RDS coder such as the RE 531 RDS Coder. The commands enable the RDS coder to re-transmit some or all the RDS data the RE 331 has received.

The communication between the RE 331 and the attached RDS coder takes place in the format described in the German Pflichtenheft Nr.5/3.8 so the attached coder must be able to interpret this format.

The data bridge can work on the V24 interfaces B, C and D on the back of the RE 331.

The RDS data transferred on the data bridge can be selected from the terminals or from the front panel. The data can be transferred to a specific record, the record in use or all records in the attached coder. The receiving record can be selected from the terminals, the front panel or from the remote input.

The selected RDS data is transferred on the data bridge on a regular basis or whenever any change of data takes place.

For RDS data having an acknowledge message (Rückmeldung), the RE 331 can wait for the receiving of such an acknowledge message before transmitting the next command or the commands can be sent when new data is received.

For EON RDS data you can select whether special EON RDS clear commands should be sent if specific EON RDS data has not been received for 3 minutes.

Both of the above mentioned features can be selected from the terminals or from the front panel.

4.6 CPU

The main CPU controls the five V24 interfaces, the IEEE 488 interface, the front panel and the remote/alarm interface.

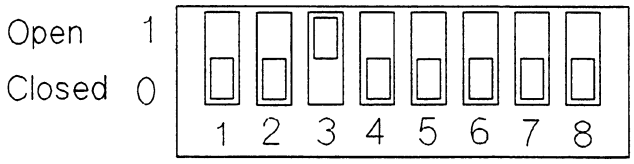


Fig. 4.2 - Switch S1

On the CPU Board the switch S1 controls some options:

	Closed	Open
1	German language version	English language version
2	90° RDS phase reference	0° RDS phase reference, NO VRF
3	Normal	Blackbox option (No front panel)
4	Normal	Scanner option installed
5	-	-
6	Normal	RDDS option installed
7	-	-
8	Normal mode	Debug mode

Table 4.1 - Settings of Switch S1

4.7 Demodulator Board

4.7.1 Introduction

The RDS demodulator decodes the RDS Biphase signal, and regenerates the hidden 57 kHz carrier. The signal source can be a standard stereo multiplexed signal (MPX signal) containing the RDS signal.

The demodulator is built around a Costas Loop. The additional circuitry enhances the dynamic range and the suppression of noise in the MPX signal. Furthermore, the additional circuitry adds measurement capability.

4.7.2 Principle of Operation

The Costas Loop is a Phase Locked Loop (PLL) which does not need a carrier for locking onto a signal, but it will basically track a Double Sideband (DSB) signal with suppressed carrier.

A special characteristic of the RDS signal and the Costas Loop is that they cannot distinguish between carriers with a multiple 180° offset, that is a phase ambiguity of 180° exists in the system due to the use of biphase modulation.

Figure 4.3 outlines the structure of the RDS demodulator. A more detailed description can be found in section 14.

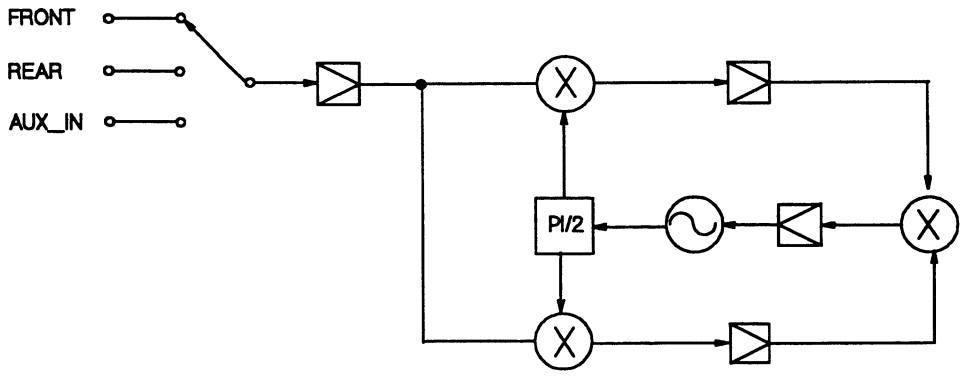


Fig. 4.3 - Basic Structure of the RDS Demodulator

The Voltage Controlled Oscillator (VCO) is controlled by the mixing of the In-Phase and Quadrature-Phase signal. The mean value of the Quadrature-Phase signal is kept close to zero when the loop is in lock, and any deviation from this can be interpreted as a difference in energy in the sidebands. The mixing of the I- and Q-Phase signals results in a DC component which is a function of the differences of the sidebands.

The synchronous detectors, which are fed from the VCO in quadrature, generate the I- and Q-Phase signals. When the Costas Loop is in lock, the 57 kHz signal fed to the quadrature mixers represent the recovered suppressed carrier. The recovered carrier is used in the Measurement Option of the RE 331 to measure phases between the 19 kHz pilot or the 57 kHz VRF carrier, if present.

In the RDS demodulator a part of the I-Phase branch takes care of the data demodulation. The central part of this process is the RDS decoding PAL.

The switching network, which is controlled by software in the RE 331, switches between different signal sources. The demodulator can either be connected to the Front or Rear connections, or to the AUX_IN input. The AUX_IN input, which is routed to the RF or MPX Scanner, is not directly accessible to the user.

4.8 Level Measuring Board

4.8.1 Introduction

The Level Measuring Board for the RE 331 is one of the two boards which constitute the Measurement Option for the RE 331. The other board is the Phase Measuring Board, which is described in section 4.9.

The board measures the levels of the RDS and VRF signals using synchronous demodulation. An A/D Converter converts the signals from the RDS and VRF synchronous demodulators alternately.

The software in the RE 331 controls the settings on this board. The network of switches, and consequently the routing of signals on the board, is set by the software. The RE 331 also controls the transfer of data from the A/D Converter.

A 57 kHz carrier is derived from the 19 kHz pilot in order to measure phases at 57 kHz. Another 57 kHz carrier is taken from the carrier in the VRF signal (if present). These two representatives for the carriers of the pilot and the VRF signal respectively are in combination with the recovered 57 kHz carrier from the RDS Demodulator used for phase measurements between any of the three combinations of the carriers.

4.8.2 Principle of Operation

Figure 4.4 outlines the basic structure of the Level Measuring Board. A more detailed description, which includes the switch set-ups for calibration, is found in Section 15.

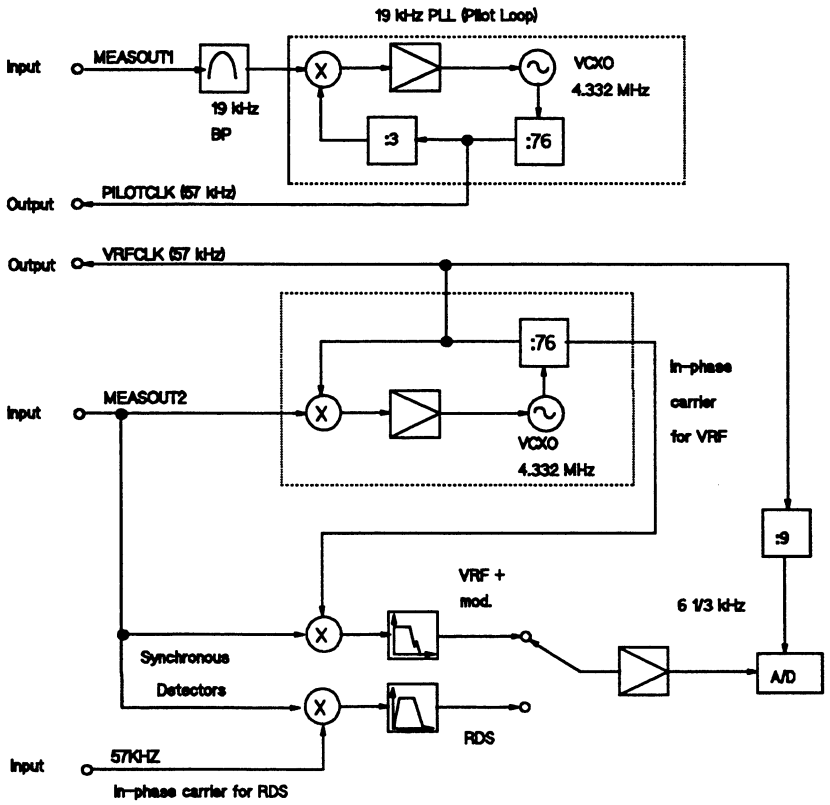


Fig. 4.4 - Basic Structure of the Level Measuring Board

The signals MEASOUT1, MEASOUT2 and 57KHZ come from the RDS Demodulator, while the signals PILOTCLK and VRFCLK are routed to the Phase Measuring Board. Besides these signals, other signals which take care of control and data acquisition are present on the board.

The signal MEASOUT1 is taken before the 57 kHz filter on the RDS Demodulator, while the signal MEASOUT2 is taken after the 57 kHz filter.

The Level Measuring Board includes a Pilot Loop, which locks on to the 19 kHz pilot in the Stereo MPX signal. This loop derives a 57 kHz clock, which can be used to measure the phase between the Pilot and either the recovered clock of the RDS signal or the carrier of a VRF signal.

A divide-by-3 circuit, which is implemented within a PAL, ensures the correlation between the 19 kHz Pilot and the derived 57 kHz carrier.

The Synchronous Detectors detect the levels of the RDS and VRF signals. Segregation of the RDS and the VRF signals is ensured by the quadrature of the carriers of the two signals.

The recovered RDS clock from the RDS Demodulator and the VRF clock from the VRF Loop on the Level Measuring Board drive the Synchronous Detectors.

The VRF Loop locks onto the VRF signal, and gives a 57 kHz clock used in both the phase measurements and in the level detection of the VRF signal.

4.9 Phase Measuring Board

4.9.1 Introduction

The Phase Measuring Board for the RE 331 is the second of the two boards which constitute the Measurement Option for the RE 331. The other board is the Level Measuring Board, described in section 4.8.

The Phase Measuring Board measures the phase between the Pilot and the suppressed RDS carrier, the phase between the Pilot and the VRF carrier, and the phase between the VRF carrier and the suppressed RDS carrier.

4.9.2 Principle of Operation

The Phase Measuring Board does not measure the phases directly, but uses the recovered 57 kHz RDS clock from the RDS Demodulator, the derived 57 kHz clock from the Pilot Loop on the Level Measuring Board and the 57 kHz VRF clock from the VRF Loop, which is also found on the Level Measuring Board.

The measurements are based on a gated oscillator technique in which the different 57 kHz clocks control a counter. A PAL controls the gating system, while another PAL takes care of communication to the RE 331. A block diagram is shown in section 17.

4.10 MPX Scanner

The MPX scanner can be considered an active switching unit feeding one out of 8 MPX signals to an RE 331 RDS decoder. This enables the decoder to scan up to 8 MPX signals thereby making it possible for smaller broadcasters to invest in professional RDS monitoring equipment.

The scanning sequence and duration is controlled entirely from the main computer in the RE 331.

Fig. 4.5 shows the overall block diagram of an 8 channel MPX scanner.

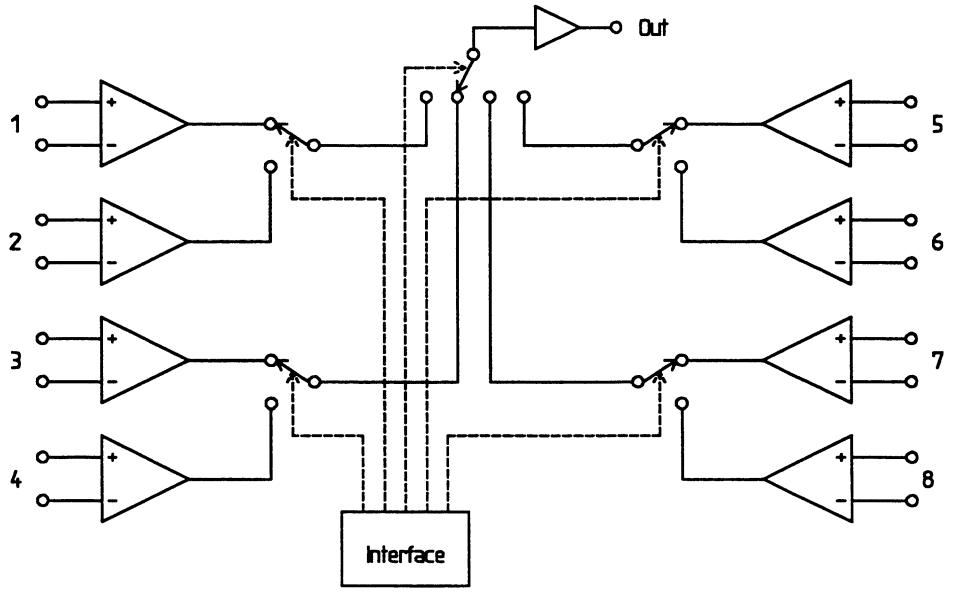


Fig. 4.5 - Block Diagram of MPX Scanner

Each of the 8 input amplifiers consists of a balanced to unbalanced buffer amplifier with a bandwidth wide enough to allow measurements on an MPX signal without influencing the phase response.

4.11 RF Scanner

The RF Scanner is an FM broadcast receiver in the 87.5 to 108.0 MHz frequency band designed to be plugged into a RE 331 RDS Decoder. This enables the decoder to monitor up to 8 broadcast channels at RF level thereby making it possible for smaller broadcasters to invest in professional RDS monitoring equipment.

The receiver frequency is synthesizer-controlled under command from the main CPU.

The receiver delivers a demodulated FM signal to the RE 331 and is equipped with a headphone output for supervising purposes.

The RF scanner is able to handle signals at the antenna input up to 130 dBμV EMF.

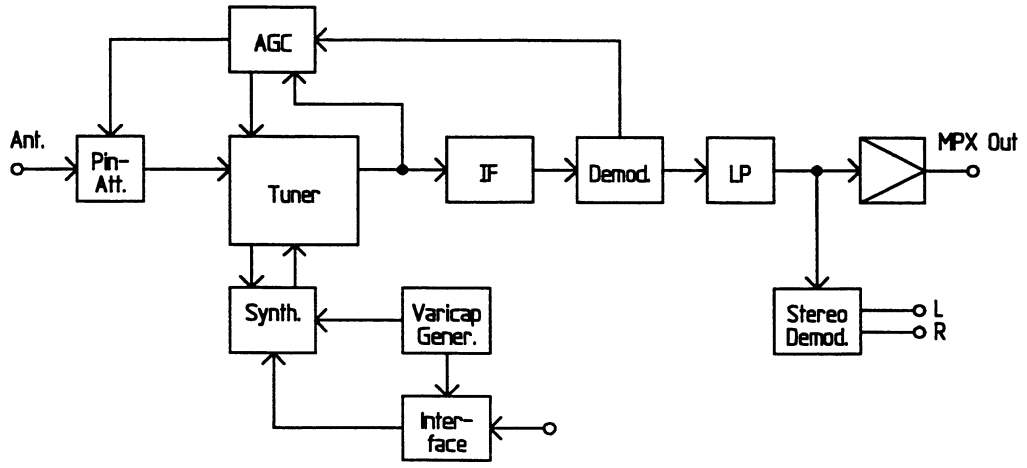


Fig. 4.6 - Block Diagram of RF Scanner

The receiver has been designed around a tuner module with 10.7 MHz intermediate frequency.

The varactor voltage controlling the RF stage and the local oscillator are generated by the synthesizer SAA1057 which receives data from the decoder via a PAL. The AGC voltage is fed to the tuner module from the AGC circuit. This circuit generates a control voltage based on the level of the IF signal partly sensed before the selective IF amplifier and partly sensed in the demodulator.

Besides controlling the gain in the tuner module, the AGC circuit controls a PIN diode attenuator at the tuner input to increase the dynamic range of the scanner.

The MPX signal is optimized for measurement purposes by an LP filter, and phase and level equalization circuits after demodulation.

To evaluate the quality of the received signal subjectively, for example during periods of reception of erroneous RDS data, the scanner is equipped with a headphone output. The stereo decoder for this output derives its signal from a point after the MPX filter and equalization.

Due to the need for a varactor voltage higher than the standard +15 V, a voltage converter is added. This circuit generates a +25 V stabilized voltage with a low noise level.

From the voltage generator a clock signal of approximately 80 kHz is used by the digital interface for converting the external 2 Mbit/s serial bus signal into the slower I^2C format used by the synthesizer.

The digital interface also interfaces 7 status signals and a single command signal to the main computer in the decoder.

Furthermore, it is possible to detect the presence of an RF scanner by writing and subsequently reading one bit of a register in the digital interface.

5. MANUAL OPERATION

Section 2.3 Tutorial gives a practical example of how to operate the RE 331 RDS Decoder.

You can control the display of the RE 331 with the 12 MENU keys.

Each menu key gives you access to a number of displays each controlling one or more settings or displaying some information.

Generally, you can change the settings using the cursor wheel or by entering a numeric value from the keyboard.When the cursor is not shown in any fields, you can use the cursor wheel to change the display shown. When the cursor is shown in a field, you can use the cursor wheel to change the values in that field.

You can protect most entries from unintended input by means of the ACCEPT/CANCEL feature.

Keyboard Operation
When you enter a number the cursor automatically moves to the first field that accepts an input. If you want to enter a number in fields other than the first one, you must move the cursor to the field in question before entering the number. You can enter the sign in signed numbers at any time during the entry of the number. You can clear the input using the [CE] key. The entry ends when you press the [ENTER] key. When the ACCEPT/CANCEL mode is enabled, the [ACCEPT] and the [CANCEL] keys start blinking after each entry. When you press [ACCEPT], the entry is accepted and the cursor moves left to the next field. When you press [CANCEL] the entry is ignored. If the ACCEPT/CANCEL mode is disabled, pressing [ENTER] accepts the entry and the cursor moves left to the next field.

Cursor Operation
When you use the cursor wheel for changing the values, the cursor must be placed on the value to be changed. When the ACCEPT/CANCEL mode is enabled, you must turn the cursor wheel, and then you must press the [ACCEPT] key. Then the cursor starts blinking and you can use the cursor wheel to change the value. If you press [CANCEL], the cursor moves on to the next field in the same direction as last used. When the ACCEPT/CANCEL mode is disabled, the cursor will start blinking immediately when the cursor is moved to the field and you can use the cursor wheel to change the value immediately.

N O T E

The values changed with the cursor wheel are always immediately reflected in the setting of the RE 331.

In the information and measuring menus "---" or empty fields normally indicate that no valid information is available.

Information in the information menus can be shown in two ways. "Dynamic" or DISP 1 mode where the information is displayed when it is received. "Static" or DISP 2 mode where the information is recalled from the information memory of the RE 331.

If DISP 1 is active (LED on), information is "dynamic" whereas DISP 2 indicates that information is "static". The information in the display is cleared every time the [DISP 1] key is pressed.

When large blocks of information (AF-lists, group order, etc.) are being displayed in static mode, you can scroll using the cursor wheel by placing the cursor on the name of the information. The cursor can be moved using the [<] or [>] keys.

When no cursor appears in the display, the cursor wheel is used to inspect other types of information.

5.1 Operation without Scanner. Set-up Menus

In the set-up menus you can control all the settings of the RE 331.

5.1.1 The SETUP Menu

The following displays are available from the SETUP Menu:

```
BLOCK ERROR
  Correct
```

In this display you can switch between Correction and Detection of errors in the RDS blocks.

```
INFO TRANSFER
Receiving Record  6
```

In this display you can set a record number. When the RE 331 works in a data bridge, the commands are sent to a record in the RDS coder with the number given here.

0	Current record
1...8	Record 1 - 8
X	All records

Note that you can only change the value when the RE 331 is in local mode and you can only change the value by using the keyboard. The cursor wheel cannot be used in this case.

5.1.2 The ADJUST Menu

The displays in the ADJUST menu are present only if the optional Measuring Unit has been installed.

N O T E

If the Measuring Unit is not installed the following text is shown:

```
No Measurement Unit
```

If the Measurement Unit is installed the following displays are available:

```
RDS REFERENCE LEVEL
      -24.5dBu
```

In this display you can set up the reference level for the RDS signal. The RE 331 will accept entries from -30.0 to -5.0 dBu. If another level measuring unit than dBu is selected the reference level is given in this unit. The accepted range depends on the calibration factors.

```
RDS LEVEL ADJUSTMENT
      0.0dB
```

In this display you can set the level correction factor for the RDS signal. The RE 331 will accept entries from -6.0 to +3.0 dB.

```
RDS PHASE ADJUSTMENT
      0.0°
```

In this display you can set the phase correction factor for the RDS signal. The RE 331 will accept entries in the range ±10°. This phase correction is also used for VRF phase measurements.

```
VRF MONITORING
      On
```

In this display you can enable or disable the VRF part of the RE 331. The values On and Off are valid. In case VRF MONITORING is "Off", all VRF related menus disappear and VRF signals are not surveyed.

N O T E

The following five displays do not appear:

in case VRF MONITORING is switched off, or
switch S2 on the CPU board disables VRF tests, or
the optional Measuring Unit is not installed.

```
SK REFERENCE LEVEL
     -14.2dBu
```

In this display you can set the SK reference level for the VRF signal. The RE 331 will accept entries in the range -30.0 to -5.0 dBu. If another level measuring unit than dBu is selected the reference level is given in this unit. The accepted range depends on the calibration factors.

```
SK LEVEL ADJUSTMENT
      0.0dB
```

In this display you can set a separate level correction factor for the VRF signal. The RE 331 accepts entries in the range -6.0 to +3.0 dB.

```
BK AREA
   A
```

In this display you can set the BK frequency (A to F) that should be used as reference during VRF measurements.

```
BK MODULATION INDEX
      60%
```

In this display you can set the reference BK modulation index used during surveillance. The legal range is 5 to 100 %.

```
DK MODULATION INDEX
      30%
```

In this display you can set the reference DK modulation index used during surveillance. The legal range is 5 to 100 %.

```
UNIT      SENSITIVITY          DEVIATION
kHz       20kHz = 2191mVpp     100% =  75kHz
```

If the RE 331 is in the American RBDS mode, you can select the unit you want your measurement result to be shown in. You can select between the following units:

- dBu
- mVpp
- kHz
- %

In order to let the RE 331 convert from one unit to another, you must supply some calibration constants. These calibration constants are set in the same display as the unit selection.

The conversion from dBu to mVpp and back, is straightforward from the definition of dBu.

0 dBu corresponds to the voltage that will give 1 mW in a load of 600 Ω. (approximately 2191 mVpp)

When you set the Sensitivity, you control the conversion from dBu and mVpp to kHz and back. You set:

20 kHz equals X mVpp.

If you want to measure in mVpp, set the Sensitivity to the sensitivity of your transmitter. If you have set the Sensitivity to the sensitivity of your transmitter and you use an HF scanner and measure on the on-air signal, you can in this way measure the voltage of the RDS signal being input to your transmitter.

The default value of the sensitivity is 20 kHz corresponding to 2191 mVpp. This is the sensitivity of most transmitters in Europe.

When you set the Deviation calibration, you control the conversion from kHz to % and back. The RE 331 then uses the Sensitivity to convert to dBu and mVpp. You set:

100% equals Y kHz.

The default value is 100 % equals 75 kHz. This is the normal deviation used in Europe.

NOTE: When you leave the American RBDS mode the calibration values are automatically reset to the default values.

5.1.3 The REF. Menu

The following displays are available from the REF. Menu:

```
          REFERENCE RECORD 1
PI:DB▒9 PS:NDR 2 SH TP:0 Inactive
```

```
          REFERENCE RECORD 2
PI:DB▒8 PS:NDR 3 SH TP:1 Active
```

```
          REFERENCE RECORD 3
PI:DB▒7 PS:NDR 4 SH TP:0 Inactive
```

```
          REFERENCE RECORD 4
PI:DB▒6 PS:NDR 5 SH TP:0 Inactive
```

```
          REFERENCE RECORD 5
PI:DB▒5 PS:NDR 6 SH TP:0 Inactive
```

```
          REFERENCE RECORD 6
PI:DB▒4 PS:NDR 7 SH TP:0 Inactive
```

```
          REFERENCE RECORD 7
PI:DB▒3 PS:NDR 8 SH TP:0 Inactive
```

```
          REFERENCE RECORD 8
PI:DB▒2 PS:NDR 9 SH TP:0 Inactive
```

The fields PI, PS and TP show the current contents of the Reference Record - positions shown as "▒" characters are "don't care" positions that will not be tested.

You can change any position in a reference record to a "don't care" position: Place the cursor below the character in question and turn the cursor wheel.

You can only set the contents of the characters by using the STORE function from the front panel or by using the "REF" command from the terminal.

The last field shown can take the values "Inactive", "Active" and "Connected" and can be used to de-activate, activate or attach the Reference Record to the record in the RDS coder that receives information with the data bridge. You can change the values from the keyboard if the RE 331 is in local mode. The following values are valid:

0 = Inactive
1 = Active
X = Connected

The cursor wheel can not be used to change the values.

If "Connected" is selected all the reference records are put in the connected mode. The active Reference Record will then be the record with the number set in the INFO TRANSFER display in the SETUP MENU. If the Receiving Record is set to 0 (Current Record) or X (All Records) all Reference Records will be active. If all reference records are connected and one of the reference records are put in the inactive or active mode, the other reference records are put in the inactive mode. If more than one Reference Record is active the received information must differ from all the active records before an alarm is triggered.

Note that the A or B reference monitoring limits must be set active before the surveillance takes place.

5.1.4 The LIMITs Menu

In the LIMITs Menu you can control all the limits for all surveillance done by the RE 331.

You can turn each surveillance function off using the cursor wheel. Place the cursor on the time field (or the value field if no time field). Turn the cursor wheel right until the word "Off" appears. You can turn the surveillance function on again by turning the cursor wheel left or by entering a legal value using the keyboard.

The following displays are available from the LIMITS Menu:

```
A POWER FAIL
Time:  30sec
```

An A-alarm is triggered if the RE 331 is turned off for a longer period than the specified time. The following values are allowed:

1 to 30 seconds or OFF.

```
B POWER FAIL
Time:  20sec
```

A B-alarm is triggered if the RE 331 is turned off for a longer period than the specified time. The following values are allowed:

1 to 30 seconds or OFF.

```
A REFERENCE MONITORING
        Limit:  20
```

An A-alarm is triggered if the number of detected discrepancies between received RDS data and contents of all the active Reference Records exceeds the specified number. The following values are valid:

2 to 200 in steps of 2 or OFF.

```
B REFERENCE MONITORING
        Limit:  20
```

A B-alarm is triggered if the number of detected discrepancies between received RDS data and contents of all the active Reference Records exceeds the specified number. The following values are valid:

2 to 200 in steps of 2 or OFF.

```
  A INFORMATION CHANGES
Limit: 5      Time:20sec
```

An A-alarm is triggered if the PI, PS, TP, TA, DI, MS or PTY information changes more than the specified number of times during the specified period. The time is counted from the first change detected. The following values are valid:

Number of changes: 2 to 5
Period (seconds): 2, 5, 10, 20 or OFF.

```
  B INFORMATION CHANGES
Limit: 5      Time:20sec
```

A B-alarm is triggered if the PI, PS, TP, TA, DI, MS or PTY information changes

more than the specified number of times during the specified period. The time is counted from the first change detected. The following values are valid:

Number of changes: 2 to 5
Period (seconds): 2, 5, 10, 20 or OFF.

```
A RDS LEVEL TOLERANCE
Limit:  2.0dB       Time:  5min
```

An A-alarm is triggered if the RDS level differs more than the specified tolerance from the reference RDS level for a period longer than the specified time. The following values are valid:

Level tolerance: 0.4 to 2 dB in steps of 0.2 dB
Period (seconds): 10, 20, 30, 40, 50 or 60
Period (minutes): 5, 10, 15, 20, 25, 30 or OFF.

```
B RDS LEVEL TOLERANCE
Limit:  2.0dB       Time:  5min
```

A B-alarm will be triggered if the RDS level differs more than the specified tolerance from the reference RDS level for a period longer than the specified time. The following values are valid:

Level tolerance: 0.4 to 2 dB in steps of 0.2 dB
Period (seconds): 10, 20, 30, 40, 50 or 60
Period (minutes): 2 to 6 or OFF.

```
A RDS PHASE TOLERANCE
Limit:    5°        Time:10min
```

An A-alarm is triggered if the RDS to Pilot signal phase differs more than the specified tolerance from the reference value for a period longer than the specified time. The reference value is normally 90.0° unless the RDS 0° mode has been selected with switch 2 on the CPU board. The following values are valid:

Phase tolerance: 2 to 15°
Period (seconds): 10, 20, 30, 40, 50 or 60
Period (minutes): 5, 10, 15, 20, 25, 30 or OFF.

N O T E Please observe that if the pilot signal disappears for example during transmission of Mono signals, you will also get an RDS Phase alarm.

```
B RDS PHASE TOLERANCE
Limit:    5°        Time:5min
```

A B-alarm is triggered if the RDS to Pilot signal phase differs more than the specified tolerance from the reference value for a period longer than the specified time. The reference value is normally 90.0° unless the RDS 0° mode has been selected with switch 2 on the CPU board. The following values are valid:

Phase tolerance: 2 to 15°
Period (seconds): 10, 20, 30, 40, 50 or 60
Period (minutes): 2 to 6 or OFF.

N O T E Please observe that if the pilot signal disappears for example during transmission of Mono signals, you will also get an RDS Phase alarm.

```
A RDS/VRF PHASE TOLERANCE
Limit:    3°        Time: 10min
```

An A-alarm is triggered if the RDS to VRF phase differs more than the specified tolerance from the reference value for a period longer than the specified time. The reference value is predefined to 90.0° The following values are valid:

Phase tolerance: 2 to 15°
Period (seconds): 10, 20, 30, 40, 50 or 60
Period (minutes): 5, 10, 15, 20, 25, 30 or OFF.

```
B RDS/VRF PHASE TOLERANCE
Limit:    3°        Time: 3min
```

A B-alarm is triggered if the RDS to VRF phase differs more than the specified tolerance from the reference value for a period longer than the specified time. The reference value is predefined to 90.0° The following values are valid:

Phase tolerance: 2 to 15°
Period (seconds): 10, 20, 30, 40, 50 or 60
Period (minutes): 2 to 6 or OFF.

```
A BLOCK ERRORS
Limit: 10%      Time: 15 sec
```

An A-alarm is triggered if the block error rate exceeds the specified value for a period longer than the specified time. The following values are valid:

Error rate:	5 to 25 % in steps of 5%
Period (seconds):	5 to 60 in steps of 5, or OFF.

```
B BLOCK ERRORS
Limit: 10%      Time: 15 sec
```

A B-alarm is triggered if the block error rate exceeds the specified value for a period longer than the specified time. The following values are valid:

Error rate:	2 to 10 % in steps of 2 %
Period (seconds):	1 to 15 or OFF.

```
A SK LEVEL TOLERANCE
Limit:  2.0dB          Time: 60sec
```

An A-alarm is triggered if the VRF SK level differs more than the specified tolerance from the VRF reference level in a period longer than the specified time. The following values are valid:

Level tolerance:	0.4 to 2.0 dB in steps of 0.2 dB
Period (seconds):	10, 20, 30, 40, 50 or 60
Period (minutes):	5, 10, 15, 20, 25, 30 or OFF.

```
B SK LEVEL TOLERANCE
Limit:  2.0dB          Time: 60sec
```

A B-alarm is triggered if the VRF SK level differs more than the specified tolerance from the VRF reference level in a period longer than the specified time. The following values are valid:

Level tolerance:	0.4 to 2.0 dB in steps of 0.2 dB
Period (seconds):	10, 20, 30, 40, 50 or 60
Period (minutes):	2 to 6 or OFF.

```
A VRF PHASE TOLERANCE
Limit:    5°          Time: 10min
```

An A-alarm is triggered if the VRF to Pilot signal phase differs more than the specified tolerance from the reference value for a period longer than the specified time. The reference value is 0.0°. The following values are valid:

Phase tolerance:	2 to 15°
Period (seconds):	10, 20, 30, 40, 50 or 60
Period (minutes):	5, 10, 15, 20, 25, 30 or OFF.

```
B VRF PHASE TOLERANCE
Limit:    5°          Time:  6min
```

A B-alarm is triggered if the VRF to Pilot signal phase differs more than the specified tolerance from the reference value for a period longer than the specified time. The reference value is 0.0°. The following values are valid:

Phase tolerance:	2 to 15°
Period (seconds):	10, 20, 30, 40, 50 or 60
Period (minutes):	2 to 6 or OFF.

```
A BK MODULATION INDEX TOLERANCE
Limit:  6%          Time: 30min
```

An A-alarm is triggered if the BK modulation index differs more than the specified tolerance from the BK modulation index reference value for a period longer than the specified time. The following values are valid:

Index tolerance:	2 to 20 %
Period (seconds):	10, 20, 30, 40, 50 or 60
Period (minutes):	5, 10, 15, 20, 25, 30 or OFF.

```
B BK MODULATION INDEX TOLERANCE
Limit:  6%          Time: 2min
```

A B-alarm is triggered if the BK modulation index differs more than the specified tolerance from the BK modulation index reference value for a period longer than the specified time. The following values are valid:

Index tolerance:	2 to 20 %
Period (seconds):	10, 20, 30, 40, 50 or 60
Period (minutes):	2 to 6 or OFF.

```
A DK MODULATION INDEX TOLERANCE
Limit:  6%          Time: 30min
```

An A-alarm is triggered if the DK modulation index differs more than the specified tolerance from the DK modulation index reference value or from 0 for a period longer than the specified time. The following values are valid:

Index tolerance:	2 to 20 %
Period (seconds):	10, 20, 30, 40, 50 or 60
Period (minutes):	5, 10, 15, 20, 25, 30 or OFF.

```
B DK MODULATION INDEX TOLERANCE
Limit:  6%          Time: 4min
```

A B-alarm is triggered if the DK modulation index differs more than the specified tolerance from the DK modulation index reference value or from 0 for a period longer than the specified time. The following values are valid:

Index tolerance:	2 to 20 %
Period (seconds):	10, 20, 30, 40, 50 or 60
Period (minutes):	2 to 6 or OFF.

5.1.5 The V.24 Menu

The following displays are found in the V.24 Menu:

```
          INTERFACE CONTROL
Term : On    B : On    C : Off   D : Off
```

In this display you can enable or disable the terminals, Line B, Line C and Line D. The values On and Off are valid.

```
TERMINAL FRONT
Baudrate: 19200 Parity:  Even Data: 7
```

```
TERMINAL REAR
Baudrate: 19200 Parity:  Even Data: 7
```

```
LINE B (RDS CODER)
Baudrate: 19200 Parity:  Even Data: 7
```

```
LINE C (TPZ)
Baudrate: 19200 Parity:  Even Data: 7
```

```
LINE D (IH)
Baudrate: 19200 Parity:  Even Data: 7
```

In these displays you can set the baud rate, parity and number of data bits for the different V24 interfaces.

For all interfaces, the following Values are valid:

Baud rate:	75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, 19200
Parity:	Even, Odd, None
Number of data bits:	7 to 8

N O T E

The following display only appears if the RDDS option has been properly installed.

```
RDDS STATE
Front: Last  Rear: Off
```

In this display you can set the RDDS state of the two terminals Front and Rear. The valid entries are "On", "Off" and "Last".

5.1.6 The SELECT Menu

The following displays are found in the SELECT Menu:

```
STATUS B: PS  TA  RT
```

```
STATUS C: NO INFORMATION
```

```
STATUS D: ALL INFORMATION
```

In these displays the RE 331 display the kind of information that is transferred on the data bridge via Line B, Line C and Line D. The displays are for information only and the contents can not be changed here. You can scroll through the information by placing the cursor on "STATUS" and turning the cursor wheel, if all the information cannot be shown at one time.

```
INHIBIT PI  PS  AF  TP  TA  DI  MS  PTY
LINE    -CD -CD -CD BCD BCD BCD BCD BCD
```

```
INHIBIT PIN RT  TDC IH  PGN PAG
LINE    BCD BCD BCD BCD BCD BCD
```

In these displays you can enable or disable the transmission of specific RDS data via the data bridge on the three interfaces B, C and D. The transmission of a specific data type is inhibited on the interfaces shown below the data type. If the character "-" is shown instead of the interface letter, the transmission of that data type is enabled.

PGN is the Paging Network Designation information and PAG is the Pagecall information.

In the example above the transmission of the PI, PS and AF information is enabled on line B and all other transmissions are disabled.

```
INHIBIT EON PS  AF  TP  TA  PTY PIN
LINE       BCD BCD BCD BCD BCD BCD
```

```
INHIBIT EON EG  LA  LI  IH
LINE       BCD BCD BCD BCD
```

```
INHIBIT EON AC10 AC11 AC12 AC13 AC
LINE       BCD  BCD  BCD  BCD  BCD
```

In these displays you can enable or disable the transmission of specific RDS EON information via the data bridge on the three interfaces B, C and D.

The EG, LA and LI information is parts of the linkage information. AC10, AC11, AC12 and AC13 are information sent in group 14A with usage codes 10, 11, 12 and 13. This information has not yet been assigned any meaning by EBU. AC is information in group 14B not yet assigned any meaning by EBU.

```
INHIBIT 1A  1B  3A  3B  4A  4B  7B
LINE    BCD BCD BCD BCD BCD BCD BCD
```

```
INHIBIT 8A  8B  9A  9B  10A 10B 11A 11B
LINE    BCD BCD BCD BCD BCD BCD BCD BCD
```

```
INHIBIT 12A 12B 13A 13B 15A
LINE    BCD BCD BCD BCD BCD
```

In these displays you can enable or disable the transmission of specific RDS information via the data bridge on the three interfaces B, C and D.

The information covered here is all the information from the different group types that have not yet been assigned any meaning by EBU.

5.1.7 The AUX Menu

The following displays are found in the AUX Menu:

```
RDS standard
American RBDS
```

You can select "American RBDS" mode or "European RDS" mode.

If you select "American RBDS", a number of new possibilities appear.

In the ADJUST menu and the RDS menu new pictures become visible. On the terminal you are allowed to use a number of new commands.

```
DISPLAY CONTROL
Automatic Shut-Down: No
```

In this display you can enable or disable the automatic power down of the display. The values Yes and No are possible.

When automatic shut-down is enabled the display is blanked after 5 minutes with no keyboard activity. Press any key to activate the display.

```
ACCEPT/CANCEL ENABLED
Yes
```

In this display you can enable or disable the security system based on the [ACCEPT]/[CANCEL] keys. The values Yes and No are valid.

```
ADDRESS
30
```

In this display you can set the IEEE address of the RE 331. The legal range is 0 to 30.

Note that the IEEE address is also used as the address in the RDDS system, when the RDDS option is installed.

```
RTC DD-MM-YYYY HH.MM.SS
    22-01-1992 14.01.13
```

In this display you can set the built-in real time clock.

To enter the setting above using the keyboard, enter the following:
22-01-1992 [ENTER] followed by 14.01.13 [ENTER].

```
CLEAR INFORMATION MEMORY ?
No
```

In this display you can clear the information memory of the RE 331 (Intermediate storage for received information which is inspected when DISP 2 mode is selected). While clearing the memory RE 331 will show "Yes" and then "No" when the information memory is cleared.

```
LOCAL KEY
Status outputs disabled:  No
```

In this display you can block the Alarm/status outputs when in Local mode. The values Yes and No are valid.

```
WAIT FOR ACKNOWLEDGE
On
```

In this display you can control one of the features of the data bridge in the RE 331. In case the value is "On", the RE 331 will wait for a special acknowledge from the attached coder when sending commands for Radio Texts, In-House information, Transparent Data Channel information and RAW data. If set to "Off", commands for this type of information are sent as fast as the information is received without waiting for an acknowledge message from the attached RDS coder.

```
AUTOMATIC EON CLEAR
        On
```

In this display you can control one of the features of the data bridge in the RE 331. If the value is "On", the RE 331 sends special EON clear commands in case specific EON information has not been received for 3 minutes. Also the EON information in the information memory is removed after 3 minutes. If set to "Off" no special EON clear commands are sent.

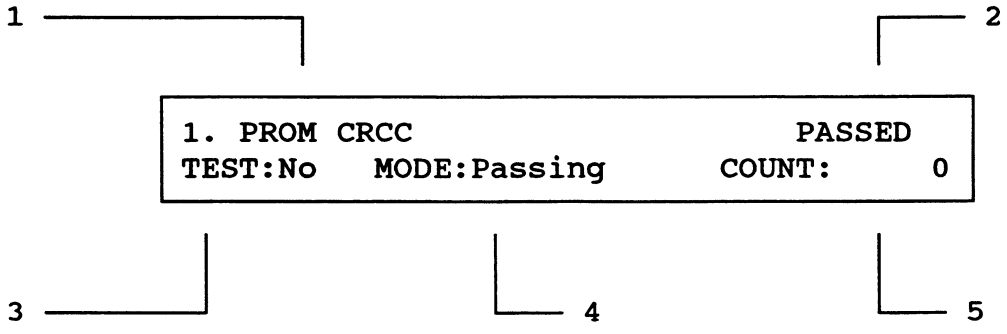
```
SAVE INSTRUMENT SETTING IN EEPROM
                No
```

In this display you can save the current settings of the RE 331 in the EEPROM. During the programming of the EEPROM the display will show "Please Wait". If the SAVE command is used on the terminal the display will show "Yes" during the programming of the EEPROM.

5.1.8 The TEST Menu

Using the TEST Menu the correct operation of some parts of the RE 331 is ensured. The TEST Menu contains 19 different tests (20 if a scanner is installed) ranging from PROM tests to tests on RS-232 interfaces using dummy connectors.

Typically an entry in the test menu looks this.



The five fields have the following meaning:

1. Shows the name of the test. You can use the cursor wheel or enter the number of the test to change the test.

2. Shows the result of the test(s).

3. You can start or stop the test.

4. You can instruct the RE 331 to perform the test(s):
   Once - performs the test once
   Error - repeats until the test is passed
   Passing - repeats until an error is found
   Continuous - performs the test continously

5. Indicates how many times the test has been performed (up to 9999)

The following tests are available from the TEST MENU:

1. PROM CRCC	Tests the EPROMs using Cyclical Redundancy Check Characters.
2. INTERRUPT CONTROLLER	Tests the interrupt controller.
3. REAL TIME CLOCK	Tests the real-time clock chip.
4. (KEYBOARD)	Used from the terminal to test the keyboard. Cannot be called from the keyboard.
5. (DISPLAY)	Used from the terminal to test the display. Cannot be called from the keyboard.
6. TMS 320	Used to check the communication between the main CPU and the Digital Signal Processor (TMS 320C10) on the COM/SYNC Board.
7. DEMODULATOR BOARD	Tests the communication between the main CPU and the demodulator.
8. MEASUREMENT BOARD	Tests the communication between the main CPU and the optional Measuring Unit.
9. FRONT TERMINAL UART	Tests the Universal Asynchronous Receive Transmit chip handling the terminal interface on the front panel of the RE 331.
10. REAR TERMINAL UART	As (9), but for the terminal interface on the rear panel of the RE 331.
11. LINE B UART	As (9), but for LINE B on the rear panel of the RE 331.
12. LINE C UART	As (9), but for LINE C on the rear panel of the RE 331.

13. LINE D UART	As (9), but for LINE D on the rear panel of the RE 331.
14. REMOTE LOOPBACK	Tests the Status inputs using the Alarm outputs using cables constructed as described in section 3.4
15. FRONT TERMINAL LOOPBACK	Tests the terminal interface on the front panel. To run the test, a 25-pole male Sub-D plug connecting pin 2 to pin 3, pin 4 to pin 5 and pin 6 to pin 20 should be inserted in the front terminal connector.
16. REAR TERMINAL LOOPBACK	As (15) but for the rear terminal connector.
17. LINE B LOOPBACK	As (15) but for Line B on the rear panel.
18. LINE C LOOPBACK	As (15) but for Line C on the rear panel.
19. LINE D LOOPBACK	As (15) but for Line D on the rear panel.

5.1.9 The STORE Function

When you press the [STORE] key the following display is shown.

```
REFERENCE   PI:1111  PS:DR 1 KGX  TP:1
    1       No       No           No
```

The display shows the received PI, PS and TP. You can select a reference record to receive the information in the first field. In the next three fields you can transfer the information to the selected reference record by changing "No" to "Yes". Before you transfer the information to the reference record, you can change selected characters of the information in the PI, PS and TP fields to the "▒" "don't care" symbol by placing the cursor on the character and then use the cursor wheel.

5.2 Operation without Scanner. INFO Menus

5.2.1 The RDS Menu

The following displays are found in the RDS Menu:

```
PI    PS        DI  TP  TA  MS  LA  PTY
----  --------  --  -   -   -   -   --
```

This display display the received PI, PS, DI, TP, TA, MS, LA and PTY.

In DISP 1 mode, the PS field is built from the single segments as they are received.

In DISP 2 mode, only complete PS information is shown.

```
AF : [* 5] 100.0  99.9  98.8  97.7  96.6
      [12]  88.8  89.9  90.0  91.1  92.2
```

This display shows the received AF-lists. The number of frequencies in a list is indicated in square brackets "[ ]".

A specific main frequency may be marked to facilitate inspection of AF-lists in DISP 2 mode by pressing the [ENTER] key when the list containing the main frequency is displayed. A selected list is indicated by a "*" in front of the number of frequencies in the list.

[*5] 99.8 100.7 104.3 88.9 97.7

indicates that the frequency 99.8 has been marked. (Refer to the "AFLIST"-command in the PROGRAMMING section).

```
CT                PIN       PTY TP TA MS
20-01-1992 15.22  20.12:10  --  -  -  M
```

This display shows Clock and Time (CT), PIN, PTY, TP, TA and MS information.

```
RT :    abcdefghijghijklmnopqrstuvxyz 12
        4567890
```

This display shows Radio Texts (RT). In DISP 1 mode the RE 331 follows the EBU standard and the clears the display when a change in the radio text A/B flag is detected. If no radio text A/B flag change takes place when a new text begin, the old text is just overwritten. In DISP 2 mode the last 16 radio texts received can be displayed. Below "RT" the number of the text is shown, 0 being the newest, 15 the oldest.

```
TDC:  0,28293d3f  0,61626364  0,65666768
h     0,696a6b6c
```

This display shows Transparent Data Channel number and contents. The information can be shown in 3 formats:

Hexadecimal : Shows channel, shows content as a hexadecimal number.
Alphanumeric : Shows channel, shows content as EBU RDS characters, and non printing characters as control characters
Compact : Shows content as EBU RDS characters and non printing characters as "."

You can select the format by placing the cursor on the letter below "TDC" and turning the cursor wheel. In Hexadecimal and Alphanumeric format the content of block 3 of 5B groups are shown as "....".

In DISP 1 mode the TDC information is shown when it is received. In DISP 2 mode the TDC information from the last 64 TDC groups can be shown. The characters "<" and ">" below "TDC" indicates the direction the cursor wheel can be turned to scroll through the information when the cursor is placed on "TDC".

```
TDC    0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0
CH:    *               **
```

In this display the active TDC channels are indicated by a "*". In the above display TDC channels 0, 15 and 17 have been received.

```
IH :  0,11223344  0,55667788  0,99aabbcc
h     0,ddeeff00
```

```
IH      0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0
CH:       *                 *     *
```

In these displays In-house information is shown in the same manner as the TDC information. The 5 bits in block 2 of group 6 are interpreted as a channel number in the same way as for TDC. In the above IH channel display IH channels 4, 21 and 27 have been received.

Note that the "*" indicating In-house channel 2 information is cleared 5 seconds after the last reception of In-house channel 2.

```
GR :  0A  2A  0A  7A 14A  1A  0A  2A  0A
     14A  0A  2A  0a 14A  0A  2A  1A  0A
```

In DISP 1 mode the groups are shown as they are received. The last 18 groups are shown and the newest are indicated by a lower case group letter. In the above example the 0a group in the lower line.

In DISP 2 mode groups can be shown in 2 different formats.

Table : Shows the last 36 groups received.

Order : Shows the received group sequence as the RE 331 tries to extract it from the received groups.

The 2 formats can be selected by placing the cursor on the letter "T" or "O" below "GR". The information can be scrolled by placing the cursor on "GR" and turning the cursor wheel in the direction indicated by the "<" and ">" characters.

```
GR :   0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
       a a a       ba            a  b
```

This display gives an overview of the group types that are being (or have been) received: In the example above, groups of type 0A, 1A, 2A, 6B, 7A, 14A and 15B have been received. Note that in case A and B type groups are mixed upon reception, the RE 331 is able to display both types at the same time thus illegal group orders may also be identified.

```
PI      PS            PTY     PTY NAME
1234    RE  Tech      01      PTY TEST
```

This display is shown if you select American RBDS mode. The PTY NAME information is found in the 10A groups.

```
CITY       STATE LAT   LONG    CODE INFO
BIG TOWN WA     47.6 122.2     1    123456AB
```

This display is shown if you select the American RBDS mode. The location information is found in the 3A groups.

The CODE and INFO fields show the contents of the C and D blocks whose functions are not yet defined in the RBDS standard. The CODE field can be scrolled when in DISP 2 mode.

```
TIME    NET    PAGING  INFO
32:07   0-99   123456 789 987654321012345
```

This display shows the time (in minutes) when received from the 4A groups and the seconds of the time as received with the 1A groups.

"NET" is the paging network designation as received with 1A groups and shows the interval of the 2 first digits in the page number that is sent on this network.

"PAGING" shows the page call number from the 7A groups.

"INFO" shows any additional information sent with the page call. In the case of 80 characters alphanumeric paging, the last 19 characters are shown.

In the above example minutes are 32, seconds are 07, all calls are sent on this network, the last call was to page number "123456". The call was a 15-digit international call with the country code "789" and the information content "987654321012345".

In DISP 1 mode the time is updated as the 1A and 4A groups are received and the page calls are shown as they are received.

In DISP 2 mode the time is frozen and the last 8 received calls can be shown by placing the cursor on "PAGING" and turning the cursor wheel. This also scrolls through the complete 80 characters alphanumeric paging information.

```
GR  0   ECC TMC 2   3   4   5   IH  EWS
1A  0E0 D   --- --- --- --- --- 000 ---
```

This display shows the raw information received in block 3 in 1A groups. The upper line shows the 8 usage codes, TMC (Traffic Message Channel) for usage code 1, IH (Inhouse) for usage code 6 and EWS (Emergency Warning System) for usage code 7.

The last 8 bits for usage code 0 are combined with the first 4 bits of the PI code to provide the ECC (Extended Country Code) and shows an abbreviation of the country name.

```
INFO          1111 041A 737D 7264
GRP   XX      1111 2409 3920 2020
```

This display shows "raw" RDS information as 4 blocks each of 4 hexadecimal characters corresponding to the 4 times 16 bits in an RDS group.

The group type shown can be selected by placing the cursor on the group type select field (above "XX") and then using the cursor wheel, or by just entering the number of the wanted group type. "XX" means all group types.

Blocks are always placed in the position where they belong. Empty space indicates that no block of that type was received. "----" indicates one block time spent without receiving any RDS blocks.

In DISP 1 mode the groups are shown as they are received.

In DISP 2 mode the last 4 groups of a specific group type or the last 16 of an unspecified ("XX") group type can be inspected by placing the cursor on "INFO" and then scroll by means of the cursor wheel. The characters "<" and ">" indicate the possible direction of the cursor wheel.

5.2.2 The ON Menu

The following displays are found in the ON Menu:

```
EON PI      1112 1113 1112 1113 1112 1113
            1112 1113
```

In DISP 1 mode the EON PI are shown as the EONs are received.

DISP 2 mode shows a list of all the EONs on which the RE 331 has information. If the list is longer than 12 EONs, "<" and ">" characters appears below "EON PI".

The list can then be scrolled with the cursor wheel after moving the cursor to the "< >" field.

N O T E

In the other EON displays the information is shown one EON at a time. In the leftmost field the EON PI is shown. You can control the PI code of the EON shown using the cursor wheel. You can select a specific PI code or a "X" mode. In the "X" mode information from all EONs are shown as received when in DISP 1 mode.

In the DISP 1 mode and the "X" mode the display is cleared each time the PI code of a new EON is received for the first time. The segments of the PS name are shown as they are received.

```
EON PI  PS         TP  TA  PTY   PIN
X 1112  eon 1112   0   0   00    01.02:03
```

This display shows PS, TP, TA, PTY and PIN belonging to an EON identified by a specific PI.

In DISP 2 mode the PS name are shown only if all segments are received.

```
EON PI  PS         LA  EG  LN    IH
X 1112  eon 1112   1   0   0421  8888
```

This display shows PS, LA, EG, LN and IH belonging to an EON identified by a specific PI.

In DISP 2 mode the PS name is shown only if all segments are received.

```
EON PI  PS         AC10 AC11 AC12 AC13 AC
X 1112  eon 1112   ---- ---- 0    000  -
```

This display shows PS, AC10, AC11, AC13 and AC belonging to an EON identified by a specific PI. This is the information in group 14A, block 3, usage code 10 and 11, the unused bits in usage codes 12 and 13 and the unused bits in group 14B, block 2. All these bits are not yet assigned any meaning by EBU.

In DISP 2 mode the PS name is shown only if all segments are received.

```
EON PI  TN  98.0  98.0                98.0
X 1234  AF  99.0 100.0                1602
```

This display shows mapped AF-lists belonging to an EON identified by a specific PI.

In DISP 1 mode the tuned frequency and the mapped frequency are shown together as they are received.

In DISP 2 mode the tuned frequency is shown only once for each list and the mapped frequencies belonging to that tuned frequencies are shown below. Only correctly received lists are shown. If there is more than one tuned frequency for that EON the lists can be scrolled by placing the cursor on "TN" and turning the cursor wheel.

```
EON PI  AF      [12]  88.0  89.0  90.0
X 1112          91.0  92.0  93.0  94.0
```

This display shows the method A, AF-list belonging to an EON identified by a specific PI.

In DISP 1 mode the alternative frequencies are shown as they are received.

In DISP 2 mode the frequency list from the memory is shown. If the list is longer than 7 frequencies, you can scroll the list by placing the cursor on "AF" and turning the cursor wheel.

5.2.3 The MEAS Menu

The following displays are found in the MEAS. Menu:

```
 RDS LEVEL     RDS PHASE    R-V     ERR SYN
-24.5+0.5dBu     0.0+0.4°   91.0°    2%
```

```
 RDS LEVEL     RDS PHASE           ERR  SYN
-24.5+0.5dBu     0.0+0.4°           2%
```

This display only appears if the optional Measuring Unit is installed. If VRF watching is enabled the upper display is shown. If VRF watching is disabled the lower display is shown.

The display shows the current RDS level (including the correction factor), RDS phase relative to 19 kHz pilot signal (including correction factor) and the phase relation

between RDS and VRF if the VRF monitoring is enabled.

Finally, this display shows the number of block errors calculated as a running average over the last 100 blocks. When block synchronism is lost, a "▒" is displayed under "SYN".

You can enter the correction values from the ADJUST Menu; however, it may also be entered directly using the MEAS. Menu which means that it is easy to find the correct values as the RE 331 continues to display measured values while the adjustment is going on - preferably this adjustment should be done using the cursor wheel.

```
  SK LEVEL        DK     BK         PHASE
-15.2dBu  0.5dB   29%   A   60%       0.2°
```

This display only appears in case the optional Measuring Unit is installed and VRF monitoring is enabled.

The display shows the current VRF level including correction factor, DK and BK modulation indexes, the BK area code and phase relative to the 19 kHz pilot signal.

The correction factor may be modified in this display or from the ADJUST menu.

```
BLOCK ERROR
     0%
```

The display shows the current block error rate calculated as a running average measured over the last 100 blocks.

5.2.4 The ERROR Menu

In the ERROR menu you can inspect the list of errors that the RE 331 maintains based on the surveillance on levels, phase etc. that is performed. The RE 331 not only indicates the errors, the value that gave the maximum difference from the reference value and the duration of the error, but it also indicates *when* this error occurred (year, month, day, hour, minute and second **and** the time the error disappeared. In this way you can easily correlate the errors with other influences such as thunderstorms.

```
CLEAR ERROR LIST ?
        No
```

In this display you can delete all inactive error messages with one command. Change No to Yes by using the cursor wheel or by entering 1. After the error messages have been deleted, the RE 331 will automaticly change Yes to No.

```
28-07-1990 14.50.38 B Power
28-07-1990 15.02.50
```

If the cause of the error/warning is still active, the RE 331 displays the message **ACTIVE** instead of the error end time.

Inactive errors can be removed from the error list. When the RE 331 shows an inactive error the LEDs in the [Accept]/[Cancel] keys flash to indicate that the error message may be removed by pressing the [Accept] key.

A maximum of 100 inactive errors can be stored in the RE 331. Further inactive errors are not stored.

The possible hardware error messages are:

Global Variable	: Variables controlling the settings lost on power-up
Heap	: Variables on the heap lost on power-up
Error List	: The error list was lost on power-up
EEPROM variable	: Variable saved in the EEPROM lost on power-up
PROM crcc	: PROM content damaged
RT	: Real Time Clock defective
Interrupt cont	: Interrupt controller defective
TMS 320	: TMS 320 defective
Demodulator	: Communication to demodulator board defective
Measurement Board	: Communication to measurement board defective
Scanner Board	: Communication to scanner board defective
IEEE	: IEEE 488 interface defective
Keyboard	: Front panel keyboard defective
Display	: Front panel display defective
Alarm Board	: Communication to alarm board defective
RTXA	: UART for line A (rear terminal) defective
RTXB	: UART for line B defective
RTXC	: UART for line C defective
RTXD	: UART for line D defective
RTXT	: UART for line T (front terminal) defective

The possible data bridge error messages are:

No DTR on line B	: No DTR detected
No DTR on line C	:
No DTR on line D	:
No CTS on line B	: Hardware handshake keeps the commands from
No CTS on line C	: being transmitted for more than 5 seconds
No CTS on line D	:
Timeout on line B	: No ACK/NAK/CAN within 5 seconds after the
Timeout on line C	: command was sent
Timeout on line D	:
CAN on line B	: CAN was send from the attatced coder.
CAN on line C	: This means the RE 331 are not allowed to write
CAN on line D	: the information.

The possible surveillance error messages are:

Power	: The RE 331 has been turned off
Reference	: RDS data differs from reference
Info	: Too many changes in RDS data
Block Errors	: Too many block errors
RDS level	: Wrong RDS level
VRF level	: Wrong VRF level
DK Modulationindex	: Wrong DK modulation index
BK Modulationindex	: Wrong BK modulation index
RDS phase	: Wrong RDS to pilot phase
VRF phase	: Wrong VRF to pilot phase
RDS-VRF phase	: Wrong RDS to VRF phase
BK area	: Wrong BK area code
DK Frequency	: Wrong DK frequency

5.3 Operation with Scanner. Setup Menus

When a scanner is installed the SETUP, ADJUST and REF. menus are modified.

5.3.1 The SETUP Menu

Three new displays are shown in the SETUP menu when a scanner is installed. The display used to select the input is the only different display from the MPX scanner and the HF scanner. All other displays are the same for the MPX scanner and the HF scanner.

Here we will show the input select displays for both the MPX scanner and the RF scanner.

N O T E

When a scanner is installed and you press the [MPX] key, the MPX scanner or the HF scanner display is shown on the screen and the cursor is placed in the first field. Pressing the [MPX] key again makes the RE 331 shift to the next possible input in the cycle: Front, Rear, Input 1 to Input 8, Activating scanning and then back to Front.

```
SCANNER INPUT              PI    PS
Input:   Scanning Front    1111  DR 2 KGX
```

This display is shown only if the MPX scanner is installed.

Field one shows the current input - Front, Rear or MPX 1 to 8. The prefix Scanning is shown if scanning takes place. The input can be changed by entering the number (X for scanning) or placing the cursor on the field and then turning the cursor wheel.

The last two fields show the PI and the PS of the received RDS signal. The fields are cleared when the input number is changed but otherwise they behave as normal information fields with DISP 1 and DISP 2 modes.

```
   FREQUENCY LVL PLT MONO  PI    PS
S1  96.51MHz 3  ▒< ▒ On    1111  DR 2 KGX
```

This display is shown only if the HF scanner is installed.

Field one shows the current input - F (front), R (rear) or 1 to 8. The prefix S is shown if scanning takes place. When front or rear is selected the frequency field is blanked. The input can be changed by entering the number (X for scanning) or placing the cursor on the field and then turning the cursor wheel.

Field two shows the frequency assigned to the input number shown in field one.

Field three shows the measured RF level on a scale from 0 to 3. The following table shows the connection between the indicated scale values, the approximate antenna EMF and the way the RE 331 reacts:

LVL	Antenna EMF	Reaction
0	< +18 dBμV	Headphone output switched to Mono, RDS decoding and measurements are corrupted by noise.
1	18 to 40 dBμV	If Pilot is present the headphone output is switched to stereo, RDS decoding is possible but measurements will give too large values due to noise (refer to Specifications Section 25).
2	40 to 58 dBμV	If no interference is present, RDS data will be decoded completely and RDS measurements are correct.
3	> 58 dBμV	The maximum noise suppression of the receiver takes place in this range.

Field four shows tuning aid. ">" means the frequency is too low, "<" means the frequency too high. The "▒" in the middle shows that the Phase Lock Loop in the receiver is in lock.

Field five shows a stereo pilot indicator. "▒" means a pilot signal is detected.

Field six is used to force the receiver to mono mode. Place the cursor in the field and turn the cursor wheel to select mono or stereo. MONO "On" means that the earphone outputs are switched to Mono.

The last two fields show the PI and the PS of the received RDS signal. The fields are cleared when the input number is changed but otherwise they behave as normal information fields with DISP 1 and DISP 2 modes.

The following displays are common to both scanners:

```
SCANNER SEQUENCE          TIME
Input:   Rear             10min
```

In this display you set the period the RE 331 should stay on the selected input when scanning takes place. In order to *exclude* an input from the scanner sequence "TIME" should be set to 0 min.

INPUT	1	2	3	4	5	6	7	8
INDICATION	N	R	N	R	R	N	N	N

This display shows the input status as detected on the remote input. When a scanner is installed, the 8 record inputs indicate the status of the signal source. "N" means that the input is in NORMAL state. "R" means that the input is in "RESERVE" state.

Surveillance error messages are marked with a "*" if the corresponding input is in the "RESERVE" state.

5.3.2 The ADJUST Menu

In the ADJUST menu the displays where the RDS level correction, RDS phase corrections, VRF surveillance on/off, VRF level correction and BK area can be set disappears and two new displays appear instead.

N O T E

The reference levels used are the same for all inputs.

SCANNER VRF	VRF	LEVELCORR	BK
Input: Rear	On	0.0dB	C

In this display you can set VRF surveillance on/off, set the VRF level correction and set the BK area code for each input

SCANNER RDS	LEVELCORR	PHASECORR
Input: Rear	0.0dB	0.0°

In this display you can set the RDS level correction and the RDS phase correction for each input.

5.3.3 The REF. Menu

When a scanner is installed the reference menu is changed to reflect the fact that there are now one reference record per input and three regional references.

```
REFERENCE            PI    PS          TP
Scan1                1▒▒▒  DR▒▒▒▒▒▒▒▒  ▒    On
```

```
REFERENCE  INPUT    PI    PS          TP
Reg 1      Scan1    1234  ▒▒▒▒▒▒▒▒▒▒  1    On
```

The first display shows the reference records connected to the inputs. The second display shows the reference records for the regional reference records.

Note that any change in the settings may only take place when in local mode.

The "INPUT" field in the display with the regional references shows the input which the regional reference is connected to. You can change the value with the cursor wheel. It is possible to connect more than one regional reference to the same input. The normal reference record is automatically inactive when a connected regional reference record is active.

The PI, PS and TP fields show the contents of the reference record. "▒" is the "don't care" character. You can change the characters in the fields to "don't care" or back to the original content by placing the cursor on the character and turning the cursor wheel. The value of the characters can be set using the STORE function from the front panel or the "REF" command from the terminal.

The last field controls if the reference record is active. You can only change the value by entering "0" = "Off" or "1" = "On". The cursor wheel cannot be used.

Any reference error message indicates the source of the reference error. F, R, N or R1, R2, R3 for the front, rear, normal or regional reference 1, 2 and 3.

5.3.4 The TEST Menu

The TEST Menu has been modified, so it is possible to test the communication to the scanner board.

```
20. Scanner                          ----
Test:No    Mode:Passing        Count:      0
```

5.3.5 The STORE Function

When a scanner is installed the "STORE" function are modified to allow you to store information in the reference record for each input and in the regional reference records.

```
REFERENCE   PI:1111  PS:DR 1 KGX  TP:1
    Scan1   No       No            No
```

Apart from this there is no change in the function.

5.4 Operation with Scanner Info. Menus

5.4.1 The RDS Menu and ON Menu

When a scanner is installed the displays in the RDS and the ON menu do not change. The only change is that every time one of the menus is selected or every time the scanner shifts input, the active input is shown for 2 seconds in the display.

```
        Input : Scanning Rear
```

5.4.2 The MEAS Menu

In the MEAS Menu the previous display is also shown every time the menu is selected or every time the scanner shifts input.

```
 RDS LEVEL     RDS PHASE    R-V     ERR SYN
-24.5+0.5dBu     0.0+0.4°   91.0°    2%
```

```
  SK LEVEL          DK     BK          PHASE
-15.2dBu  0.5dB    29%   A    60%        0.2°
```

In the two displays with measurement results the RDS level correction, the RDS phase correction and the VRF level correction always refer to the corrections for the active input. You can change the values in these displays or in the displays in the ADJUST Menu.

5.4.3 The ERROR Menu

In the ERROR Menu all the error messages relating to a specific input shows the input number as the first character.

```
2 27-01-92 09.52.00 A Info          2  20s
* 27-01-92 09.52.25 PS DI
```

In the above example the error message is from input number 2. The "*" below "2" indicates that input 2 had the "RESERVE" status at the time of the disturbance.

6. PROGRAMMING

This section contains information on how to control the RE 331 from the two terminal interfaces: The standard V24 interfaces or via the IEEE 488 interface.

You can send commands to the terminal interfaces from any device with a V24 interface. Normally you will use a standard V24 terminal or a PC.

The RE 331 has build-in support of both German and English languages. This manual describes the english language version.

6.1 Command Descriptions

The rest of this section describes all the commands of the RE 331.

All command descriptions has a similar structure, consisting of the following four parts:

Description,
Syntax,
Parameters, and
Exsamples

6.1.1 Description

The functional description outlines the action caused by the commands, and how you use them in conjunction with the variety of functions available in the RE 331.

Reference to related commands and any restrictions on the use of the commands are also found in this part.

6.1.2 Syntax

This part will describe the syntax of the command, including the number and position of any parameters.

6.1.3 Parameters

Here you will find the actual specification of the parameters, including what ranges and units are allowed, and any default values that will be assumed, if the parameter is omitted.

6.1.4 Examples

Each commands description is concluded with examples of how you use the particular command.

6.2 Command Structure

6.2.1 Command Strings

You send commands to the RE 331 in form of character strings. These strings can be terminated by CR (13 decimal, 0D hexadecimal), LF (10 decimal, 0A hexadecimal) or EOI (on IEEE interface), or any combination of these.

The command name and the parameters are always separated from each other by means of a comma ",". Spaces may be freely inserted around the comma.

The command strings can contain more than one command by separating them with a semicolon ";". If for example, you want to change both the block error limit and the information change limit, you can issue the two commands on a single line:

```
BLKERR,A,10%,40s  ;  INFO,A,4,20
```

Note that all the letters in the command names, alphanumeric parameters and units are significant. The RE 331 are case-insensitive in command names, alphanumeric parameters and units.

An ETX character (hexadecimal or [CTRL C]) stops further output of information from the RE 331. Xoff [CTRL S] and Xon [CTRL Q] characters may be used to control the display of information (Stop scroll/Start scroll) - Backspace may be used to edit commands for the RE 331.

6.2.2 Help Strings

If you just enter the command name for a command with parameters, the RE 331 responds with a command description, the current value of the parameters and the legal range for the parameters.

If only the command

INFO [ENTER]

is entered, the RE 331 responds by displaying

RDS Information tolerance (A or B tolerance):

and waits for the user to select A or B limits. In case an "A" is entered, the RE 331 responds by displaying

A RDS Information tolerance 5,20s (Range:2 .. 5 Step:1, Range: 2/5/10/20s):

thus indicating that the current setting is 5 changes over a period of 20 seconds and indicating that first parameter (number of information changes) may take on values between 2 and 5 in steps of 1 while the second parameter (time) may only take on the discrete values 2, 5, 10 or 20 seconds. If the user decides not to change anything, he or she should only press the [ENTER] key and the RE 331 responds as follows

Command ignored

whereas parameter errors result in a new prompt. If a correct response is given, the RE 331 responds by

Accepted

Experienced users may of course enter commands without utilizing the prompts:

INFO,A,5,10 [ENTER]

modifies the setting without further prompts. If an error is detected, the RE 331 starts prompting the user.

6.2.3 Common Queries

The setting of a few commands can be found by entering the command followed by a question mark "?". For example the question **UR?** will return the status for the Clock Control.

6.3 The Commands

The commands for the RE 331 have been divided into 4 groups.

6.3.1 Inspect Commands

These are used in order to inspect the incoming RDS data

(0A...15B)	A specific RDS group as raw hexadecimal data
(ACON)	AC from EON
(AC10)	AC10 from EON
(AC11)	AC11 from EON
(AC12)	AC12 from EON
(AC13)	AC13 from EON
(AF)	AF
(AFLIST)	AF once from Information Memory
(AFLON)	EON AF once from Information Memory
(AFON)	AF from EON
(AI)	All information (except AF, ON and EON) once
(AION)	All EON information (except AF) once
(APVAL)*	All RDS and VRF measurements periodically
(AVAL)*	All RDS and VRF measurements once
(CT)	CT
(DI)	DI
(EGON)	EG from EON
(GR)	Group order
(IH)	IH
(IHON)	IH from EON
(LA)	LA from group 1A
(LAON)	LA from EON
(LION)	LI from EON
(LOCATE)*	Show Location information
(MS)	MS
(NETGRP)	Net group from paging information
(PAGE)	Data from pagecalls
(PGTIME)	Pagetime from pagecalls
(PI)	PI
(PIN)	PIN
(PINON)	PIN from EON
(PION)	PI from EON
(PS)	PS
(PSON)	PS from EON
(PTY)	PTY
(PTYNAM)*	Show Program type name
(PTYON)	PTY from EON
(PVALUE)	Measured RDS values periodically
(RT)	RT
(TA)	TA
(TAON)	TA from EON
(TDC)	TDC
(TP)	TP

(TPON) TP from EON
(VALUES)* Measured RDS values
(XX)* All received information as raw hexadecimal data

6.3.2 RDS Setup Commands

(ALL) Set all surveillance on/off
(BLKERR,A) Set up A limit for block errors
(BLKERR,B) Set up B limit for block errors
(INFO,A) Set up A limit for RDS information changes
(INFO,B) Set up B limit for RDS information changes
(LEVADJ) Set up level correction values
(LEVLIM,A) Set up A limit for RDS level
(LEVLIM,B) Set up B limit for RDS level
(MODE) Change error correction/detection mode
(PHADJ) Set up phase correction values
(PHLIM,A) Set up A limit for RDS phase
(PHLIM,B) Set up B limit for RDS phase
(POWER,A) Set up A limit for power fail
(POWER,B) Set up B limit for power fail
(RDSREF) Set up RDS reference level
(RDSVRF,A) Set up A limit for RDS-VRF phase
(RDSVRF,B) Set up B limit for RDS-VRF phase
(RECORD) Enter record to be used during RDS rebroadcasting
(REF) Enter RDS Reference Record number and contents
(REFLIM,A) Set up A limit for reference errors
(REFLIM,B) Set up B limit for reference errors
(SELECT) Disable rebroadcasting of RDS information

6.3.3 VRF Setup Commands

(BKFREQ) Enter the BK area code (frequency)
(BKLIM,A) Set up A limit for BK modulation
(BKLIM,B) Set up B limit for BK modulation
(BKMOD) Enter the BK modulation index
(DKLIM,A) Set up A limit for DK modulation
(DKLIM,B) Set up B limit for DK modulation
(DKMOD) Enter the DK modulation index
(SKADJ) Enter SK level correction
(SKLIM,A) Set up A limit for SK level
(SKLIM,B) Set up B limit for SK level
(VRFPHL,A) Set up A limits for VRF to Pilot signal phase
(VRFPHL,B) Set up B limits for VRF to Pilot signal phase
(VRFREF) Set up VRF reference level

6.3.4 Miscellaneous Commands

Miscellaneous Commands

(?)* Obtain software release information
(ACKNOW) Enable/Disable the await of acknowledges Disturbances
(ALARMS) Inspect disturbances
(DEVCAL)* Set the deviation calibration
(ECHO) Control the echo function of the RE 331
(EONCLR) Enable/Disable automatic EON clearing
(HELP)* Display a help screen showing all commands
(ID)* Give the Instrument an identity number
(IEEE) Set the IEEE address of the RE 331
(LIMITS)* Show all limits
(LOCAL) Toggle between Local and Remote Mode
(MEMCLR) Clearing of information memory
(MENU)* Display the Menu structure of the RE 331
(MPX)* Switch between front and rear MPX input
(RDSMOD)* Set RDS Mode
(REFLST)* List all Reference Records
(RESET)* Reset the RE 331
(RTC)* Set the Real Time Clock
(SAVE)* Save all settings in EEPROM
(SENS)* Set Sensitivity
(STTY)* Set up RS-232 parameters for all RS-232 interfaces
(TEST) Test the RE 331
(UNIT)* Set Level Measuring Unit
(VRF)* Switch VRF part of the RE 331 on/off

IEEE 488 Specific Commands

(SS)* Set IEEE 488 Service Request Disable/Enable Mask

Clock Control Commands

(RU)* Remove Clock Control Settings
(UR)* Set Clock Control Commands
(UR?)* Inspect Commands Scheduled for Execution

RDDS Commands

(AR)* Address/Deaddress the unit

N O T E

Commands marked with a "*" are not found in Pflichtenheft 5/3.9.

SCANNER Specific Commands

used in order to:

(FREQ)	Set Frequency for HF Scanner
(LEVADJ)	Enter Level Correction for Scanner
(MONO)	Toggle Stereo/Mono for Earphones in HF Scanner
(MPX)	Switch between front, rear and Scanner inputs
(PHADJ)	Enter Phase Adjustment for Scanner
(REF)	Enter RDS Reference Record for Scanner
(REFLST)	List Contents of RDS Reference Records for Scanner
(REGION)	Set Regional Connections for Scanner
(SKADJ)	Enter SK level correction for Scanner
(TIME)	Set Time to Scan Inputlines
(VRF)	Toggle VRF Option for Scanner

6.4 Inspect Commands

Inspect an RDS group as raw data (0A to 15B)

Description

By entering the group identifier 0A, 0B, 1A, ..., 15B, the RE 331 displays the information contained in the specified group type as 4 groups each consisting of 4 hexadecimal characters, which means that the CRCCs are not displayed. The command takes no parameters.

Syntax

0A, 0B, 1A, 1B, 2A, 2B, 3A, 3B, 4A, ... or **15B**

Parameter	Range	Default Value
None		

Examples

2A This command makes the RE 331 display all data received in 2A groups as raw hexadecimal data, without the crcc codes. The form of the output is:

```
9201 2008 4B4C 4D4E
9201 2009 4F50 5152
9201 200A 5354 5556
9201 200B 5758 595A
...
```

In case the groups 1A, 1B, 3A, 3B, 4A, 4B, 5A, 5B, 7A, 7B, 8A, 8B, 9A, 9B, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B and 15B are shown, in each line are additionally show the last five bits of block 2 and block 3 and 4.

In case group 4A are shown, also bits 5, 4 and 3 are shown as a number. (This is the RAW 4A information).

ACON, Inspect AC from EONs

Description

This is used to inspect the AC information in the transmitted EONs. The AC information is the value of the 3 lowest bits in block 2 of a 14B group, which has not yet been assigned a special purpose.

Syntax

ACON

Parameter	Range	Default Value
None		

Examples

ACON makes the decoder display the pi of the received EON, followed by the AC information from the 14B group, displayed as a digit in the range 0 to 7:

```
ACON:
D323: 7 7 7 7 .....
```

AC10, Inspect AC10 from EONs

Description

This is used to inspect the AC10 information in the transmitted EONs. The AC10 information is the value of block 3 of the 14A groups, when these are transmitted with usage code 10. These bits have not yet been assigned a special purpose.

Syntax

AC10

Parameter	Range	Default Value
None		

Examples

AC10 makes the decoder display the pi of the received EON, followed by the AC10 information from the 14A group, displayed as four hexadecimal digits in the range 0000 to FFFF:

```
AC10:
D323: AAAA AAAA AAAA ...
```

AC11, Inspect AC11 from EONs

Description

This is used to inspect the AC11 information in the transmitted EONs. The AC11 information is the value of block 3 of the 14A groups, when these are transmitted with usage code 11. These bits have not yet been assigned a special purpose.

Syntax

AC11

Parameter	Range	Default Value
None		

Examples

AC11 makes the decoder display the pi of the received EON, followed by the AC11 information from the 14A group, displayed as four hexadecimal digits in the range 0000 to FFFF:

```
AC11:
D322: ABEA ABEA ABEA ...
```

AC12, Inspect AC12 from EONs

Description

This is used to inspect the AC12 information in the transmitted EONs. The AC12 information is the value of bit 13 in block 3 usage code 12 of a 14A group, which has not yet been assigned a special purpose.

Syntax

AC12

Parameter	Range	Default Value
None		

Examples

AC12 makes the decoder display the pi of the received EON, followed by the AC12 information from the 14A group, displayed as 0 or 1:

```
AC12:
D323: 1 1 0 0 .....
```

AC13, Inspect AC13 from EONs

Description

This is used to inspect the AC13 information in the transmitted EONs. The AC13 information is the value of the 10 bits in block 3 of the 14A groups, transmitted with usage code 13. The bits 1 to 10 have not yet been assigned (bit 0 contains the Traffic Announcement flag of the other network, while bits 11 to 15 hold the Program Type code for the other network).

Syntax

AC13

Parameter	Range	Default Value
None		

Examples

AC13 makes the decoder display the pi of the received EON, followed by the AC13 information from the 14A group, displayed as three hexadecimal digits in the range 000 to 3FF:

```
AC13:
D322: 3AB 3AB 3AB ...
```

AF, Inspect AF-list(s)

Description

This is used to inspect the lists of Alternative Frequencies currently being received as data from block 3 in groups 0A.

Syntax

AF

Parameter	Range	Default Value
None		

Examples

AF makes the decoder display all the currently received AF-list(s), every list prefixed by the number of frequencies in the list. If the list is not coded in an even number of bytes, the filler codes are marked as '---'. The output has the format:

```
AF:
14 91.9/ 87.8 91.9/ 91.5 98.3/ 91.9 98.9/ 91.9 103.2/ 91.9
104.7/ 91.9 87.8/ 91.9 ---
15 92.9/ 88.8 92.9/ 92.5 98.3/ 92.9 98.9/ 92.9 103.2/ 92.9
104.7/ 92.9 87.8/ 91.9 88.9
14 91.9/ 87.8 91.9/ 91.5 98.3/ 91.9 98.9/ 91.9 103.2/ 91.9
104.7/ 91.9 87.8/ 91.9 ---
...
```

AFLIST, Inspect AF-list(s) from Information Memory One Time

Description

This is used to inspect the lists of Alternative Frequencies currently recorded in the decoder memory. The lists recorded in memory is displayed once. Only valid lists are displayed.

Syntax

AFLIST, *Frequency*

Parameter	Range	Default Value
Frequency	**87.5 - 107.9 (FM)**	None
Frequency Unit	**MHz**	MHz

Examples

AFLIST,100.2 MHz makes the decoder display the recorded AF-lists with the AF-list having 100.2 MHz as its first frequency, as the first list. The output has the format:

```
13   100.2 /  89.8 100.2 /  93.5 100.2 /  93.9 100.2 /  98.9 100.2 /  95.9 100.2 /  92.9 100.2
 9    88.8 /  88.8  94.3 /  88.8  92.2 /  88.8 104.2 /  88.9 101.5
```

AFLIST. If the parameter is absent, the RE 331 displays the message *Frequency of the 1. list (MHz/kHz)* and waits for the user to enter the value of the frequency parameter.

AFLON, Inspect all EON AFlists

Description

This is used to make the RE 331 display the EON AFlists from the information memory once. The displayed lists are grouped as belonging to an EON record, identified by the PI of the EON record. The information concerning the alternative frequencies of an EON record are received in the third block of group 14A.

Syntax

AFLON

Parameter	Range	Default Value
None		

Examples

AFLON makes the RE 331 output all EON AFlists from the information memory once, and the lists are grouped as belonging to an EON record, identified by the PI of the EON record. Type A starts with the number of frequencies in the lists, while the mapped lists are just displayed as their contents, with the indication "---" for those usage codes, that are not transmitted. The format of the output is:

```
1111   :  TN  100.0  AF  101.0  102.0   ---    ---    ---
          TN   99.0  AF   98.0   ---    ---    ---    ---
          TN   90.0  AF   91.0   ---    ---    ---    ---
2222   :  TN   95.1  AF   97.5   ---    ---    ---    ---
          TN   98.8  AF   99.9   ---    ---    ---    ---
3333   :        6        100.0 /  101.0  102.0 /  103.0  104.0 /  105.0   ---
```

AFON, Inspect AF-list(s) from EONs

Description

This is used to inspect the lists of Alternative Frequencies currently being received as the Alternative Frequencies for EON data records transmitted as block 3 data in groups 14A. There are two types of EON AFlists, type A lists, where the frequencies are transmitted with usage code four and mapped lists, that are transmitted with usage codes five though nine.

Syntax

AFON

Parameter	Range	Default Value
None		

Examples

AFON makes the decoder display all the EON AF-list(s) as received. Each list is identified by the pi of the EON network.

Type A lists have the number of frequencies at the beginning of the list, while the mapped lists are displayed as the Tuned Network frequency (TN) followed by the AF-list. In the output the 2 methods can be mixed, reflecting the received data. The output has the format:

Method A:

```
AFON:
D323:
 25   96.7 /  99.8  96.9 /  94.4 ...
D324:
 25   98.3 /  97.4  94.1 / 100.9 ...
```

Mapped Method:

```
AFON   :
1111   :  TN   99.0  AF   98.0
          TN   90.0  AF   91.0
          TN  100.0  AF  101.0  102.0
2222   :  TN   95.1  AF   97.5
          TN   98.8  AF   99.9
```

AI, Inspect All Information received

Description

This is used to inspect all measurement results, the disturbance list and RDS information from the information memory (except for AFs, and EON information). The information is displayed in the following order:

VALUES, ALARMS, GR, PI, PS, TP, TA, DI, MS, PTY, PIN, RT, CT, TDC, IH.

The group information is the received group order as the decoder tries to extract it. In some case the decoder cannot find a group order.

The RT is the last 16 received radio texts.

TDC and IH is the content of the last 64 groups of TDC and IH information.

Syntax

AI
AI,DATA

Parameter	Range	Default Value
None		
DATA		

Examples

AI makes the decoder display all measurement results, disturbances and RDS information from the information memory (except for AFs, ON and EON information).

AI,DATA makes the decoder display RDS information from the information memory (except for AFs and EON information). Measurement results and disturbances are skipped.

The information is shown one page (20 lines) a time. After each page you must press [ENTER] to get the next page.

AION, Inspect all EON Information

Description

This is used to inspect the received EON information as it is received in groups 14A and 14B.

Syntax

AION

Parameter	Range	Default Value
None		

Examples

AION makes the RE 331 output all the EON information from the information memory (except for the EON AF-lists) each information is displayed once. The information is displayed record by record identified by the corresponding PI:

```
EON PI: 1111  PS:   eon1      EG:   -     LA:   -  LN:   ----
              PTY:   0        TP:   0     TA:   0  PIN:  --.--:--  IH: ----
              AC10: ----      AC11: ----  AC12: -  AC13: 0000      AC: -
EON PI: 2222  PS:   eno2      EG:   -     LA:   -  LN:   ----
              PTY:   0        TP:   0     TA:   0  PIN:  --.--:--  IH: ----
              AC10: ----      AC11: ----  AC12: -  AC13: 0000      AC: -
EON PI: 3333  PS:   eon3      EG:   -     LA:   -  LN:   ----
              PTY:   0        TP:   0     TA:   0  PIN:  --.--:--  IH: ----
              AC10: ----      AC11: ----  AC12: -  AC13: 0000      AC: -
```

APVAL, Inspect All Measured Values Periodically

Description

This is used to inspect all measured RDS and VRF values with correction values and to output these values periodically. The period is given as the parameter for the command.

Syntax

APVAL, *Period*

Parameter	Range	Default Value
Period	**1** to **3600**	None
Unit	**S**	S

Examples

APVAL,30 makes the RE 331 output all measured values (RDS level, RDS phase, RDS-VRF phase, VRF phase, BK and DK modulation indexes and the error rate) every 30 seconds. The output format:

```
RDS-Level    RDS-Phase      RDS-VRF    VRF-Level   VRF-Phase   DK   BK   Error
-24.5+2.5dBu  91.0 -3.0Deg   90.0Deg  -14.0+0.0dBu   0.2Deg    30%  60%    3%
-24.5+2.5dBu  91.1 -3.0Deg   90.0Deg  -14.0+0.0dBu   0.2Deg    30%  60%    3%
-24.5+2.5dBu  91.0 -3.0Deg   90.1Deg  -14.0+0.0dBu   0.1Deg    30%  60%    3%
-24.5+2.5dBu  90.9 -3.0Deg   90.0Deg  -14.0+0.0dBu   0.0Deg    30%  60%    3%
```

APVAL. If the parameter is absent, the RE 331 displays the message *Measurement interval (1-3600):* and waits for the user to enter the parameter value.

AVAL, Inspect All measured Values

Description

This is used to inspect all measured RDS and VRF values with correction values.

Syntax

AVAL

Parameter	Range	Default Value
None		

Examples

AVAL makes the RE 331 output all information about all measured RDS and VRF values with correction values. The format of the output is:

```
RDS-Level     RDS-Phase      RDS-VRF    VRF-Level    VRF-Phase   DK   BK   Error
-24.5+2.5dBu  91.0 -3.0Deg   90.0Deg  -14.0+0.0dBu    0.0Deg    30%  60%    3%
```

CT, Inspect Clock and Time Information

Description

This is used to inspect clock and date information as received with group 4A.

Syntax

CT

Parameter	Range	Default Value
None		

Examples

CT makes the RE 331 output the day, month, year, hour and minute, according to the time information every time a 4A group is received.

```
CT:
14.05.1985 13:40  14.05.1985 13:41 ...
```

DI, Inspect the Decoder Identification Code

Description

This is used to inspect the received Decoder Identification code as it is received in groups 0A, 0B and 15B. Remember, 4 0A or 0B groups or 2 15B groups with all the 4 different DI segment codes are needed to receive the complete DI information.

Syntax

DI

Parameter	Range	Default Value
None		

Examples

DI makes the RE 331 output the decoder identification code as it is received currently. The decoder identification code is displayed as a two-digit decimal number. The output format is as follows:

```
DI :
01 01 01 01 01 01 01 01 01...
```

EGON, Inspect Extended Generic Indicator from EONs

Description

This is used to inspect the extended generic indicator flag of the 14A groups transmitted with usage code 12. The third block of a group 14A contains linkage information for the EON network, and the extended generic indicator bit is the second highest bit of this information.

Syntax

EGON

Parameter	Range	Default Value
None		

Examples

EGON makes the RE 331 display the extended generic indicator flag from the 14A groups received. The EG flag takes the values 0 or 1. The output format is:

```
EGON :
1234 :  0000
4568 :  1111
1234 :  000...
```

GR, Inspect the Incoming Groups

Description

This is used to make the RE 331 display the group types as the groups are received.

Syntax

GR

Parameter	Range	Default Value
None		

Examples

GR makes the RE 331 output the type of the groups as they are received. The output format is:

```
GR:
0A  6A  2A  0A  6A  6A 15B
```

IH, Inspect In-house Channel Information

Description

This is used to inspect the data transmitted via a specified In-house channel. The command takes as parameter the identification of the channel(s) to be inspected.

Syntax

IH, *Channel*

Parameter	Range	Default Value
Channel	**0** to **31** **X** (all channels)	None

Examples

IH,30 makes the RE 331 display the data received via In-house channel 30. The output format is:

```
IH: 30,02468ACE  30,02468ACE ...
```

IH If the parameter is absent, the RE 331 displays the message *Inhouse channel (0-31/X):* and wait for the user to enter the channel number.

IHON, Inspect In-house Channel Information from EONs

Description

This is used to inspect the EON In-house data sent in block 3 of group 14A with usage code 15.

Syntax

IHON

Parameter	Range	Default Value
None		

Examples

IHON makes the RE 331 display the data received via the EON In-house channel. The In-house information displayed is associated with the corresponding, unique PI code for the EON network, followed by the IH information as 4 hexadecimal digits. The output format is:

```
IHON:
D324: FFFF
D325: 0ABE
D327: 0001...
```

LA, Inspect Linkage Actuator Information from Main Network

Description

This is used to inspect the linkage actuator flag of the 1A groups received.

Syntax

LA

Parameter	Range	Default Value
None		

Examples

LA makes the RE 331 display the linkage actuator flag from the 1A groups received. The linkage actuator takes the values 0 or 1. The output format is:

```
LA:
0000000000000000000000000000000000000000000000....
```

LAON, Inspect Linkage Actuator Information from EONs

Description

The LAON command is used to inspect the linkage actuator flag of the 14A groups transmitted with usage code 12. The third block of a group 14A contains linkage information for the EON network, and the LA bit is the highest bit of this information.

Syntax

LAON

Parameter	Range	Default Value
None		

Examples

LAON makes the RE 331 display the linkage actuator flag from the 14A groups received. The linkage actuator is associated with the corresponding, unique PI code for the EON network, followed by the value of the linkage actuator for that network. The output format is:

```
LAON:
D324: 0
D325: 1
D327: 0
....
```

LION, Inspect Linkage Information from EONs

Description

This is used to inspect the data transmitted via the linkage information field of the EON networks. The linkage information for EON networks is transmitted as the third block with usage code 12 in group 14A.

Syntax

LION

Parameter	Range	Default Value
None		

Examples

LION makes the RE 331 display the data received via the EON linkage information field. The linkage information displayed is associated with the corresponding, unique PI code for the EON network, followed by the linkage information as 4 hexadecimal digits in the range 0000 to 1FFF. The output format is:

```
LION:
D324: 0128
D325: 0ABE
D327: 1CDE
...
```

LOCATE, Show Location Information

Description

The command is used to show the location information as specified in the RBDS standard. The location information is received in the 3A groups.

Syntax

LOCATE

Parameter	Range	Default Value
None		

Notes

This command only applies when the RE 331 is in the American RBDs mode.

Examples

LOCATE shows the location information.

MS, Inspect the Music/Speech Switch

Description

This is used to inspect the Music/Speech switch as received in groups 0A, 0B and 15B.

Syntax

MS

Parameter	Range	Default Value
None		

Examples

MS makes the RE 331 display the Music/Speech switch as received. The switch is displayed as M for Music or S for Speech. The output format is:

```
MS:
MMMMMMMMMMMMMMMMSSSSSSSSSSSSSSSSMMMMMMMM
```

NETGRP, Inspect Paging Netgroup Information

Description

This is used to inspect the group designation for the page calls transmitted. The group designation may be one of the following intervals: 0-0 (no page calls), 0-99, 0-39, 40-99, 40-69, 70-99, 0-19 or 20-39. The group designation is transmitted as bit 2 to bit 4 of the second block in group 1A.

Syntax

NETGRP

Parameter	Range	Default Value
None		

Examples

NETGRP makes the RE 331 display the group designation for the page calls received. If the group designation represents the interval 0 to 99, the output format will be:

NETGRP:
0-99 0-99 0-99 0-99 0-99 ....

PAGE, Inspect Information from Page Calls

Description

This is used to inspect the information received via the page calls. The page information is transmitted in group 7A.

Syntax

PAGE

Parameter	Range	Default Value
None		

Examples

PAGE makes the RE 331 display the valid data received in group 7A. The range of the displayed data depends on the type of page information. The output format is:

```
PAGE:
000220
125976  123 456 77
345678  This is an alphanumeric page call
264538
...
```

PGTIME, Inspect Page Time

Description

This is used to inspect the time information received associated with the page calls. It displays information about the seconds of the minute as received via the 1A groups.

Remember that the RE 331 must receive all the 1A groups in 6 second intervals before it is possible to identify the interval. After that the shown time is increased with one second for each received 1A group until a new complete 6 second interval is received.

Syntax

PGTIME

Parameter	Range	Default Value
None		

Examples

PGTIME makes the RE 331 display the seconds information received with the 1A groups. The output format is:

```
PGTIME:
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21... 59 0 1 2 3 4....
```

PI, Inspect PI Information

Description

This is used to make the RE 331 display the Program Identification relating to the currently received RDS record. The PI information is received in all groups.

Syntax

PI

Parameter	Range	Default Value
None		

Examples

PI makes the RE 331 display the received Program Identification of the current RDS record. The output format is:

```
PI:
DBE9 DBE9 DBE9 ...
```

PIN, Inspect PIN Information

Description

This is used to make the RE 331 display the Program Item Number relating to the current RDS record. The PIN information is received in groups 1A and 1B.

Syntax

PIN

Parameter	Range	Default Value
None		

Examples

PIN makes the RE 331 display the received Program Item Number of the current RDS Record. The output format is:

```
PIN:
14.13:30  14.13:30  ....
```

PINON, Inspect PIN Information from EONs

Description

This is used to make the RE 331 display the Program Item Number relating to the current EON records. Each EON PIN is associated with the corresponding PI for that EON record. The PIN information for EON is received in groups 14A with usage code 14.

Normally EON PIN is only sent a few times when it changes.

Syntax

PINON

Parameter	Range	Default Value
None		

Examples

PINON makes the RE 331 display the received Program Item Number for the EON records currently being received. The output format is:

```
PINON:
D232: 14.13:30
D324: 14.13.35
...
```

PION, Inspect PI Information from EONs

Description

This is used to make the RE 331 display the Program Identification for the current EON records. The PI information for EON is received in groups 14A and 14B.

Syntax

PION

Parameter	Range	Default Value
None		

Examples

PION makes the RE 331 display the received Program Identification for the current EON records. The output format is:

```
PION:
D323 D323 D323 D323 D323 D323 D324 D324..
```

PS, Inspect PS Information

Description

This is used to make the RE 331 display the Program Service Name for the current RDS record. The PS information for a RDS record is received in groups 0A and 0B. In American RBDS mode the PS information is received in group 15A as well.

Syntax

PS

Parameter	Range	Default Value
None		

Examples

PS makes the RE 331 display the Program Service Name for the current RDS record. The output format is:

```
PS:
NDR1 NDS  NDR1 NDS  NDR1 NDS
```

PSON, Inspect PS Information from EONs

Description

This is used to make the RE 331 display the Program Service Name relating to the current EON records. Each EON PS is associated with the corresponding PI for that EON record. The PS information for EON is received in groups 14A with usage code 0 to 3.

Syntax

PSON

Parameter	Range	Default Value
None		

Examples

PSON makes the RE 331 display the received Program Service Name for the current EON records. The output format is:

```
PSON:
D323: Bayern 3
D322: Bayern 2
...
```

PTY, Inspect PTY Information

Description

This is used to make the RE 331 display the Program Type Code relating to the current RDS record. The PTY information is received in all groups.

Syntax

PTY

Parameter	Range	Default Value
None		

Examples

PTY makes the RE 331 display the received Program Type Code for the current RDS record. The output format is:

```
PTY:
01 01 01 01 01 01 01 ...
```

PTYNAM, Show Program Type Name

Description

The command is used to show the Progam Type Name as specified in the RBDS standard. The Program Type Name is received with 10A groups.

Syntax

PTYNAM

Parameter	Range	Default Value
None		

Notes

This command only applies when the RE 331 is in the American RBDs mode.

Examples

PTYNAM shows the Program Type Name as the information is received.

PTYON, Inspect PTY Information from EONs

Description

This is used to make the RE 331 display the Program Type Code relating to the current EON records. Each EON PTY is associated with the corresponding PI for that EON record. The PTY information for EON is received in groups 14A with usage code 13.

Syntax

PTYON

Parameter	Range	Default Value
None		

Examples

PTYON makes the RE 331 display the received Program Type code for the current EON records. The output format is:

```
PTYON:
D323:  2
D322:  3    3
...
```

PVALUE, Inspect the Measured Values Periodically

Description

This is used to make the RE 331 output the values of all measured values including the correction values periodically. The period for the output is given as the parameter of the command.

Syntax

PVALUE, *Period*

Parameter	Range	Default Value
Period	**1** to **3600**	None
Period Unit	**s**	s

Examples

PVALUE,12 makes the RE 331 display the measured values (RDS level, RDS phase, RDS-VRF phase and the error rate) every 12 seconds. The output format is:

```
VALUES:
RDS-Level          RDS-Phase          RDS-VRF        Error
-24.5+2.5dBu       91.0 -3.0Deg       92.0Deg         3%
-24.5+2.5dBu       91.0 -3.0Deg       92.0Deg         3%
-24.5+2.5dBu       91.0 -3.0Deg       92.0Deg         3%
```

PVALUE. If the parameter is absent, the RE 331 will display the message *Measurement interval (1-3600):* and wait for the user to enter the parameter value.

RT, Inspect RT Information

Description

This is used to make the RE 331 display the Radio Texts relating to the current RDS record. The RT information is received in groups 2A or 2B.

The radio text is written as it is received. If a segment is not received spaces will be written. If a lower segment number is received a new line is started.

Syntax

RT

Parameter	Range	Default Value
None		

Examples

RT makes the RE 331 display the contents of the received Radio Texts for the current RDS record. The output format is:

```
RT:
< UKW / FM - ARD - Radio text >
< UKW / FM - ARD - Radio text >
...
```

TA, Inspect TA Information

Description

This is used to make the RE 331 display the Traffic Announcement Code relating to the current RDS record. The TA information is received in groups 0A, 0B and 15B. In the American RBDS mode the TA information is received in the 15A groups as well.

Syntax

TA

Parameter	Range	Default Value
None		

Examples

TA makes the RE 331 display the received Traffic Announcement Code for the current RDS record. The output format is:

```
TA:
00011111111111111111111111110000000000 ...
```

where 0 is off and 1 is on.

TAON, Inspect TA Information from EONs

Description

This is used to make the RE 331 display the Traffic Announcement Code relating to the current EON records. Each EON TA is associated with the corresponding PI for that EON record. The TA information for EON is received in groups 14A with usage code 13 and in groups 14B.

Syntax

TAON

Parameter	Range	Default Value
None		

Examples

TAON makes the RE 331 display the received Traffic Announcement Code for the current EON records. The output format is:

```
TAON:
D323:0
D327:0
D323:11111111
D327:0
....
```

where 0 is off and 1 is on.

TDC, Inspect TDC Information

Description

This is used to make the RE 331 display all data received on a specific Transparent Data Channel or a list of data received on all data channels. The groups containing information about Transparent Data Channels are groups 5A and 5B.

Syntax

TDC, *Channel*

Parameter	Range	Default Value
Channel	**0** to **31** **X** (All channels)	None

Examples

TDC,21 makes the RE 331 display the TDC information received on Transparent Data Channel 21. The output format is:

```
TDC:
21,44617495    21,6E6B616E
```

Note that the TDC information is displayed as hexadecimal groups - 1 byte = 2 hex digits.

TDC If the parameter is absent, the RE 331 displays the message *Transparent data channel (0-31/X):* and waits for the user to enter the parameter value.

TP, Inspect TP Information

Description

This is used to make the RE 331 display the Traffic Program Identification relating to the current RDS record. The TP information is received in all groups.

Syntax

TP

Parameter	Range	Default Value
None		

Examples

TP makes the RE 331 display the received Traffic Program Identification for the current RDS record. The output format is:

```
TP:
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY ...
```

where Y=Yes (on), N=No (off)

TPON, Inspect TP Information from EONs

Description

This is used to make the RE 331 display the Traffic Program Identification relating to the current EON records. Each EON TP is associated with the corresponding PI for that EON record. The TP information for EON is received in groups 14A and 14B.

Syntax

TPON

Parameter	Range	Default Value
None		

Examples

TPON makes the RE 331 display the received Traffic Program Identification for the current EON records. The output format is:

```
TPON:
D323:N
D327:N
D323:YYYYYYYYYYYYY
D327:N
....
```

where N is No (=off) and Y is YES (=on).

VALUES, Inspect the Measured Values

Description

This is used to make the RE 331 output the values of all measured values including the correction values.

Syntax

VALUES

Parameter	Range	Default Value
None		

Examples

VALUES makes the RE 331 display all measured values including correction values. The output format is:

```
VALUES:
RDS-Level          RDS-Phase          RDS-VRF        Error
-24.5+2.5dBu       91.0 -3.0Deg       92.0Deg         3%
```

XX, Inspect All Received Groups as Raw Data

Description

This is used to make the RE 331 display all data received as raw data. The data is formatted in blocks of four hexadecimal digits, the four digits representing the 16 bits of information in a RDS data block. The crcc codes are not displayed. A carriage return linefeed character is output after each four block sequence indicating the end of the reception of a RDS group.

Time equal to the normal block time spent without receiving RDS information is indicated by '----'.

Blocks are always placed in the correct column, that is blocks with the A syndrome are in column 1 and blocks with the D syndrome are in column 4. This can result in empty spaces with a noisy RDS signal.

Syntax

XX

Parameter	Range	Default Value
None		

Examples

XX makes the RE 331 display the received data as raw blocks of hexadecimal data. The output format is:

```
XX:
D234 0245 D234 A5F2
D234 4367 70AF 1234
D234      8432 ----
---- 0246 D346 8974
...
```

6.5 RDS Setup Commands

ALL Turn all Surveillance On or Off

Description

This is used to turn all surveillance on/off.

When the surveillance is turned on the RE 331 takes the surveillance parameters from the EEPROM if any valid data is saved. Otherwise all surveillance is set to on, even if it was off when you turned if off with the ALL command.

Syntax

ALL, *State*

Parameter	Range	Default Value
State	**ON** or **1**, **OFF** or **0**	None

Examples

ALL,ON makes the RE 331 transfer all the surveillance limits from the EEPROM. This means if you have saved some surveillance as OFF if will still be inactive after the command.

ALL,OFF Disables all surveillance.

BLKERR,A, Enter A Trigger-Value for Link Surveillance

Description

This is used to enter the block error rate and the surveillance time. If the block error rate exceeds the given limit for a longer period than the surveillance time given, the RE 331 issues an A-alarm.

Syntax

BLKERR,A, *Block Error Rate, Time*

Parameter	Range	Default Value
Block Error Rate	**5,10,15,20** or **25** **OFF**	None
Block Error Unit	**%**	%
Time	**5,10,15,20,25,30** **35,40,45,50,55** or **60**	None
Time Unit	s	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

BLKERR,A,10,20 makes the RE 331 issue an A-alarm in case the sliding average Block Error Rate exceeds 10% for more than 20 seconds.

BLKERR,A If the parameters are absent, the RE 331 prompts the user as follows: *A Bit Error tolerance 4%, 10s (Range:OFF/5...25% Step: 5%, Range: 5...60s Step: 5s):* and waits for the user to enter the two numbers (separated by ",").

BLKERR,B, Enter B Trigger-Value for Link Surveillance

Description

This is used to enter the block error rate and the surveillance time. If the block error rate exceeds the given limit for a longer period than the surveillance time given, the RE 331 issues a B-alarm.

Syntax

BLKERR,B, *Block Error Rate, Time*

Parameter	Range	Default Value
Block Error Rate	**2,4,6,8** or **10** **OFF**	None
Block Error Unit	**%**	*%*
Time	**1** to **15**	None
Time Unit	s	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

BLKERR,B,6,2 makes the RE 331 issue a B-alarm in case the sliding average Block Error Rate exceeds 6% for more than 2 seconds.

BLKERR,B If the parameters are absent, the RE 331 prompts the user as follows: *B Bit Error tolerance 4%, 10s (Range:OFF/2...10% Step: 2%, Range: 1...15s Step: 1 s):* and waits for the user to enter the two numbers (separated by ",").

INFO,A, Enter A Trigger-Value for RDS Information

Description

This is used to enter the number of changes that are accepted within a given time limit. The RDS information under surveillance is PI, PS, TP, TA, DI, MS and PTY.

Syntax

INFO,A, *Changes, Time*

Parameter	Range	Default Value
Changes	**2** to **5** **OFF**	None
Surveillance Time	**2, 5, 10** or **20**	None
Time Unit	**S**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

INFO,A,3,10 makes the RE 331 generate an INFO A alarm in case the received RDS information PI, PS, TP, TA, DI, MS or PTY changes more than 3 times within 10 seconds.

INFO,A If the parameters are absent, the RE 331 will prompt the user as follows: *A RDS information tolerance X,YYs (Range:OFF/2...5 Step: 1; Range: 2/5/10/ 20s):* and wait for new values. These values must be separated using a "," as for example "3,10". (X and YY being current values).

INFO,B, Enter B Trigger-Value for RDS Information

Description

This is used to enter the number of changes, that are accepted within a given time limit. The RDS information under surveillance is PI, PS, TP, TA, DI, MS and PTY.

Syntax

INFO,B, *Changes, Time*

Parameter	Range	Default Value
Changes	**2** to **5** **OFF**	None
Surveillance Time	**2**, **5**, **10** or **20**	None
Time Unit	**S**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

INFO,B,3,10 makes the RE 331 generate an INFO B alarm in case the received RDS information PI, PS, TP, TA, DI, MS or PTY changes more than 3 times within 10 seconds.

INFO,B If the parameters are absent, the RE 331 will prompt the user as follows: *B RDS information tolerance X,YYs (Range:OFF/2...5 Step: 1; Range: 2/5/10/ 20s):* and wait for new values. These values must be separated using a "," as for example "3,10". (X and YY being current values).

LEVADJ, Enter RDS Level Correction

Description

This is used to enter the RDS level correction. The value may be entered in a resolution of 0.1dB.

Syntax

LEVADJ, *Level Correction*

Parameter	Range	Default Value
Level Correction	-6 to +3	None
Level Corr. Unit	**dB**	dB

Examples

LEVADJ,2.8 sets the RDS level correction value in the RE 331 to 2.8 dB.

LEVADJ If the parameter is absent, the RE 331 prompts the user as follows: *Level adjustment +x.y dB (Range: -3..+6 dB Step: 0.1 dB):* and waits for the user to enter the new value. ("+x.y dB" being the current value).

LEVLIM,A, Enter A Trigger-Value for RDS Level

Description

This is used to enter the time limit for an A-alarm for the RDS level surveillance. Following a period where the RDS level has been outside the valid range longer than the given time limit, the RE 331 issues an A-alarm. The tolerance may be given with a 0.2 dB resolution.

Syntax

LEVLIM,A, *RDS Tolerance, Time*

Parameter	Range	Default Value
RDS Tolerance	**0.4** to **2** **OFF**	None
RDS Tolerance Unit	dB	dB
Time	**10,20,30,40,50** or **60** (s) **5,10,15,20,25** or **30** (min)	None None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

LEVLIM,A,1.0,5min makes the RE 331 generate a LEVLIM A alarm in case the RDS level differs more than 1.0 dB from the correct value for more than 5 minutes.

LEVLIM,A If the parameters are absent, the RE 331 prompts the user as follows: *A RDS Level tolerance 0.4 dB, 20s (Range:OFF/0.4...2dB Step: 0.2, Range: 10s...30min Step: 10s/5min):* and waits for the user to enter the two new values (separated using ",").

LEVLIM,B, Enter B Trigger-Value for RDS Level

Description

This is used to enter the time limit for a B-alarm for the RDS level surveillance. Following a period where the RDS level has been outside the valid range longer than the given time limit, the RE 331 issues a B-alarm. The tolerance may be given with a 0.2 dB resolution.

Syntax

LEVLIM,B, *RDS Tolerance*[,] *Time*

Parameter	Range	Default Value
RDS Tolerance	**0.4** to **2** **OFF**	None
RDS Tolerance Unit	dB	dB
Time	**10,20,30,40,50** or **60** (s) **1** to **6** (min)	None None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

LEVLIM,B,1.0,20s makes the RE 331 generate a LEVLIM B alarm in case the RDS level is 1.0 dB outside the correct value for more than 20 seconds.

LEVLIM,B If the parameters are absent, the RE 331 prompts the user as follows: *B RDS Level tolerance 0.4 dB, 20s (Range:OFF/0.4...2dB Step: 0.2, Range: 10s...6min Step: 10s/1min):* and waits for the user to enter the two new values (separated using ",")

MODE, Enter Error Correction Mode

Description

This is used to enter the error correction mode to the RE 331. There is a choice between Correction and Detection of errors. The detection mode just detects errors, while correction mode makes the RE 331 correct all one bit errors in the received RDS data and those two bit errors where there is at most three bits in between the two erroneous bits.

Syntax

MODE, *Error Mode*

Parameter	Range	Default Value
Error Mode	**CORR** (Correction) **DETECT** (Detect)	None

MODE,CORR makes the RE 331 correct burst errors in the received RDS data.

MODE If the parameter is absent, the RE 331 prompts the user as follows: *Bit Error mode DETECT (Range:CORR/DETECT):* when DETECT was the previously recorded state, and waits for the user to enter the new value.

PHADJ, Enter RDS Phase Correction

Description

This is used to enter the RDS phase correction.

Syntax

PHADJ, *Phase Correction*

Parameter	Range	Default Value
Phase Correction	**-10** to **+10**	None
Phase Corr. Unit	**deg**	deg

Examples

PHADJ,-5 sets the RDS phase correction value in the RE 331 to -5°.

PHADJ If the parameter is absent, the RE 331 prompts the user as follows: *Phase adjustment -z (Range: -10..+10deg Step: 1deg):* and waits for the user to enter a new value. ("-zdeg" being the current value).

PHLIM,A, Enter A Trigger-Value for RDS Phase

Description

This is used to enter the time limit for an A-alarm for the RDS phase surveillance. Following a period where the RDS phase has been outside the valid range longer than the given time limit, the RE 331 issues an A-alarm.

Syntax

PHLIM,A, *Phase Tolerance, Time*

Parameter	Range	Default Value
Phase Tolerance	**2** to **15** **OFF**	None
Phase Tolerance Unit	deg	deg
Time	**10,20,30,40,50** or **60** (s) **5,10,15,20,25** or **30** (min)	None None
Time Unit	**s** **min**	s

Notes

Please observe that if the pilot signal disappears for example during transmission of Mono signals, you will also get an RDS Phase alarm.

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

PHLIM,A,5,10min the RE 331 generate a PHLIM A alarm in case the RDS phase error is greater than 5° for more than 10 minutes.

PHLIM,A If the parameters are absent, the RE 331 prompts the user as follows: *A RDS-Phase tolerance 2deg, 10s (Range:OFF/2...15deg Step: 1deg, Range: 10s...30min Step: 10s/5min):* and waits for the user to enter the two new values (separated by ",").

PHLIM,B, Enter B Trigger-Value for RDS Phase

Description

This is used to enter the time limit for a B-alarm for the RDS phase surveillance. Following a period where the RDS phase has been outside the valid range longer than the given time limit, the RE 331 issues a B-alarm.

Syntax

PHLIM,B, *Phase Tolerance, Time*

Parameter	Range	Default Value
Phase Tolerance	**2** to **15** **OFF**	None
RDS Tolerance Unit	**deg**	deg
Time	**10,20,30,40,50** or **60** (s) **1** to **6** (min)	None None
Time Unit	**s** **min**	s

Notes

Please observe that if the pilot signal disappears for example during transmission of Mono signals, you will also get an RDS Phase alarm.

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

PHLIM,B,3,10s makes the RE 331 generate a PHLIM B alarm in case the RDS phase error is greater than 3° for more than 10 seconds.

PHLIM,B If the parameters are absent, the RE 331 prompts the user as follows: *B RDS-Phase tolerance 2deg, 10s (Range:OFF/2...15deg Step: 1deg, Range: 10s...6min Step: 10/1):* and waits for the user to enter the two new values (separated by ",").

POWER,A, Enter A Value for Power Failure

Description

This is used to enter the time limit for an A-alarm for power failure. Following a power failure with a duration more than the time limit entered, the RE 331 issues an A-alarm.

Syntax

POWER,A, *Time*

Parameter	Range	Default Value
Time	**1** to **30** **OFF**	None
Time Unit	**S**	s

Examples

OFF turns the surveillance off.

POWER,A,15 makes the RE 331 generate a POWER A alarm in case a power failure with a duration exceeding 15 seconds occurs.

POWER,A If the parameter is absent, the RE 331 prompts the user as follows: *A Power Fail tolerance Zs (Range:OFF/1 to 30s Step: 1s):* and waits for the user to enter a new value. ("Zs" being the current value).

POWER,B, Enter B Value for Power Failure

Description

This is used to enter the time limit for a B-alarm for power failure. Following a power failure with a duration more than the time limit entered, the RE 331 issues a B-alarm.

Syntax

POWER,B, *Time*

Parameter	Range	Default Value
Time	**1** to **30** **OFF**	None
Time Unit	**S**	S

Examples

OFF turns the surveillance off.

POWER,B,7 makes the RE 331 generate a POWER B alarm in case a power failure with a duration exceeding 7 seconds occurs.

POWER,B If the parameter is absent, the RE 331 prompts the user as follows: *B Power Fail tolerance Zs (Range:OFF/1 to 30s Step: 1s):* and waits for the user to enter a new value. ("Zs" being the current value).

RDSREF, Enter RDS Reference Level

Description

This is used to enter the RDS reference level. If you have selected the American RBDS mode and then selected another measurement unit than dBu, this unit can be used. The valid range of the parameter then depends on the selected calibration factors.

Syntax

RDSREF, *RDS Reference Level*

Parameter	Range	Default Value
RDS Reference Level	**-30.0** to **-5.0**	None
RDS Ref. Level Unit	**dBu**	dBu

Examples

RDSREF,-24.4 makes the RE 331 set the RDS reference value to -24.4 dBu.

RDSREF If the parameters are absent, the RE 331 prompts the user as follows: *RDS Reference Level -24.6dBu (Range: -30.0...-5.0dBu Step: 0.1dBu):* and waits for the user to enter the parameter.

RDSVRF,A, Enter A Trigger-Value for RDS-VRF phase

Description

This is used to enter the phase tolerance value for the phase difference between the RDS and VRF signal. Where the RDS-VRF phase error exceeds the range given for a period longere than the specified period, the RE 331 issues an A-alarm.

Syntax

RDSVRF,A, *Phase Tolerance, Time*

Parameter	Range	Default Value
Phase Tolerance	**2** to **15** **OFF**	None
Phase Unit	**deg**	deg
Time	**10,20,30,40,50** or **60** (s) **5,10,15,20,25** or **30** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

RDSVRF,A,10,10Min makes the RE 331 generate a RDSVRF A alarm in case the RDS-VRF phase error exceeds 10° for more than 10 minutes.

RDSVRF,A If the parameters are absent, the RE 331 prompts the user as follows: *A RDS-VRF-Phase tolerance 3deg, 20s (Range:OFF/2...15deg Step: 1deg, Range: 10s...30min Step: 10s/5min):* and waits for the user to enter the two values (separated by ",").

RDSVRF,B, Enter B Trigger-Value for RDS-VRF phase

Description

This is used to enter the phase tolerance value for the phase difference between the RDS and VRF signal. Where the RDS-VRF phase error exceeds the range given for a period longer than the specified period, the RE 331 issues a B-alarm.

Syntax

RDSVRF,B, *Phase Tolerance, Time*

Parameter	Range	Default Value
Phase Tolerance	**2** to **15** **OFF**	None
Phase Unit	**deg**	deg
Time	**10**,**20**,**30**,**40**,**50** to **60** (s) **1** to **6** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

RDSVRF,B,10,10S makes the RE 331 generate a RDSVRF B alarm in case the RDS-VRF phase error exceeds 10° for more than 10 seconds.

RDSVRF,B If the parameters are absent, the RE 331 prompts the user as follows: *B RDS-VRF-Phase tolerance 3deg, 20s (Range:OFF/2...15deg Step: 1deg, Range: 10s...6min Step: 10s/1min):* and waits for the user to enter the two values (separated by ",").

RECORD, Enter RDS Coder Record(s) to Receive Information

Description

This is used to direct the data bridge commands from the RE 331 to a specific record in a RDS coder. The RE 331 receives the RDS data and makes commands to store the received data in a RDS record.

Syntax

RECORD, *Record Number*

Parameter	Range	Default Value
Record Number	**0** (current RDS record) **1** to **8** (RDS record number) **X** (All RDS records)	None

Examples

RECORD,X makes the RE 331 generate commands to store the received data in all RDS records in the attached RDS coder.

RECORD If the parameter is absent, the RE 331 prompts the user as follows: *Record 1 (Range:0 to 8/X):* when 1 was the old value of the RDS coder record number, and waits for the user to enter a new value.

REF, Enter Contents for Reference Records

Description

This is used to enter the Contents (the PI, the PS, the TP and the state) of each of the eight reference records.

Syntax

REF, *Record Number*, *PI Code*, *PS String*, *TP Flag*, *State*

Parameter	Range	Default Value
Record Number	**0** (Current Record) **1** to **8** (Record Number) **X** (All records)	None
PI Code	4 hex digits (according to EBU rec. 3244) or "#" (don't check this position)	None
PS String	8 characters (according to EBU doc. 3244) or "#" (don't check this position)	None
TP Flag	**0** or **1** or **"#"** (don't check this position)	None
State	**ACT** (active) or **NACT** (not active) **CORR** (connected to the record(s) receiving data in the RDS coder)	None

Examples

REF,2,DB#9,NDR##NDS,0,ACT will enter the PI code DB#9, the PS-string NDR##NDS and the TP value 0 in reference record number 2. Finally the record is activated.(positions entered as "#" will not be tested by the RE 331 ("don't cares")).

REF If the parameters are absent, the RE 331 prompts the user as follows: *Reference*

Record (Range: 0...8/X): and waits for input, then prompts *Reference PI:DBE PS:NDR1 NDS TP:1* and waits for inputs. Finally the prompt *Active COR (Range: ACT/NACT/COR):* appears and the RE 331 waits for the last parameter.

N O T E

The characters "#", " ", ",", ";" and "/" have special meanings for the interpreter but may be entered as part of a Reference Record by placing a"/" in front of the character.

REFLIM,A, Enter A Reference Record Surveillance Value

Description

This is used to enter the number of successive discrepancies between the PI, PS and/or TP from the active Reference Record(s) and the received RDS data. Following a period where the received RDS data differs from the active reference records more than the number of times allowed, the RE 331 issues an A-alarm. The number of discrepancies may be entered with a resolution of 2.

Syntax

REFLIM,A, *Discrepancies*

Parameter	Range	Default Value
Discrepancies	**2** to **200** **OFF**	None

Examples

OFF turns the surveillance off.

REFLIM,A,8 makes the RE 331 generate a REFLIM A alarm in case 8 or more successive discrepancies between reference data and received data are detected. The received data must differ from all active reference records.

REFLIM,A If the parameter is absent, the RE 331 prompts the user as follows: *A RDS-reference tolerance Z (Range:OFF/2...20 Step: 2):* and waits for the user to enter a new value. ("Z" being the current value).

REFLIM,B, Enter B Reference Record Surveillance Value

Description

This is used to enter the number of successive discrepancies between the PI, PS and/or TP from the active Reference Record(s) and the received RDS data. Following a period where the received RDS data differs from the active reference records more than the number of times allowed, the RE 331 issues a B-alarm. The number of discrepancies may be entered with a resolution of 2.

Syntax

REFLIM,B, *Discrepancies*

Parameter	Range	Default Value
Discrepancies	**2** to **200** **OFF**	None

Examples

OFF turns the surveillance off.

REFLIM,B,4 makes the RE 331 generate a REFLIM B alarm in case 4 or more successive discrepancies between reference data and received data have been detected. The received data must differ from all active reference records.

REFLIM,B If the parameter is absent, the RE 331 prompts the user as follows: *B RDS-reference tolerance Z (Range:OFF/2...20 Step: 2):* and waits for the user to enter a new value. ("Z" being the current value).

SELECT, Activate or Deactivate Information for a Serial Interface

Description

This is used to activate or deactivate the retransmission to a RDS coder of specific types of RDS information via the lines B, C or D.

Syntax

SELECT, *Interface Id*, *Info Type*, *Info Type*, *Info Type* ....

Parameter	Range	Default Value
Interface Id	**B**, **C** or **D**	None
Info Type	**AI** (all information) **NI** (no information) **AF**,**PIN**,**PI**,**PS**,**TP**,**TA**,**PTY**, **MS**,**DI**,**RT**,**IH**,**TDC**,**PGNET**,**PAGE**, **PSON**,**AFON**,**TPON**,**TAON**,**PTYON**, **LAON**,**EGON**,**LION**,**PINON**,**IHON**, **AC10**,**AC11**,**AC12**,**AC13**,**ACON**, **1A**,**1B**,**3A**,**3B**,**4A**,**4B**,**7B**, **8A**,**8B**,**9A**,**9B**,**10A**,**10B**, **11A**,**11B**,**12A**,**12B**, **13A**,**13B**,**15A**	None (Specific RDS info)

Examples

SELECT,**B**,**IH**,**PIN**,**MS**,**AF** makes the RE 331 suppress the RDS information of type IH, PIN, MS and AF on the line marked "B".

6.6 VRF Setup Commands

BKFREQ, Enter BK Frequency

Description

This is used to enter the BK frequency.

Syntax

BKFREQ, *BK Area*

Parameter	Range	Default Value
BK Area	**A**,**B**,**C**,**D**,**E** or **F**	None

Examples

BKFREQ,C makes the RE 331 set the BK frequency to range C.

BKFREQ If the parameter is absent, the RE 331 prompts the user as follows: *BK Area A (Range: A to F):* and waits for a correct parameter.

BKLIM,A, Enter A Trigger-Value for BK Modulation

Description

This is used to enter the limits for the BK modulation tolerance. If the BK modulation exceeds the given limit for a period longer than the interval specified, an A-alarm will be triggered.

Syntax

BKLIM,A, *BK Modulation Error, Time*

Parameter	Range	Default Value
BK Modulation Error	**2** to **20** **OFF**	None
Modulation Unit	**%**	%
Time	**10,20,30,40,50** or **60** (s) **5,10,15,20,25** or **30** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

BKLIM,A,6%,30min makes the RE 331 trigger an A-alarm in case the BK modulation error exceeds 6 % for more than 30 minutes.

BKLIM,A If no parameters are present, the RE 331 prompts the user as follows: *A BK Modulation index tolerance 6%, 30min (Range:OFF/2 to 20% Step: 1%, Range: 10s to 30min Step: 10s/5min):* and waits for the user to enter the correct parameters.

BKLIM,B, Enter B Trigger-Value for BK Modulation

Description

This is used to enter the limits for the BK modulation tolerance. If the BK modulation exceeds the given limit for a period longer than the interval specified, a B-alarm is triggered.

Syntax

BKLIM,B, *BK Modulation Error, Time*

Parameter	Range	Default Value
BK Modulation Error	**2** to **20** **OFF**	None
Modulation Unit	**%**	%
Time	**10,20,30,40,50** or **60** (s) **1** to **6** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

BKLIM,B,3%,3min makes the RE 331 trigger a B-alarm in case the BK modulation error exceeds 3 % for more than 3 minutes.

BKLIM,B If no parameters are present, the RE 331 prompts the user as follows: *B BK Modulation index tolerance 3%, 3 min (Range:OFF/2 to 20% Step: 1%, Range: 10s to 6min Step: 10s/1min) :* and waits for the user to enter the correct parameters.

BKMOD, Enter Reference BK Modulation in %

Description

This is used to enter the reference BK modulation value.

Syntax

BKMOD, *Modulation*

Parameter	Range	Default Value
Modulation	**5** to **100**	None
Modulation Unit	**%**	%

Examples

BKMOD,60% makes the RE 331 set the BK modulation reference to 60 %. All measurements regarding BK modulation will then use 60 % as reference value.

BKMOD If the parameter is absent, the RE 331 prompts the user as follows: *BK Modulation index 60% (Range: 5 to 100% Step: 1%)* and waits for the user to enter a value.

DKLIM,A, Enter A Trigger-Value for DK Modulation

Description

This is used to enter the limits for the DK modulation tolerance. If the DK modulation exceeds the given limit for a period longer than the interval specified, an A-alarm is triggered.

Syntax

DKLIM,A, *DK Modulation Error, Time*

Parameter	Range	Default Value
DK Modulation Error	**2** to **20** **OFF**	None
Modulation Unit	**%**	%
Time	**10,20,30,40,50** or **60** (s) **5,10,15,20,25** or **30** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

DKLIM,A,6%,30min makes the RE 331 trigger an A-alarm in case the DK modulation error exceeds 6 % for more than 30 minutes.

DKLIM,A If no parameters are present, the RE 331 prompts the user as follows: *A DK Modulation index tolerance 6%, 30min (Range:OFF/2 to 20% Step: 1%, Range: 10s to 30min Step: 10s/5min):* and waits for the user to enter the correct parameters.

DKLIM,B, Enter B Trigger-Value for DK Modulation

Description

This is used to enter the limits for the DK modulation tolerance. If the DK modulation exceeds the given limit for a period longer than the interval specified, a B-alarm is triggered.

Syntax

DKLIM,B, *DK Modulation Error, Time*

Parameter	Range	Default Value
DK Modulation Error	**2** to **20** **OFF**	None
Modulation Unit	**%**	%
Time	**10,20,30,40,50** or **60** (s) **1** to **6** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

DKLIM,B,3%,3min makes the RE 331 trigger a B-alarm in case the DK modulation error exceeds 3 % for more than 3 minutes.

DKLIM,B If no parameters are present, the RE 331 prompts the user as follows: *B DK Modulation index tolerance 3%, 3 min (Range:OFF/2 to 20% Step: 1%, Range: 10s to 6min Step: 10s/1min):* and waits for the user to enter the correct parameters.

DKMOD, Enter Reference DK Modulation in %

Description

This is used to enter the reference DK modulation value.

Syntax

DKMOD, *Modulation*

Parameter	Range	Default Value
Modulation	**5** to **100**	None
Modulation Unit	**%**	%

Examples

DKMOD,30% makes the RE 331 set the DK modulation reference to 30 %. All measurements regarding DK modulation will then use 30 % as reference value.

DKMOD If the parameter is absent, the RE 331 prompts the user as follows: *DK Modulation index 30% (Range: 5 to 100% Step: 1%)* and waits for the user to enter a value.

SKADJ, Enter SK Level Adjustment

Description

This is used to enter the SK level adjustment. The level may be entered with 0.1 dB resolution.

Syntax

SKADJ, *Level Adjustment*

Parameter	Range	Default Value
Level Adjustment	**-6.0** to **+3.0**	None
Level Unit	**dB**	dB

Examples

SKADJ,-2.4 makes the RE 331 set the SK level correction to -2.4 dB.

SKADJ If the parameters are absent, the RE 331 prompts the user as follows: *SK Level adjustment -0.1dBu (Range: -6.0... +3.0dB Step: 0.1dB):* and waits for the user to enter the parameter.

SKLIM,A, Enter A Trigger-Value for SK Level

Description

This is used to enter the limits for the SK level tolerance. If the SK level exceeds the given limit for a period longer than the interval specified, an A-alarm is triggered. The level tolerance may be entered with 0.2 dB resolution.

Syntax

SKLIM,A, *SK Level, Time*

Parameter	Range	Default Value
SK Level	**0.4** to **2** **OFF**	None
Level	**dB**	dB
Time	**10,20,30,40,50** or **60** (s) **5,10,15,20,25** or **30** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

SKLIM,A,1dB,10min makes the RE 331 trigger an A-alarm in case the SK level error exceeds 1 dB for more than 10 minutes.

SKLIM,A If no parameters are present, the RE 331 prompts the user as follows *A SK Level tolerance 2.0 dB, 30min (Range:OFF/0.4 to 2 dB Step: 0.2 dB, Range: 10s..30min Step: 10s/5min):* and waits for the missing parameters.

SKLIM,B, Enter B Trigger-Value for SK Level

Description

This is used to enter the limits for the SK level tolerance. If the SK level exceeds the given limit for a period longer than the interval specified, a B-alarm is triggered. The level tolerance may be entered with 0.2 dB resolution.

Syntax

SKLIM,B, *SK Modulation Error, Time*

Parameter	Range	Default Value
SK Level	**0.4 to 2** **OFF**	None
Level	**dB**	dB
Time	**10,20,30,40,50** or **60** (s) **1** to **6** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

SKLIM,B,1dB,10sec makes the RE 331 trigger a B-alarm in case the SK level error exceeds 1 dB for more than 10 seconds.

SKLIM,B If no parameters are present, the RE 331 prompts the user as follows *B SK Level tolerance 2.0 dB, 3 min (Range:OFF/0.4..2 dB Step: 0.2 dB, Range: 10s..6min Step: 10s/1min):* and waits for the missing parameters.

VRFPHL,A, Enter A Trigger-Value for VRF to Pilot Phase

Description

This is used to enter the limits for VRF to Pilot phase tolerance. If the VRF to Pilot phase error exceeds the given limit for a period longer than the interval specified, an A-alarm is triggered.

Syntax

VRFPHL,A, *Phase Tolerance, Time*

Parameter	Range	Default Value
Phase Tolerance	**2** to **15** **OFF**	None
Phase Unit	**deg**	deg
Time	**10,20,30,40,50** or **60** (s) **5,10,15,20,25** or **30** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

VRFPHL,A,10,10min makes the RE 331 trigger an A-alarm in case the VRF to Pilot phase error exceeds 10° for more than 10 minutes.

VRFPHL,A If no parameters are present, the RE 331 prompts the user as follows *A VRF Phase tolerance 15deg, 30min (Range:OFF/2 to 15deg Step: 1deg, Range: 10s ... 30min Step: 10s/5min)* and waits for the missing parameters.

VRFPHL,B, Enter B Trigger-Value for VRF to Pilot Phase

Description

This is used to enter the limits for VRF to Pilot phase tolerance. If the VRF to Pilot phase error exceeds the given limit for a period longer than the interval specified, a B-alarm is triggered.

Syntax

VRFPHL,B, *Phase Tolerance, Time*

Parameter	Range	Default Value
Phase Tolerance	**2** to **15** **OFF**	None
Phase Unit	deg	deg
Time	**10,20,30,40,50** or **60** (s) **1** to **6** (min)	None
Time Unit	**s** **min**	s

Examples

If the first parameter is **OFF**, the second parameter is optional. **OFF** turns the surveillance off.

VRFPHL,B,10,10sec makes the RE 331 trigger a B-alarm in case the VRF to Pilot phase error exceeds 10° for more than 10 seconds.

VRFPHL,B If no parameters are present, the RE 331 prompts the user as follows *B VRF Phase tolerance 15deg, 4 min (Range:OFF/2 to 15deg Step: 1deg, Range: 10s to 6min Step: 10s/1min)* and waits for the missing parameters.

VRFREF, Enter VRF Reference Level

Description

This is used to enter the VRF reference level. The level may be entered with 0.1 dBu resolution. If you have selected the American RBDS mode and then selected another measurement unit than dBu, this unit can be used. The valid range of the parameter then depends on the selected calibration factors.

Syntax

VRFREF, *Reference Level*

Parameter	Range	Default Value
Reference Level	**-30.0** to **-5.0**	None
Level Unit	**dBu**	dBu

Examples

VRFREF,-14.0 makes the RE 331 set the VRF reference value to -14.0 dBu.

VRFREF If the parameters are absent, the RE 331 prompts the user as follows: *VRF Reference Level -15.1dBu (Range: -30.0...-5.0 dBu Step: 0.1 dBu):* and waits for the user to enter the parameter.

6.7 Miscellaneous Commands

?, Inspect software release number

Description

This is used to inspect the software version and the list of installed options.

Syntax

?

Parameter	Range	Default Value
None		

Examples

? makes the RE 331 respond as follows:

RE 331 RDS DECODER
SOFTWARE VERSION X.Y.Z YYMMDD

where X.Y.Z is the software version and YY, MM, DD indicates the year, month and day, the revision was issued. The RE 331 also displays a list of the installed options, for example measurement option or scanner option.

ACKNOW, Control the Waiting for Acknowledge

Description

This is used to control the way the RE 331 works when used as an RDS re-braodcast decoder: If the value is "ON", the RE 331 will wait for a special acknowledgement from the attached coder when re-transmitting Radio Texts, In-House information, Transparent Data Channel information and RAW data. If set to "OFF", this type of information will be re-braodcast as fast as received without waiting for an acknowledgement from the attached RDS coder.

Syntax

ACKNOW, *State*

Parameter	Range	Default Value
State	**ON** or **1**, **OFF** or **0**	None

Examples

ACKNOW,OFF makes the RE 331 re-braodcast information without waiting for an acknowledgement from an attached RDS coder.

ACKNOW If no parameter is present, the RE 331 prompts the user as follows *Wait for acknowledge ON (Range:0/OFF/1/On) :* and waits for a correct parameter.

ALARMS, Inspect Disturbances

Description

This is used to make the RE 331 display a list of all stored disturbances. The list contains information about the start time of the disturbance, the cause and duration of the disturbances.

The disturbances are listed in the order of occurrence. The shown value are the value that differs most from the reference value.

The list is shown one page (20 lines) at a time. You can get the next page by pressing [ENTER].

Inactive errors are show with a stop time as well. Inactive errors may be removed from the list by answering 'YES' or 'Y' to the question
'Alarm List Clear (YES/NO):'.

Syntax

ALARMS

Parameter	Range	Default Value
None		

Examples

ALARMS makes the RE 331 display the list of all stored alarms. The output format is:

```
ALARMS:
25-07-1990 12.29.40 Power fail          A:   16s
25-07-1990 14.20.00 Block errors        B:    3%     385s
26-07-1990 15.29.40 RDS level error     B:  1.8dB    375s   26-07-1990 15.32.20
27-07-1990 16.29.40 RDS phase error     A:  3.0Deg.  120s
29-07-1990 18.29.40 RDS info error      B:   6 TA     20s

Alarm list clear (YES/NO) :
```

DEVCAL, Set Deviation Calibration

Description

The command is used to set the deviation calibration. The deivation calibration is used when the RE 331 converts a level measurement from dBu to %. You set the number of kHz that corresponds to 100 % deviation.

This command only applies when the RE 331 is in the American RBDs mode. When the RE 331 leaves the American RBDS mode the deviation calibration is reset to 100 % which is equal to 75 kHz.

Syntax

DEVCAL, *Size*

Parameter	Range	Default Value
Size	**10** to **200**	
Unit	**kHz**	**kHz**

Examples

DEVCAL,100 sets the deviation calibration to 100 kHz.

DEVCAL If no parameter is present, the RE 331 prompts the user as follows *Deviation Calibration 100%= 75kHz (Range 10..200kHz) :* and waits for a correct parameter.

ECHO, Control the Echo Function of the RE 331

Description

This is used to control the echo function on the terminal interfaces. The echo may be turned on/or.

Syntax

ECHO, *State*

Parameter	Range	Default Value
State	**ON** or **1**, **OFF** or **0**	None

Examples

ECHO,OFF makes the RE 331 not to echo the received characters to the terminal interface.

ECHO If no parameter is present, the RE 331 prompts the user as follows *ECHO ON/OFF* and waits for a correct parameter.

EONCLR, Control the clearing of EON information

Description

This is used to control the erasure of EON information in attached RDS coders - when the value "ON" is entered, the decoder will send commands to clear a specific EON information in case the EON information in question has not been received in a period of 3 minutes. Also the EON information in the information memory is cleared.

Syntax

EONCLR, *State*

Parameter	Range	Default Value
State	**ON** or **1**, **OFF** or **0**	None

Examples

EONCLR,ON The RE 331 sends clearing commands (to the attached RDS coder) in case a specific EON information has not been received within 3 minutes.

EONCLR If no parameter is present, the RE 331 prompts the user as follows *EON automatic removal ON (Range:0/OFF/1/On) :* and waits for a correct parameter.

HELP, Display All Commands

Description

This is used to make the RE 331 display a list of all valid commands to the terminal.

The list depends on the commands available with the current configuration.

Syntax

HELP

Parameter	Range	Default Value
None		

Examples

HELP The RE 331 now outputs a list of all valid commands to the terminal.

ID, Enter Unit Identification Number

Description

This is used to modify the unit identity number. The identity number is only for user defined purposes, and does not serve as address for communication. The identity number is displayed together with the software release information if the query "ID?" is entered.

Syntax

ID, *ID Number*

ID?

Parameter	Range	Default Value
ID Number	**0** to **65535**	None

Examples

ID,1536 The RE 331 unit now has its identification number set to 1536.

ID? The query makes the RE 331 display the stored ID number together with the software release information.

ID If no parameter is present, the RE 331 prompts the user as follows *Identity number 1536 (Range: 0 to 65535):* and waits for an entry.

IEEE, Set the IEEE Address of the RE 331

Description

This is used to modify the unit IEEE address.

Note that the IEEE address is also used with the RDDS option for addressing the unit in the RDDS chain.

Syntax

IEEE, *IEEE Address*

Parameter	Range	Default Value
IEEE Address	**0** to **30**	None

Examples

IEEE,28 The RE 331 now has the IEEE address 28.

IEEE If no parameter is present, the RE 331 prompts the user as follows *IEEE address 28 (Range:0* to 30) and waits for a correct parameter.

LIMITS, Inspect all limits

Description

This is used to make the RE 331 display all limits from "A Power Fail tolerance" to "B VRF Phase tolerance".

Syntax

LIMITS

Parameter	Range	Default Value
None		

Examples

LIMITS makes the RE 331 output all the limits from "A POWER FAIL" to "B VRF PHASETOL". The output format is:

```
A Power Fail tolerance                10s
B Power Fail tolerance                 2s
.
.
.
A VRF Phase tolerance                 15Deg          30m
B VRF Phase tolerance                 15Deg           6m
```

LOCAL, Local Command

Description

This is used in connection with the Scanner option to toggle the unit between local and remote mode and for locking the error relays.

Both parameters are optional.

Syntax

LOCAL, *Local State*, *Error Relay Locked*

Parameter	Range	Default Value
Local State	**YES** or **1**, **NO** or **0**	None
Error Relay Locked	**LOCK** or **UNLOCK**	None

Examples

LOCAL,1,LOCK This switches the decoder to local mode and locks the error relay outputs at the rear of the RE 331 during operations in local mode.

LOCAL If the scanner input parameters are missing, the RE 331 displays: *Local YES,UNLOCK (Range: NO/0/YES/1 Range:LOCK/UNLOCK) :*

MEMCLR, Control the clearing of Information Memory

Description

This is used to clear the information memory (Intermediate storage for received information). When the value "ON" or "1" is entered, the storage for received information is cleared.

Syntax

MEMCLR, *State*

Parameter	Range	Default Value
State	**ON** or **1**, **OFF** or **0**	None

Examples

MEMCLR,ON The RE 331 clears the intermediate storage for received data.

MEMCLR **If** no parameter is present, the RE 331 prompts the user as follows *Information memory clear OFF (Range:0/OFF/1/On):* and waits for a correct parameter.

MENU, Display the Menu Structure of the RE 331

Description

This is used to make the RE 331 display several pages of information identifying the menu structure "hidden" under each menu key.

This includes the displays that will disapear depending on the configuration. As an exsample scanner specific displays that disapear when the scanner is not installed.

Syntax

MENU

Parameter	Range	Default Value
None		

Examples

MENU The RE 331 outputs several pages of information concerning the menu structure.

MPX, Switch between the MPX Input on the front and Rear

Description

This is used to switch between the MPX input on the front and rear of the RE 331.

Syntax

`MPX,` *MPX Input*

Parameter	Range	Default Value
MPX Input	**`REAR`**, **`R`** or **`1`**, **`FRONT`**, **`F`** or **`0`**	None

Examples

`MPX,REAR` The RE 331 utilizes the MPX input at the rear of the instrument.

`MPX` **`If`** no parameter is present, the RE 331 prompts the user as follows *MPX Input (Range: Front/F/0/Rear/R/1):* and waits for the parameter.

RDSMOD, RDS Mode

Description

This is used to set the RE 331 in the RDS standard (European) mode or in the American RBDS mode. When the RE 331 is set to American RBDS mode a number of new commands are allowed and a number of new displays appear on the front panel.

Syntax

RDSMOD, *Mode*

Parameter	Range	Default Value
Mode	**Europe** **US**	None

Examples

RDSMOD,US sets the RE 331 in the American RBDS mode.

RDSMOD If no parameter is present, the RE 331 prompts the user as follows *RDS/RBDS Mode American RBDS (Range Europe/US)) :* and waits for a correct parameter.

REFLST, Inspect all Reference Records

Description

This is used to make the RE 331 display the contents of all the reference records. The PI, PS, TP and the current state of all the reference records will be displayed.

Syntax

REFLST

Parameter	Range	Default Value
None		

Examples

REFLST makes the RE 331 display the contents of all reference records. The output format is:

```
REFLST:
Reference 1:PI:xxxx PS:yyyyyyyy TP:z Active: q
Reference 2:PI:xxxx PS:yyyyyyyy TP:z Active: q
.
.
.
```

where xxxx is the PI code, yyyyyyyy is the PS, z is the TP bit and q is ACT, NACT, or CUR (connected to the receiving record in the attached RDS coder).

RESET, Reset the RE 331

Description

The command is used to reset the RE 331.

Syntax

RESET
RESET, *Type*

Parameter	Range	Default Value
Type	**RAM** **EEPROM**	None

Examples

RESET makes a soft restart of the RE 331.

RESET,RAM clears RAM, restore all settings from the EEPROM and makes a soft restart of the RE 331.

RESET,EEPROM clears EEPROM and RAM, restore all settings to factory defaults and makes a soft restart of the RE 331.

RTC, Set the Real Time Clock

Description

This is used to set the real time clock in the RE 331 unit.

Syntax

RTC, *Day, Month, Year, Hour, Minute, Second*

Parameter	Range	Default Value
Day	**1** to **31**	None
Month	**1** to **12**	None
Year	**1900** to **2100**	None
Hour	**0** to **23**	None
Minute	**0** to **59**	None
Second	**0** to **59**	None

Examples

RTC,6,1,1991,12,0,0 will set the real time clock in the RE 331 to 6. January 1991 12:00:00.

RTC If no parameters are present, the RE 331 prompts the user as follows *Real time : 1,08,1990,16,48,18 :* and waits for a new set of parameters.

SAVE, Store all Information in EEPROM

Description

This is used to make the RE 331 store all settings and contents of Reference Records in non-volatile EEPROM. If the battery fails, the RE 331 reads all information back into RAM from the EEPROM

Syntax

SAVE

Parameter	Range	Default Value
None		

Examples

SAVE The RE 331 writes all settings and the contents of the reference records to the EEPROM.

SENS, Set Sensitivty

Description

The command is used to set the sensitivity. The sensitivity is used when the RE 331 converts a level measurement from dBu to kHz. You set the number of mVpp that corresponds to 20 kHz deviation.

This command only applies when the RE 331 is in the American RBDs mode. When the RE 331 leaves the American RBDS mode the sensitivity is reset to 20 kHz which is equal to 2191 mVpp.

Syntax

SENS,*Sensitivity*

Parameter	Range	Default Value
Sensitivity	**250** to **5000**	
Unit	**mVpp**	**mVpp**

Examples

SENS,800 sets the sensitivity to 800 mVpp.

SENS If no parameter is present, the RE 331 prompts the user as follows *Sensitivity Calibration 0dBu = 2191mVpp (Range 250..5000mVpp) :* and waits for a correct parameter.

STTY, Control Communication Parameters of RS-232 Interfaces

Description

This is used to set up the RS-232 Interfaces. The STTY command is used to set the baud rate, the number of data bits, the parity and the RDDS state for each of the RS-232 interfaces. Note however, that the RDDS option is only valid for the two terminal lines, and that only lines B, C or D may be turned OFF. Any of the parameters may be omitted, except for the RS-232 interface identifier.

Syntax

STTY, *RS-232 ID*, *Baud Rate*, *Databits*, *Parity*, *RDDS State*, *Line State*

Parameter	Range	Default Value
RS-232 ID	**A**,**T**,**B**,**C** or **D**	None
Baud Rate	**75** to **19200**	None
Databits	**7** or **8**	None
Parity	**n**, **o** or **e** (None, Odd or Even)	None
RDDS State	**NORM**, **RDDS** or **LAST** (No RDDS, RDDS or Last in line)	None
Line State	**ON** or **OFF**	None

Examples

STTY,A,9600,8,n,LAST The terminal interface A in the RE 331 is set to the following state: 9600 baud, 8 data bits, no parity, Last in RDDS line.

STTY If no parameters are present, the RE 331 prompts the user as follows *V 24 setting (Range: A/T/B/C/D):* a "B" results in the following prompt *V24 setting B (Range: <75 to 19200>, <7,8>, <n,o,e>).*

TEST, Initiate the Self-Test Procedure

Description

This is used to initiate a self test procedure.

If a specific test number is entered, that specific test is performed.

If no test number is entered a number of tests are performed. If the command are given from the IEEE 488 interface all tests are preformed. If the command are given from a V24 interface all test not concerning the V24 interfaces and not requiring a special loop-back connector is preformed.

Syntax

TEST
TEST, *Test Number*

Parameter	Range	Default Value
Test Number	**1** to **20**	None

Examples

TEST,1 The RE 331 performs the PROMs test. The result of the test is be written to the terminal.

TEST. The RE 331 executes a number of self test procedures. The result of the tests will be written to the terminal.

The following tests are available:

1.	PROM CRCC	Used to test the EPROMs using Cyclical Redundancy Check Characters.
2.	INTERRUPT CONTROLLER	Used to test the interrupt controller.
3.	REAL TIME CLOCK	Used to test the real time clock chip.
4.	KEYBOARD	Used to test the keyboard.
5.	DISPLAY	Used to test the display.

6. TMS 320	Used to check the communication between the main CPU and the Digital Signal Processor (TMS 320C10) on the COM/SYNC Board.
7. DEMODULATOR BOARD	Used to test the communication between the main CPU and the demodulator.
8. MEASUREMENT BOARD	Used to test the communication between the main CPU and the optional Measuring Unit.
9. FRONT TERMINAL UART	Used to test the Universal Asynchronous Receive Transmit chip handling the terminal interface on the front.
10. REAR TERMINAL UART	As (9), but for the terminal interface on the rear panel of the RE 331.
11. LINE B UART	As (9), but for LINE B on the rear panel of the RE 331.
12. LINE C UART	As (9), but for LINE C on the rear panel of the RE 331.
13. LINE D UART	As (9), but for LINE D on the rear panel of the RE 331.
14. REMOTE LOOPBACK	Used to test the Status inputs by means of the Alarm outputs by means of cables constructed as described in section 3.4.
15. FRONT TERMINAL LOOPBACK	Used to test the terminal interface on the front. To run the test, a 25-pole male Sub-D plug connecting pin 2 to pin 3, pin 4 to pin 5 and pin 6 to pin 20 should be inserted in the front terminal connector.
16. REAR TERMINAL LOOPBACK	As above for the terminal on the rear panel.
17. LINE B LOOPBACK	As above for Line B on the rear panel.
18. LINE C LOOPBACK	As above for Line C on the rear panel.
19. LINE D LOOPBACK	As above for Line D on the rear panel.

20. SCANNER	Used to test the communication between the main CPU and the scanner board.

UNIT, Set Level Measuring Unit

Description

The command is used to set the Level Measuring Unit. The selected unit will be used when the results of the level measurements are shown on the terminal or on the front panel. Also the unit will be used for the RDS and VRF reference levels.

This command only applies when the RE 331 is in the American RBDs mode. When the RE 331 leaves the American RBDS mode the unit is reset to dBu.

Syntax

UNIT, *Type*

Parameter	Range	Default Value
Type	**dBu**, **mVpp**, **kHz**, **%**	None

Examples

UNIT,kHz sets the level measuring unit to kHz.

SENS If no parameter is present, the RE 331 prompts the user as follows *Level Unit dBu (Range dBu/kHz/mVpp/%) :* and waits for a correct parameter.

VRF, Switch the VRF Specific Part on or off

Description

This is used to enable or disable the VRF part of the RE 331. If the VRF part of the RE 331 is disabled, all VRF tests cease to operating and at the same time all VRF related menus of the RE 331 will disappear.

Syntax

VRF, *State*

Parameter	Range	Default Value
State	**ON** or **1, OFF or 0**	None

Examples

VRF,OFF The RE 331 stops to perform all VRF tests, and the menus relating to VRF information will disappear.

VRF If no parameter is present, the RE 331 prompts the user as follows *VRF on/off:* and waits for the parameter.

6.8 IEEE 488 Specific Commands

SS, Set Service Request Disable/Enable Mask (IEEE 488 Interface)

Description

This is used to enable or disable the Service Request on the IEEE 488 Interface. Note however, that this command is only available from the IEEE interface.

Syntax

SS, *Mask*

Parameter	Range	Default Value
Mask	**0** to **3** **0** (=enable all SRQs) **1** (=disable SRQs from errors/warnings) **2** (=disable SRQs from results/queries) **3** (=disable all SRQs)	None

Examples

SS,0 All Service Request Masks are enabled on the IEEE 488 Interface of the RE 331.

6.9 Clock Control Commands

The Clock Control option has been introduced in the RE 331, to facilitate automatic toggling of certain alarms and activation and de-activation of reference records. The clock control operates on a weekly basis, and is thus able to execute a given command at any specified time until the command is removed from the set of stored commands. Within one week 64 events can be set.

If the Clock Control option is installed in the RE 331 the following two commands may be used to enter and delete commands that are to be executed at certain predefined times during a week.

UR, Set Clock Control Commands

Description

This is used in connection with the Clock Control option to enter commands for the setting of the surveillance to be executed at a given time and day during the week.

A maximum of 5 sets of "Command,Command Par" can be entered with one UR command.

Syntax

UR, *Day*, *Hour*, *Minute*, *Command*, *Command Par*, *Command*, *Command Par* ....

Parameter	Range	Default Value
Day	**MO**, **TU**, **WE**, **TH**, **FR**, **SA** or **SU**	None
Hour	**0** to **23**	None
Minute	**0** to **59**	None
Command	**REFACT** (activation of a reference record) **REFINA** (de-activation of a reference record) **REFLIM** (RDS reference record alarm) **INFO** (RDS information tolerance alarm) **BLKERR** (Block error tolerance alarm) **LEVLIM** (RDS level tolerance alarm) **SKLIM** (SK level tolerance alarm) **PHLIM** (RDS phase tolerance alarm) **VRFPHL** (VRF phase tolerance alarm) **RDSVRF** (RDS-VRF phase tolerance alarm) **BKLIM** (BK modulation index tolerance alarm) **DKLIM** (DK modulation index tolerance alarm) **ALL** (All surveillance on or off)	None
Par	**1** to **8** or **X**(all) (For REFACT and REFINA, the rec. no) **ON** or **OFF** (Set the surveillance on or off)	None

Examples

UR,MO,0,15,BLKERR,OFF makes the RE 331 switch off the block error tolerance alarm every Monday at a quarter past midnight.

UR If no parameters are present, the RE 331 prompts the user as follows

```
Time Control    (MO/TU/WE/TH/FR/SA/SU,Hour,Minut,ALL/REFACT
,REFINA/REFLIM,INFO/BLKERR/LEVLIM/PHLIM/RDSVRF/SKLIM/VRFPH
L,BKLIM/DKLIM/,On/Off ) :
```

RU, Remove a Clock Control Setting

Description

This is used in connection with the Clock Control option to delete a clock control setting. The full entry must be specified for each setting to be deleted, since more than one shaltuhr command can be scheduled for execution at any given time.

Syntax

RU, *Day*, *Hour*, *Minute*, *Command*, *Command Par*, *Command*, *Command Par* ....

Parameter	Range	Default Value
Day	**MO**, **TU**, **WE**, **TH**, **FR**, **SA** or **SU**	None
Hour	**0** to **23**	None
Minute	**0** to **59**	None

Command	**REFACT**	None
	(activation of a reference record)	
	REFINA	
	(de-activation of a reference record)	
	REFLIM	
	(RDS reference record alarm)	
	INFO	
	(RDS information tolerance alarm)	
	BLKERR	
	(Block error tolerance alarm)	
	LEVLIM	
	(RDS level tolerance alarm)	
	SKLIM	
	(SK level tolerance alarm)	
	PHLIM	
	(RDS phase tolerance alarm)	
	VRFPHL	
	(VRF phase tolerance alarm)	
	RDSVRF	
	(RDS-VRF phase tolerance alarm)	
	BKLIM	
	(BK modulation index tolerance alarm)	
	DKLIM	
	(DK modulation index tolerance alarm)	
	ALL	
	(All surveillance on/off)	
Par	**1** to **8** or **X**(all)	None
	(For REFACT and REFINA, the rec. no)	
	ON or **OFF**	
	(The setting of the surveillance)	

Examples

RU,MO,0,15,BLKERR,OFF deletes the scheduled command to switch off the block error tolerance alarm every Monday at a quarter past midnight.

RU If no parameters are present, the RE 331 prompts the user as follows :

Time Control (MO/TU/WE/TH/FR/SA/SU,Hour,Minut,ALL/REFACT ,REFINA/REFLIM,INFO/BLKERR/LEVLIM/PHLIM/RDSVRF/SKLIM/VRFPH L,BKLIM/DKLIM/,On/Off) :

UR?, Inspect Commands Scheduled for Execution

Description

This is used in connection with the Clock Control option to inspect the scheduled commands stored in the RE 331.

Syntax

UR?

Parameter	Range	Default Value
None		

Examples

UR? The RE 331 displays all stored settings for the clock control in the following format:

```
Time Control Settings
MO 00:15  BLKERR,OFF
```

UR If the parameter is absent, the RE 331 prompts the user as follows:

```
Time Control Settings  ( MO/TU/WE/TH/FR/SA/SU,Hour,Minut,
ALL/REFACT/REFINA/REFLIM/INFO/BLKERR/LEVLIM/PHLIM/RDSVRF/SKLIM/VRFPHL/BKLIM/DKLIM,On/Off ) :
```

6.10 RDDS Commands

AR, Address the unit

Description

This is used in connection with the RDDS option to address a unit in the RDDS chain. When the unit sees the AR command, and the parameter of the command corresponds to its own IEEE address, the unit will de-address the other units in the chain, and start to interpret the commands received from the chain.

Note that the RDDS option must be installed for the terminal line.

Syntax

AR, *IEEE Address*

Parameter	Range	Default Value
IEEE Address	**0** to **30**	None

Examples

AR,28 sets the IEEE address of the RE 331 to 28, the RE 331 is addressed and receives and interprets the commands communicated via the chain of other RDS coders and decoders.

AR? returns the address of the currently addressed unit in the RDDS chain.

6.11 Scanner Commands

A few terminal commands have been added and a few have been modified in order to be able to set up the scanner via the terminal input.

FREQ, Set up Frequency for RF Scanner

Description

This is used in connection with the Scanner option to set the scanner inputs to scan specified frequencies.

Syntax

FREQ, *Input Number, Frequency*

Parameter	Range	Default Value
Input	**1** to **8** **X** (All inputs)	None
Frequency	**87.50** to **108.00**	None
Frequency Unit	**MHz**	MHz

Examples

FREQ,1,101.1 sets the scanner input 1 in the RE 331 to scan the frequency 101.1 MHz.

FREQ If the scanner input parameter is missing, the RE 331 displays *Scanner Frequency (Input: 1 to 8/X) :*

FREQ,1 If the Frequency parameter is missing, the RE 331 displays: *Scanner Frequency Input : 1 101.90 (Range 87.5 to 108.00 MHz):*

LEVADJ, Enter Level Correction

Description

This is used in connection with the Scanner option to enter the RDS level correction attached to a given scanner input. The level correction may be entered in steps of 0.1 dB.

Syntax

LEVADJ, *Input*, *Adjustment*

Parameter	Range	Default Value
Input	**1** to **8** **X** (All inputs) **FRONT** or **REAR** **F** or **R**	None
Adjustment	**-6.0** to **+3.0**	None
Adjustment Unit	**dB**	dB

Examples

LEVADJ,1,-2.4 sets the RDS level correction for the RF scanner input 1 to -2.4 dB.

LEVADJ If the scanner input parameter is missing, the RE 331 displays: *Level Adjustment (Input: Front/F/Rear/R/1 .. 8/X) :*

LEVADJ,1 If the second parameter is missing the RE 331 displays: *Level adjustment Input : 1 0.0dB (Range -6..+3dB Step 0.1dB):*

MONO, Toggle Stereo/Mono for Earphones

Description

This is used in connection with the Scanner option to switch the earphone output of the RF scanner between mono and stereo.

Syntax

MONO, *State*

Parameter	Range	Default Value
State	**OFF** or **0**, **On** or **1**	None

Examples

MONO,OFF sets the earphone output from the RF scanner to stereo.

MONO **If** the scanner input parameter is missing, the RE 331 displays: *Mono OFF (RANGE: OFF/0/ON/1):*

MPX, Switch between the Scanner Inputs

Description

This is used to switch between the scanner inputs and the front and rear of the RE 331.

NOTE that this command is used even with an RF scanner.

Syntax

MPX, *MPX Input*

Parameter	Range	Default Value
MPX Input	**1** to **8**, **REAR**, **R** **FRONT**, **F** **X** (Scanning)	None

Examples

MPX,REAR The RE 331 utilizes the MPX input on the rear panel of the instrument.

MPX If no parameter is present, the RE 331 prompts the user as follows *MPX Input (Range: 1 to 8/X/Front/F/Rear/R):* and waits for the parameter.

PHADJ, Enter Phase Adjustment

Description

This is used in connection with the Scanner option to enter the RDS phase adjustment attached to a given scanner input.

Syntax

PHADJ, *Input*, *Adjustment*

Parameter	Range	Default Value
Input	**1** to **8** **X** (All inputs) **FRONT** or **REAR** **F** or **R**	None
Adjustment	**-10** to **+10**	None
Adjustment Unit	**deg**	deg

Examples

PHADJ,1,-5 sets the RDS phase adjustment for the RF scanner input 1 to -5°.

PHADJ If the scanner input parameter is missing, the RE 331 displays: *Phase Adjustment (Input: Front/F/Rear/R/1 to 8/X) :*

PHADJ,1 If the second parameter is missing the RE 331 displays: *Phase adjustment Input : 2 0.0deg (Range -10..+10deg Step 1deg):*

REF, RDS Reference Record

Description

This is used in connection with the Scanner option to set up the contents and active state for the reference records for each of the eight scanner input, the front and rear input and for the three regional inputs.

Syntax

REF, *Input*, *PI Code*, *PS String*, *TP Flag*, *Active*

Parameter	Range	Default Value
Input	**1** to **8** **X** (All inputs) **FRONT** or **REAR** **F** or **R** **REG1**, **REG2** or **REG3**	None
PI code	**0000** to **FFFF**	None
PS string	8 ASCII characters	None
TP flag	**ON** or **1**, **OFF** or **0**	None
Active	**ACT** or **NACT**	None

Examples

REF,1,D381,'WDR 1',0,Y sets the RDS reference record attached to scanner input line 1 as having PI : D381, PS : 'WDR 1' and TP : Off, and activate the record.

REF If the scanner input parameter is missing, the RE 331 displays: *Reference Record (Input : Front/F/Rear/R/1..8/X/REG1..REG3) :*

REF,1 If the some of the other parameters are missing the RE 331 displays: *Reference (PI,PS,TP) :* After entry of these values, the prompt appears: *Active: ACT (Range: ACT/NACT):*

REFLST, List the Contents of Reference Records

Description

This is used in connection with the Scanner option to make the RE 331 display the contents and active state of all reference records.

Syntax

REFLST

Parameter	Range	Default Value
None		

Examples

REFLST This makes the RE 331 output a list of the reference records and their contents.

The list has the following output format:

```
Reference Front  (PI,PS,TP)  ####,########,#  Active N
Reference Rear   (PI,PS,TP)  ####,########,#  Active N
Reference Scan1  (PI,PS,TP)  D381, WDR 1  ,0  Active N
Reference Scan2  (PI,PS,TP)  D382, WDR 2  ,1  Active N
Reference Scan3  (PI,PS,TP)  D383, WDR 3  ,0  Active N
Reference Scan4  (PI,PS,TP)  D384, WDR 4  ,0  Active Y
Reference Scan5  (PI,PS,TP)  ####,########,#  Active N
Reference Scan6  (PI,PS,TP)  ####,########,#  Active N
Reference Scan7  (PI,PS,TP)  ####,########,#  Active N
Reference Scan8  (PI,PS,TP)  ####,########,#  Active N
Reference Reg1   (PI,PS,TP)  D2#1,## MPX #,0  Active Y   Scan1
Reference Reg2   (PI,PS,TP)  D2#2,########,1  Active Y   Scan5
Reference Reg3   (PI,PS,TP)  D2#3,Q # PX #,0  Active Y   Scan3
```

REGION, Set Regional References

Description

This is used in connection with the Scanner option to set up the active state for the regional reference records for each of the three regions, and set their association with one of the eight scanner inputs or the FRONT or REAR input. If a regional reference record is set active, the associated normal reference record will be de-activated. When a regional reference record is de-activated, the associated normal reference record is activated, unless another regional reference record is active for the input line in question. The regional input is set active when it is associated with one of the scanner inputs.

Syntax

REGION, *Reg, Input*

Parameter	Range	Default Value
Input	**1**, **2** or **3**	None
Input	**1** to **8** **FRONT** or **REAR** **F** or **R** or **OFF**	None

Examples

REGION,1,2 attaches the RDS regional reference record 1 to the scanner input line 2.

REGION,2,OFF removes any connection from the RDS regional reference record 2.

REGION If the parameters are missing, the RE 331 displays: *Regional Connection (Range:1 to 3, Range:Front/F/Rear/R/1 to 8/OFF) :*

STATUS, List the Normal / Reserve status

Description

This is used in connection with the Scanner option to make the RE 331 display the Normal or Reserve status of the inputs.

Syntax

REFLST

Parameter	Range	Default Value
None		

Examples

STATUS makes the RE 331 output a list of the status of the 8 inputs of the scanner.

The list has the following output format:

```
Input    1: Normal
Input    2: Reserve
Input    3: Normal
Input    4: Normal
Input    5: Normal
Input    6: Normal
Input    7: Normal
Input    8: Normal
```

TIME, Scanner TIME

Description

This is used in connection with the Scanner option to specify for each of the scanner input lines, how long the decoder spends on this input when scanning.

Syntax

TIME, *Input, Scanner Time*

Parameter	Range	Default Value
Input	**1** to **8** **X** (All inputs) **FRONT** or **REAR** **F** or **R**	None
Scanner Time	**0** to **60**	None
Scanner Time Unit	**min**	min

Examples

TIME,1,5 makes the scanner scan input line 1 for a period of five minutes each time the line is to be scanned.

TIME If the scanner input parameter is missing, the RE 331 displays: *Scanner Time (Input : Front/F/Rear/R/1..8/X) :*

TIME,1 If the second parameter is missing the RE 331 displays: *Scanner Time Input : 2 10 (Range: 0..60min) :*

VRF, VRF Command

Description

This is used in connection with the Scanner option to toggle the VRF input for the scanner input.

Syntax

VRF, *Input*, *Adjustment*

Parameter	Range	Default Value
Input	**1** to **8** **X** (All inputs) **FRONT** or **REAR** **F** or **R**	None
VRF Input State	**ON** or **1**, **OFF** or **0**	None

Examples

VRF,1,ON turns on the VRF tests for scanner input 1.

VRF If the scanner input parameter is missing, the RE 331 displays: *VRF (Input: Front/F/Rear/R/1 to 8/X) :*

VRF,1 If the second parameter is missing the RE 331 displays: *VRF Input : 2 OFF (Range 0/OFF/1/ON):*

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7. DISMANTLING

This section describes how to dismantle the RE 331 RDS Decoder in order to gain access to the plug-in units, modify the display panel or exchange a defective mechanical part.

You will need the following tools:

* 3 mm Hexnut screwdriver
* 2.5 mm Hexnut screwdriver
* 2 mm Hexnut screwdriver
* A small pozidrive screwdriver

7.1 Keyboard and Display

The Keyboard/Display unit is a complete unit that may be dismantled as follows:

1. Remove the two hexnut screws (3 mm) placed in each of the sideframes immediately behind the rack mounting panels (see Fig. 7.1).

2. Carefully pull out the keyboard/display unit of the RE 331 frame noting the position of the three cables connecting the RE 331 motherboard (901-882) with the keyboard/display unit.

3. Remove the power cable (a red and a black wire) plugged into J14 in the motherboard.

4. Remove the flat cable plugged into J9 in the motherboard.

5. Remove the signal input cable plugged into J13 in the motherboard.

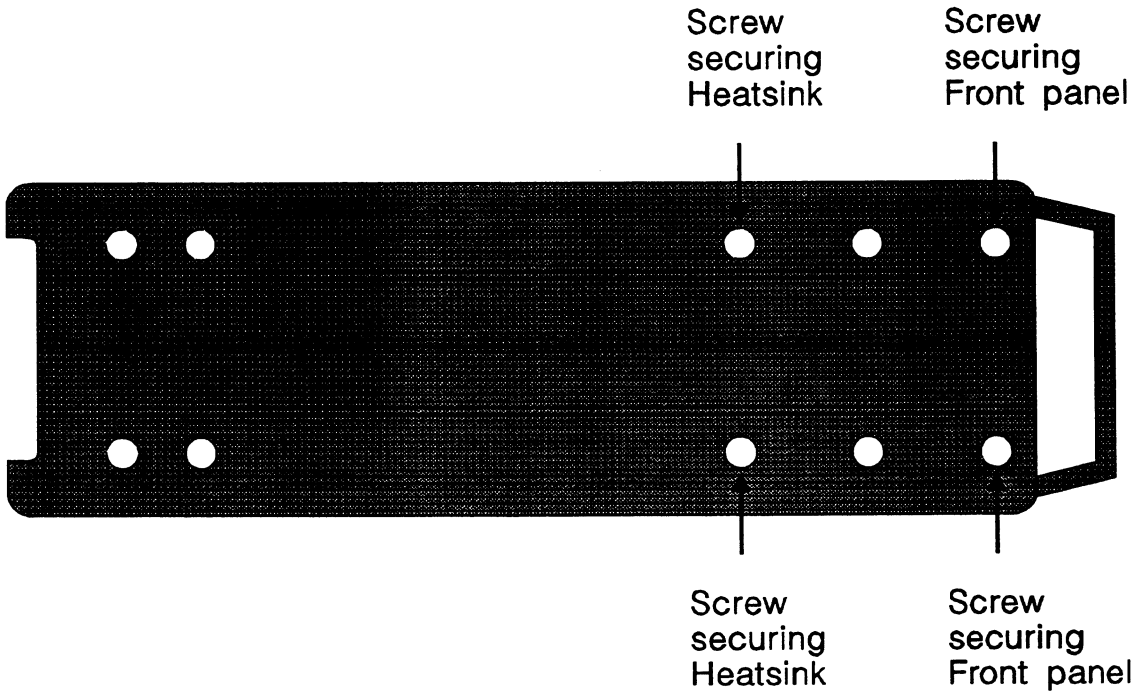

Fig. 7.1 - Removing Keyboard/Display Unit

7.2 Dismantling the Keyboard/Display Unit

Remove the Keyboard/Display unit from the RE 331 main frame as described in 7.1 and

1. Carefully remove the cursor wheel button from the keyboard. The cursor wheel button clicks onto the cursor wheel, so carefully pull the cursor wheel button off the cursor wheel.

2. Remove the upper row of screws using the pozidrive screwdriver (see Fig. 7.2). Take care not to lose any of the washers.

3. Remove the top plate of the unit using the pozidrive screwdriver (see Fig. 7.3).

4. Remove the plexiglas front of the unit.

5. Remove the 3 screws below the Keyboard/Display unit using the pozidrive screwdriver (see Fig. 7.3).

6. Remove the flat cable plugged into the 26-pole connector right of the cursor wheel (seen from the rear).

7. Remove the flat cable on the left side of the unit connecting the VFU display with the keyboard PCB.

8. Remove the cable connecting the keyboard PCB with the cursor wheel.

9. Remove the short flat cable connecting the two units which are situated immediately below the small PCB carrying the LED bargraph displays.

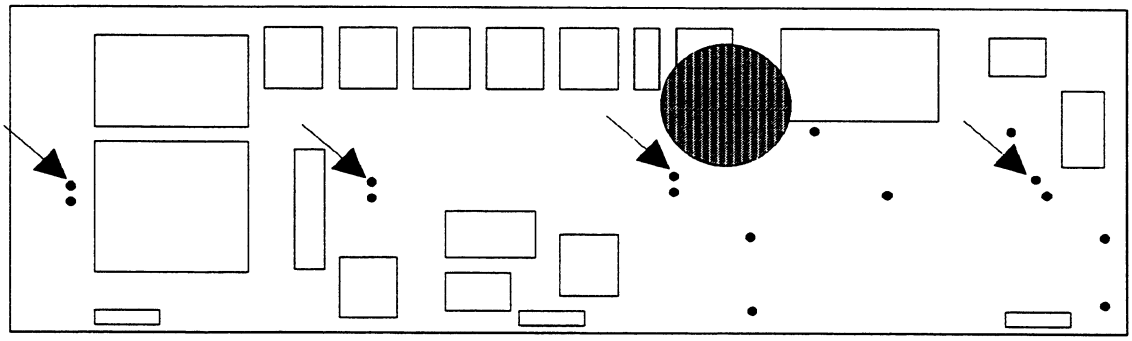

Fig. 7.2 - Dismantling Keyboard

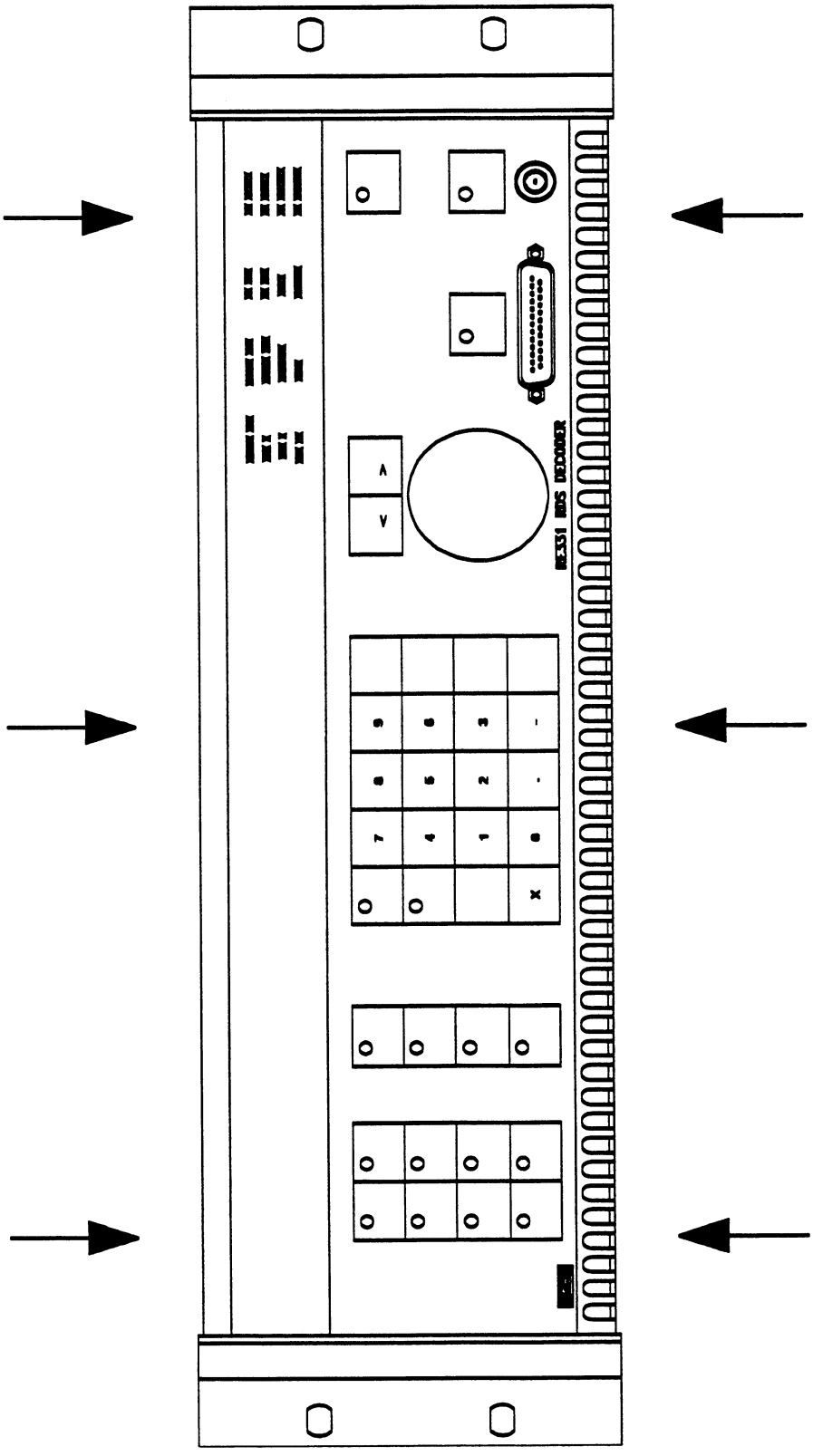

Fig. 7.3 - Removing screws below Keyboard/Display Unit

The Display and Keyboard sections are now independent units. The Display section consists of three parts: Main control PCB (901-883), a small PCB carrying the bargraph displays and the VFU display itself. The small PCB carrying the bargraph display is plugged into the main control PCB and may be removed by pulling the PCB from its connection (J4 and J5) below the small PCB. When mounting the PCB take care not to bend any of the pins. The VFU display is fastened using four screws accessible from the front of the unit whereas the main control PCB is fastened using 6 screws accessible from the rear of the unit.

The Keyboard PCB is fastened using 4 screws at the bottom of the keyboard and 4 special nuts are used to keep the distance between keyboard and display. To re-assemble the unit follow the dismantling instructions in reverse order.

7.3 Removing Plug-in Units

The RE 331 is a modular instrument based on a number of plug-in units communicating via a multilayer motherboard placed behind the Keyboard/Display unit. With all possible options installed a total of 8 plug-in modules are mounted in the instrument: All plug-in units are clearly marked at the lower part of the rear panel. Seen from the rear the following units may be installed in your RE 331 (from left to right):

1 Demodulator Board
2 Level Measuring Board*
3 Phase Measuring Board*
4 Remote and Alarm Board
5 MPX **or** HF Scanner*
6 Communication/Sync Board
7 CPU Board
8 Power Supply

Boards marked with a "*" are optional.

All modules may be installed or removed while the RE 331 is installed in a rack. We recommend that you remove the top or bottom plate, as you then have access to small slots that may be used to extract the boards from the motherboard.

1. Remove three screws at the rear part of the RE 331 top/bottom plates (use a pozidrive screwdriver).

2. Remove the top and bottom plates.

3. Remove the screws at the top and bottom part of the rear panel using a hexnut screwdriver.

4. Prise the unit out using a screwdriver inserted in the slot behind the panel (see Fig. 7.4).

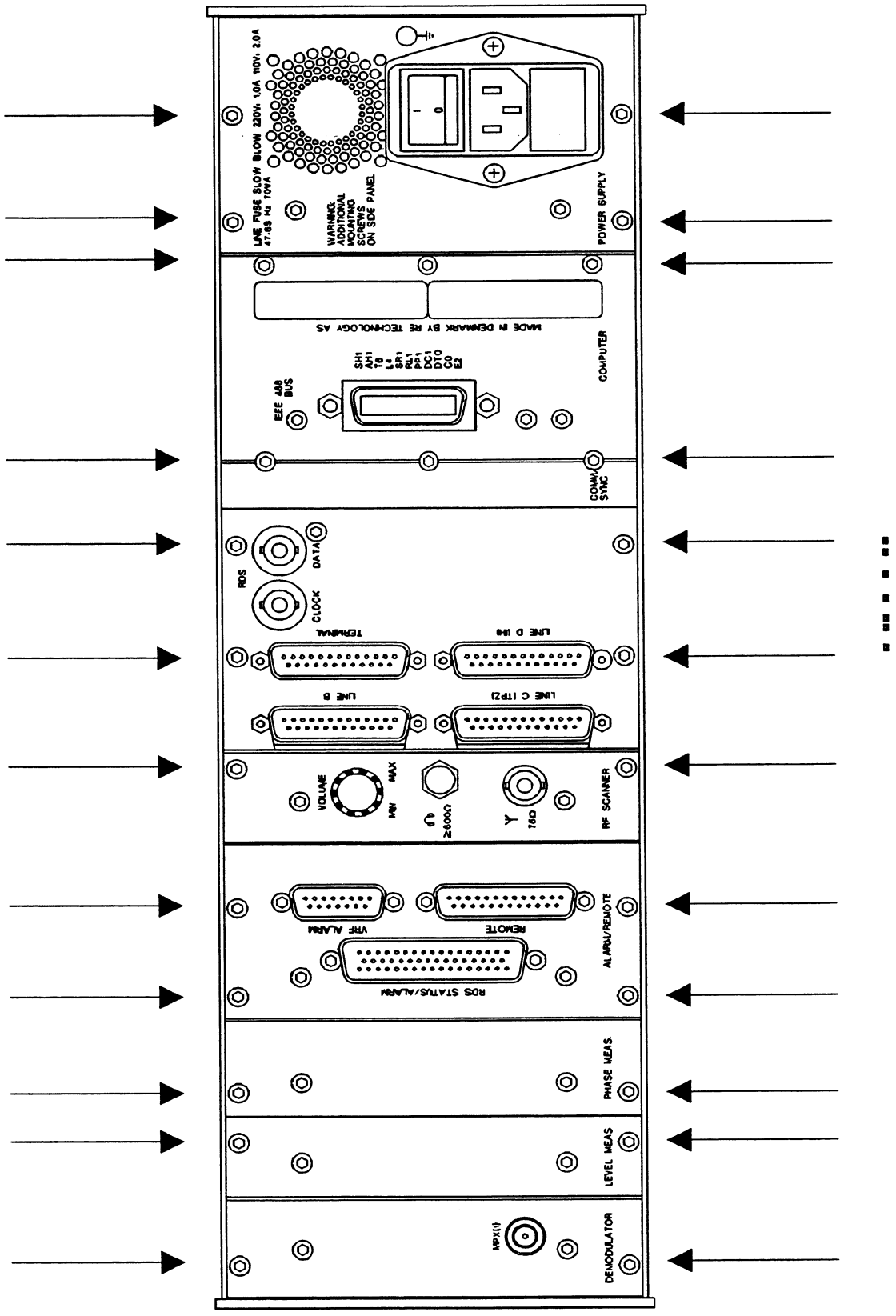

Fig. 7.4 - Dismantling Plug-in Boards

7.4 Removing the Power Supply Unit

1. Remove the two screws on the right sidepanel (seen from the rear). See Fig. 7.1. Remember to screw them back when mounting the power supply as they ensure that the power supply does not overheat.

2. Remove the top plate (see section 7.3).

3. Pull the unit out of the frame as you push the heat sink from the top of the RE 331 (see Fig. 7.4).

7.5 Removing the Communication/Sync and Scanner Boards

1. Unscrew the four hexnut screws on the connector box; two at the top of the unit and two at the bottom of the unit.

2. Unplug the flat cable connecting the connector box and the Communication/Sync unit

3. Remove the connector box.

4. Unscrew the three hexnut screws on the right of the unit (these screws are common to the Communication/Sync and the Computer board).

5. Take out the Communication/Sync board.

6. Remove the optional HF or MPX scanner boards by unscrewing the two hexnut screws on the right side of the rear panel of the unit.

When mounting the units in the RE 331 the connector box should be mounted as the last unit. Remember to connect the Communication/Sync board and the connector box using the flat cable connector.

N O T E

The first RE 331 series had a broader connector box and did not have the PCB guide installed which means that you will have to order a new connector box and install a PCB guide plate in the RE 331 before installing an HF or MPX scanner. Contact your local distributor or the factory when ordering a scanner option for these early RDS decoders.

7.6 Exchanging a Side Panel Plate

Unscrew all eight hexnut screws - ten on the left side of the RE 331 as seen from the front - (see Fig. 7.1).

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8. ADJUSTMENTS AND MAINTENANCE

8.1 Set-up of Control Registers

The following section describes a number of available adjustments. Some of these require you to set the control registers on the boards to specific values before you make the adjustments. Normally, the settings of the boards change all the time during measurements and calibration. Therefore the measurements must be stopped during the adjustments. To stop the measurements you must first put the RE 331 into debug mode:

1. Turn off the RE 331 and take out the CPU board (the board with the IEEE 488 connector).

2. Open contact number 8 on dipswitch S1, (see also section 4.6.).

3. Re-install the CPU board and turn the power on.

4. Connect a terminal to the front or rear terminal connector and issue the command **MEAS,OFF**. Now the measurements and calibrations are stopped.

You can control the settings of the boards with the command **PORT,***address,data*

where address is the IO address of the board and data is the data you want to set up. Both are in hexadecimal format. The allowed range is from **80** hex to **FE** hex for address, and **0000** hex to **FFFF** for data.

If you connect one of the boards you want to adjust without turning the RE 331 off be sure to issue the command: **PORT,FE,FFF** in order to re-synchronize the communication with the boards.

You can restart the measurements with the command **MEAS,ON**

Measurements are automatically restarted on power-up.

After the adjustments you must remember to take the RE 331 out of debug mode and set it back into normal mode by setting the switch on the CPU board.

NOTE

The commands **MEAS** and **PORT** are only available when the RE 331 is in debug mode.

8.2 Demodulator Board

This section describes how to adjust and maintain the Demodulator. Any detailed adjustments should be referred back to the factory. All the adjustments and measurements have to be made and in the order stated.

NOTE

Levels are stated as RMS values if nothing else is stated.

All jumpers should be removed at the beginning.

The address of the Demodulator is 94.

The following instruments are needed in order to complete the measurements:

* AC Level meter, accuracy < 0.1 dB,
* Oscilloscope,
* 2 synthesized LF generators,
* Phase meter, < 0.1° accuracy.
* 20 dB attenuator,
* RE 530 RDS generator,
* DC measuring DVM, < 0.1 % accuracy.

Connect the Sync input of the RE 530 Generator to a synthesized LF generator which can change frequency in 1 Hz steps. A change of frequency of 1 Hz on the Sync input corresponds to a 3 Hz change in the RDS carrier.

You can use the following table as a check list:

Trimmer	Purpose	Corresponding TP
R59	Adjustment of 57 kHz BP filter	TP3
R67	Adjustment of 57 kHz BP filter	TP4
R6	CMRR adjustment of input amp.	TP4
R64	Gain in 57 kHz BP filter	TP4
R370	Phase in VCA	TP4 & TP11
R157	Balance in mixer QD8	TP8
R217	Balance in mixer QD11	TP9
R214	Balance in mixer QD9	TP14
R229	Balance in mixer QD9	TP14
R211	Offset in mixer QD9	TP15
L6	Frequency span in Costas Loop	TP14
R189	Gain in Costas Loop	TP14
R365	Level of Biphase Signal	TP5

Table 8.1 - Demodulator, List of Trimmers

1. Adjustment of the Band-pass filter:

Set LF generator to 50.20 kHz, level 100 mV RMS.
Select input AUX_IN.
Connect LF generator to AUX_IN of Demodulator.
Adjust R59 for max. level at TP3 (appr. 300 mV).

Change frequency to 60.60 kHz, same level.
Adjust R67 for max. level at TP4 (appr. 300 mV).

Check the presence of signal on TP11.

2. The Input Switching and CMRR Adjustment.

Set LF Generator to 57 kHz, level 100 mV RMS.
Select input REAR on Demodulator.
Connect generator to REAR.
Adjust R6 to min. AC on TP4.

3. The Input Switching and the Balanced Amplifier.

Select input FRONT.
Connect LF Generator between Ground and FRONT_IN+.
Check presence of signal on MEASOUT2.
Connect LF Generator between Ground and FRONT_IN.
Check presence of signal on MEASOUT2.

4. Adjustment of MEASOUT2 Level and Phase in VCA.

Set LF Generator to 57 kHz, Level 250 mV RMS.
Connect generator to FRONT.
Adjust R64 to 0 dB gain ±0.05 dB from generator to MEASOUT2.

Connect the Phase meter between TP4 and TP11.
Do not use oscilloscope probes with different phase characteristics.
Adjust R370 to a 0° reading ±0.1°.

5. Mixer Adjustment.

Adjust R157 to min. ripple at TP8.
Adjust R217 to min. ripple at TP9.
R328 and R349 remain in centre position.

JP7 is inserted, but JP5 remains open.
Adjust R214 to min. AC on TP14.
JP5 is inserted, and JP7 is removed.
Adjust R229 to min. AC on TP14.

JP5 and JP7 are both inserted.
Adjust R211 to min. offset ±5 mV on TP15.
Remove JP5 and JP7.

6. The Costas Loop.

Set RDS Generator RE 530 to 1.6 % RDS Level.
Monitor signal on TP14 with oscilloscope.
Adjust L6 to the widest frequency span of the PLL.
Change RDS carrier frequency by changing frequency of generator connected to Sync on RE 530.
Lock must be achieved even with ±9 Hz offset.

Set RDS Generator RE 530 to 0.6 % RDS Level.
Connect generator to demodulator via a 20 dB attenuator.
Check ability to lock at ±6 Hz offset.

7. Adjustment of Biphase Level.

Set RDS generator RE 530 to 1.0 % RDS level.
Set RDS data to 0101.
Adjust R365 to 8 Vpp on TP5.

8. Injection Test.

Set injection on **PORT,94,0080**
Check signal level on MEASOUT2: 50 to 90 mV RMS measured selectively at 57 kHz.

Set injection off **PORT,94,0000**
Check signal level on MEASOUT2: < 150 μV measured selectively at 57 kHz.

NOTE

This setting will change when you select input.

9. Output Check.

Set RDS generator RE 530 to 1.6 % RDS level.
Check the presence of the recovered carrier 57 kHZ on the output J1-C13.
Check the presence of the RDS data clock on the output J1-A7.
Check the presence of RDS data on the output J1-A6 using RDS data 0000, 0101 and 1111 in RE530.

10. Out-of-band Rejection Test.

Set RDS generator RE 530 to 2.0 % RDS level.
No VRF present. RDS data: 0101.
Set LF generator frequency to 58.2 kHz, level 30 mV.
Add the signal from the LF generator to the signal from the RDS generator.
Connect the combined signal to FRONT.
Turn up signal from LF generator until RDS data on the output J1-A6 are corrupted.
Turn down signal level from LF generator until RDS data are OK again.
The signal level from the LF generator shall be $\geq$ 30 mV.
Keep RDS generator RE 530 on 2.0 % RDS level.
No VRF present. RDS data: 0101.
Set LF generator frequency to 59.4 kHz, level 250 mV.
Connect the combined signal from the LF generator and the signal from

the RDS generator to FRONT.
Turn up signal from LF generator until RDS data on the output J1-A6 are corrupted.
Turn down signal level from LF generator until RDS data are OK again.
The level from the LF generator shall be ≥ 250 mV.

8.3 Level Measuring Board

This section describes how to adjust and maintain the Level Measuring Board. Any detailed adjustments should be referred back to the factory. All the adjustments and measurements have to be made and in the order stated.

NOTE

Levels are stated as AC RMS values if nothing else is stated.

All jumpers should be removed at the beginning.

The signal from the LF generator is a sine wave signal if nothing else is stated.

The address of the Level Measuring Board is 90.

The following instruments are needed in order to complete the measurements:

* Level meter, accuracy < 0.1 dB,
* Oscilloscope,
* 2 synthesized LF generators,
* RE 530 RDS generator,
* Frequency counter,
* DC measuring DVM, < 0.1 % accuracy.

Connect the Sync input of the RE 530 generator to a synthesized LF generator which can change its frequency in 1 Hz steps. A change of frequency of 1 Hz on the Sync input corresponds to a 3 Hz change in the RDS and VRF carrier.

You can use the following table as a check list:

Trimmer	Purpose	Corresponding TP
R17	Adjustment of 19 kHz BP filter	TP15
R23	Adjustment of 19 kHz BP filter	TP16
R34	Balance in mixer in Pilot Loop	TP2
R61	Offset in mixer in Pilot Loop	TP2
L6	Frequency span of Pilot Loop	TP3
R46	Gain in Pilot Loop	TP3
R156	Adjustment of 57 kHz BP filter	TP19
R164	Adjustment of 57 kHz BP filter	TP10
R185	Balance in mixer in VRF Loop	TP14
R192	Offset in mixer in VRF Loop	TP14
L8	Frequency span of VRF Loop	TP12
R195	Gain in VRF Loop	TP12
R64	Balance in VRF detecting mixer	TP4
R87	Offset in VRF detecting mixer	TP6
R95	Gain in VRF detecting branch	TP6
R112	Balance in RDS detecting mixer	TP7
R240	Flatness in RDS detecting branch	TP6
R142	Gain in RDS detecting branch	TP6

Table 8.2 - Level Measuring Board, List of Trimmers

1. Adjustment of the 19 kHz Band-pass Filter:

Connect LF generator to MEASOUT1 of Level Meas. Board.

Keep the control signal PILOT_INP_SEL low **PORT,90,0000**
Frequency 19 kHz, Level 250 mV RMS.
Check signal level on TP1. Must equal level on MEASOUT1 within ±0.5 dB.

Adjust R17 for max. level at TP15.
Adjust R23 for max. level at TP16.

Check signal on TP21 (with 1:10 probe): Appr. 4.332 MHz TTL.

Adjust R34 for min. AC level on TP2.
Disconnect signal to MEASOUT1.
Adjust R61 for min. offset ±1 mV on TP2.

2. VRF Injection.

Set the control signal PILOT_INP_SEL high **PORT,90,0080**
Check signal level on TP16: Appr. 460 mV
measured selectively at 19 kHz.

Set the control signal PILOT_INP_SEL low **PORT,90,0000**
Check signal level on TP16: < 200 μV
measured selectively at 19 kHz.

3. Pilot Loop.

Set LF generator to 19 kHz, level 250 mV RMS.
Connect generator to MEASOUT1.
The control signal PILOT_INP_SEL is still low **PORT,90,0000**
Adjust L6 until widest frequency span of Pilot
Loop is achieved.
Monitor TP3 while adjusting L6.
Lock must be achieved with ±2 Hz offset.

Set LF generator level to 5.5 mV.
Turn R46 totally CCW.
Turn R46 slowly CW until lock is achieved as seen on TP3.

Set LF generator level to 20 mV.
Disconnect LF generator, and connect again.
Check that lock can be achieved within 0.5 s.

4. VRF Loop Switch Network.

Set LF generator to 19 kHz, 250 mV RMS.
Connect generator to MEASOUT1.
Set control signals MEASOUTSEL
and 57KHZ_VRF_BP low **PORT,90,0000**
Check level at TP9: Level reduced 7.to.7.5 dB compared to level on MEASOUT1.

Set LF generator to 57 kHz, 250 mV RMS.
Check level at TP9: Level appr. 1 dB reduced compared to level on MEASOUT1.

Disconnect generator from MEASOUT1 and connect the generator to MEASOUT2 instead.
Check that the signal on TP9 has disappeared.

Set control signal MEASOUTSEL high **PORT,90,0001**
Check that the signal on TP9 returns.

Set control signal 57KHZ_VRF_BP high **PORT,90,0003**
Check that signal on TP9 disappears.

Set LF generator to 57 kHz at TTL level.
Disconnect generator from MEASOUT2.
Connect generator to the input 57KHZ at J1-C13.
Check that signal on TP9 returns, but the level is reduced by appr. 21 dB.
Disconnect generator from 57KHZ at J1-C13.

5. Adjustment of 57 kHz Band-pass Filter.

Set control signal 57KHZ_VRF_BP low **PORT,90,0001**
Set LF generator to 57.80 kHz, level 250 mV.
Connect generator to MEASOUT1.
Adjust R156 to max. level on TP19.

Set LF generator to 56.20 kHz.
Adjust R164 to max. level on TP10.

Check gain from TP9 to TP10: 8...10 dB at 57 kHz.

6. VRF Loop Switch Network continued, Switchable Gain and DCCalibration.

Set control signal SEL_VRF_BP high and
set control signals 57KHZ_DIR_VRF
and 57KHZ_VRF_BP low **PORT,90,0005**
Set LF generator to 57 kHz, level 250 mV.

Connect generator to both MEASOUT1 and MEASOUT2.
Check that signal on TP11 is the same as on TP10.

Set control signal SEL_VRF_BP low **PORT,90,0001**
Check that signal level on TP11 drops.

Set control signal 57KHZ_DIR_VRF high **PORT,90,0009**
Check that signal on TP11 disappears.
Set LF generator to 57 kHz at TTL level.
Connect generator to the input 57KHZ at J1-C13.
Check signal at TP11: Square wave signal, appr. 430 mVpp.
Remove TTL signal from J1-C13.

Set LF generator to 57 kHz, level 250 mV.
Connect generator to MEASOUT2.
Set control signals 57KHZ_DIR_VRF and
VRF_AMP_ON low **PORT,90,0001**
Check level at TP13: AC level appr. 5 times less than the level on TP11.
Check DC level on TP11: Appr. 0 V.
Check DC level on TP13: Appr. -4.7 V.

Set control signal VRF_AMP_ON high **PORT,90,0101**
Check that level on TP13 is increased by appr. 12 dB.

Disconnect generator from MEASOUT2.
Set control signals 57KHZ_DIR_VRF and 57KHZ_VRF_BP low.
Set control signals SEL_VRF_BP and
VRF_AMP_ON high **PORT,90,0105**
Check level on TP13: < 0.3 mV.

7. VRF Loop adjustments.

Check signal on TP20: TTL signal, appr. 4.332 MHz.

Adjust R185 to min. AC on TP14.

Set all of the following control signals low:
VRF_AMP_ON, 57KHZ_DIR_VRF, SEL_VRF_BP and
57KHZ_VRF_BP **PORT,90,0001**
Adjust R192 to min. offset on TP14, < 2 mV.

Set RDS generator RE 530: VRF SK level 5.3 % (only VRF).
Set LF generator to 19 kHz.
Connect LF generator to Sync input on RE 530.
Connect RE 530 to MEASOUT2.
Monitor TP12.
Adjust L8 until the widest frequency span in the VRF Loop is achieved.
Lock must be achieved with ±6 Hz offset from 57 kHz.
Disconnect RE 530 from MEASOUT2.

Set LF generator to 57 kHz, level 2.5 mV.
Set control signals SEL_VRF_BP and VRF_AMP_ON high.
Set control signal MEASOUTSEL low **PORT,90,0104**

Connect generator to MEASOUT1.
R195 is turned completely CCW.
Turn R195 slowly CW until lock is achieved as seen on TP12.

Disconnect LF generator, and connect again.
Check that lock can be achieved.

8. The VRF Detecting Branch.

Disconnect generator from MEASOUT1.
Adjust R64 to min. AC on TP4.
Set control signal SLAVESEL low **PORT,90,0104**
Adjust R87 to min. offset on TP6 (< 2 mV).

Set LF generator to 57 kHz, level 150 mV.
Connect generator to MEASOUT2.
Check level on TP17 and TP18: Appr. 3.5 times less than level on MEASOUT2.
Check DC level on TP4: Appr. 1.5 times the RMS level on MEASOUT2.

Set control signal VRF_SLAVE_CAL high **PORT,90,0124**
Check that the signal on TP4 goes to zero.

Set LF generator to 57 kHz, level 170 mV ±1 mV.
Set all of the following control signals low:
VRF_AMP_ON, 57KHZ_DIR_VRF, SEL_VRF_BP and
SLAVESEL **PORT,90,0020**
Adjust R95 to 1V (±2 mV) on TP6.

9. The RDS Detecting Branch.

Set LF generator to 57 kHz, level 150 mV.
Keep SEL_VRF_BP, 57KHZ_DIR_VRF and VRF_AMP_ON low.
Connect generator to MEASOUT2.
Connect J1-C13 to TP22.
Adjust R112 to min. AC on TP7.

Set RDS generator RE 530: 5.3 % VRF and 2.0 % RDS.
90° phase between RDS and VRF. No phase offset.
Connect J1-C13 to TP22.
Set control signal SLAVESEL high **PORT,90,0060**

Connect RE 530 to MEASOUT2.
Adjust R240 so the RDS data codes 0000 and 1111 gives the same RMS level on TP6.

Set RDS generator RE 530: 5.3 % VRF and 2.0 % RDS.
Keep the control signal SEL_VRF_BP low **PORT,90,0060**
Adjust R142 to 300 mV RMS on TP6.

NOTE

The level adjustments in the VRF and RDS Detecting Branch may be repeated after installing the Measurement Option in the RE 331:

Adjust R95 so 170 mV RMS at 57 kHz gives -13.19 dBu.
Adjust R142 so 1.6 % RDS gives -24.5 dBu.

Use extender board.

8.4 Phase Measuring Board

This section describes how to adjust and maintain the Phase Measuring Board. Any detailed adjustments should be referred back to the factory. All the adjustments and measurements have to be made and strictly in the order stated.

NOTE

Levels are stated as AC RMS values if nothing else is stated. All jumpers should be removed at the beginning. The signal from the LF generator is a sine wave signal if nothing else is stated.

The address of the Phase Measuring Board is B0.

The following instruments are needed in order to complete the measurements:

* Voltmeter, < 0.1 % accuracy.
* Oscilloscope.
* Synthesized LF generator.
* Frequency counter.

You can use Table 8.3 as a check list:

Trimmer TP	Purpose	Corresponding
R89	Adjustment of 19 kHz BP filter	TP5
R105	Adjustment of 19 kHz BP filter	TP5
R109	Pilot Detector centre frequency	TP7
R111	Pilot Detector sensitivity	TP6
L1	8.55 MHz VCO output filter	TP8
L3	Reference Loop VCO span	TP8
R23	Lock Detector switch level	TP2
R17	Gain in Reference Loop	TP10

Table 8.3 - Phase Measuring Board, List of Trimmers

Set all control signals low:
REFSEL, APILOT, AVRF, ARDS, BPILOT,
BVRF and BRDS **`PORT,B0,0`**

1. Adjustment of the 19 kHz Band-pass Filter:

Set LF generator to 19 kHz, level 250 mV RMS.
Connect LF generator to MEASOUT1 of Phase Meas. Board.
Check signal level on TP4. Must equal level
on MEASOUT1 within ±0.5 dB.
Adjust R89 for max. level at TP5.
Adjust R105 for max. level at TP5.

2. Pilot Detector.

Set LF generator to 19 kHz, level 250 mV.
Connect generator to MEASOUT1.
If CR20 doesn't light up, adjust R109 until it does.
Adjust R109 until DC voltage on TP7 is 0 V ±0.5 V.
Use a handheld DVM.
Set LF generator level to 20 mV.
Turn R111 completely CW.
Turn R111 slowly CCW until CR20 lights up.

3. The Oscillator in the Reference Loop.

Insert JP2.
Check DC voltage on TP10: 0 V ±200 mV.

Adjust L1 to max. level on TP8 (appr. 5.7 Vpp).
Use a 1:10 probe.
Adjust L3 until frequency is 8.5506 MHz ±100 Hz
on TP8. Use a 1:10 probe.

Check signal on TP1: 57 kHz TTL signal (8.55 MHz / 150).
Check signal on TP3: 59.38 kHz TTL (8.55 MHz / 144).

4. The Oscillator in the Reference Loop, the Lock Detector and the Mixing Process.

Set LF generator to 57 kHz at TTL level.
Connect generator to VRFCLK.
Keep JP2 inserted.
Check: CR3 is turned off or is flashing. TP2 is low.

Remove JP2.
Check: CR3 lights up and TP2 goes high.

Check that lock can be achieved at 57 kHz ±12 Hz.
If necessary readjust L3.

Set LF generator to 58.2 kHz TTL.
Adjust R23 until CR3 turns off.
Adjust R17 to centre position.

Set LF generator to 57 kHz TTL.
Connect generator to VRFCLK.
Set control signals AVRF and BVRF high **PORT,BO,0048**
Check signal on TP11 and TP12:
2375 Hz mitre-like signal, appr. 1.3 Vpp.

8.5 MPX Scanner

This section describes how to adjust and maintain the MPX scanner. Note the following:

Signal names are stated in capital letters, that is "AUXOUT".
Levels are stated as RMS values if nothing else is stated.
Power supply is ±15 V and +5 V.

The following instruments are needed in order to complete the measurements:

* mV-meter,
* LF generator,
* RDS Decoder RE 331 with extender board

The following table may be used as a check list:

Trimmer	Purpose	Corresponding TP
R93	Gain	TP10
R113	Common mode rejection, channel 1	TP1
R32	Common mode rejection, channel 2	TP5
R49	Common mode rejection, channel 3	TP7
R64	Common mode rejection, channel 4	TP9
R293	Common mode rejection, channel 5	TP210
R207	Common mode rejection, channel 6	TP211
R232	Common mode rejection, channel 7	TP212
R247	Common mode rejection, channel 8	TP213

Table 8.4 - MPX Scanner, List of Trimmers

Solderlinks: 4 channel scanner SP3 is connected
8 channel scanner SP1, SP2 and SP3 disconnected

The scanner is connected to the RDS Decoder using the extender board (code no 901-864).

CMRR Adjustment

Select channel 1 from the RE 331 keyboard.

Apply a 57 kHz sinewave signal between AUXIN1+ and AUXIN1- at a level of 1 Vrms.

Adjust R113 to minimum signal on TP1.

The adjustment is repeated for channel 2 to 8 as shown in Table 8.4.

Control of Switching Function

This is covered by the checks in section 8.4.4.

Gain and Crosstalk Control

This section describes how to adjust the MPX scanner for correct gain between inputs and output. At the same time the crosstalk is controlled.

Select channel 1 from the RE 331 keyboard.

Apply a 57 kHz sine wave signal between AUXIN1+ and AUXIN1- at a level of 1 Vrms.

Adjust the level on AUXOUT so gain is set to 0 dB $\pm$0.1 dB.

Deselect channel 1 and select channel 2 to 8 and control the crosstalk (level $\leq$ -70 dB on AUXOUT relative to the level on channel 1 input).

Repeat the procedure for channel 2, that is activate channel 2, apply 57 kHz to input 2 and measure level (0 dB $\pm$0.2 dB relative to input level) on AUXOUT and crosstalk on the other channels.

Repeat the procedure for channel 3 to 4 (8).

8.6 RF Scanner

This section describes how to adjust and maintain the RF scanner. Any detailed adjustments should be referred back to the factory.

NOTE

Levels are stated as RMS values if nothing else is stated. All jumpers should be removed at the beginning. RF levels are stated as EMF ex. from a RE 104 signal generator. The RF scanner must be mounted in a RE 331 RDS decoder using an extender board.

The following instruments are needed in order to complete the measurements:

* Voltmeter, < 0.1% accuracy
* Frequency counter, $\geq$120 MHz, better than 5 ppm accuracy
* AC mV-meter,
* Oscilloscope, $\geq$120 MHz bandwidth

* RF generator,
* LF generator,
* Stereo coder,
* RDS generator,
* RDS decoder

The list of trimmers on the next page (resistors/coils/capacitors) can assist in ensuring that all relevant adjustments are made:

NOTE

The column "Location" refers to the grid on the component location drawing in question. Please see the detailed description of the circuit board in question.

Trimmer	Location	Purpose	Corresponding TP
R249	S9	IF Compensation	TP20
R160	Y8	Stereo decoder VCO frequency	TP11
R177	Y8	Stereo separation	TP18/TP19
R130	E9	Contribution from broad band rectifier to AGC	TP24
R143	N9	Voltage adjustment for demodulator	TP12
R153	M6	Attack level for AGC	TP10
R145	M9	Level for Mono/Stereo shift	TP9
L11	P6	2nd harmonic distortion in the demodulator	TP27
L12	P9	2nd harmonic distortion in the demodulator	TP27
R226	R9	DC level at center frequency	TP26
R217	U7	Phase adjustment	TP27
R227	W6	Level of MPX signal	TP27
L13	T6	285 kHz trap	TP27
L16	U8	171 kHz trap	TP27
L7	H7	10.7 MHz emitter decoupling in IF	TP25
L10	M7	10.7 MHz post filtering in IF	TP10
R245	M10	Minimum oscillator frequency	TP22
C37	R11	Reference oscillator	TP22

Table 8.5 - RF Scanner, List of Trimmers

Start by connecting U1-U2 and U4-U5 so shunting the input attenuator.

1. Voltage adjustment to the Demodulator:

The voltage on TP12 is adjusted to 13.5 V ±10 mV using R143.

2. Check of Varactor Voltage Generator:

Check the oscillator signal on TP1, within 75 to 85 kHz, app. 19 Vpp sinewave.
Check voltage on TP3, app. +31.5 V.
Check voltage on TP21, +25 V ±1.5 V.

3. Check of Synthesizer:

a. Minimum oscillator frequency:
The receiver frequency is set to 80 MHz. Note that this is only allowed in ebug mode.
Check TP2 ≤ 0.5 VDC
Adjust R245 to 95 MHz ±1 MHz on TP22

b. Lower frequency limit:
The receiver frequency is set to 87.5 MHz.
Check that the LED CR20 is lit and the oscillator frequency is 98.2 MHz ± 2.5 kHz seen on TP22 with level ≥ 20 mV.
The varactor voltage on TP2 should be ≥ 1 V.

c. Higher frequency limit:
The receiver frequency is set to 108 MHz.
Check that the LED CR20 is lit and the oscillator frequency is 118.7 MHz ± 2.5 kHz seen on TP22 with level ≥ 20 mV.
The varactor voltage on TP2 should be ≤ 18 V.
If necessary adjust the synthesizer's reference frequency by means of C37.

4. Control of IF Amplifier:

The receiver frequency is set to 100 MHz.
RF level is set to + 50 dBμV at 100 MHz, no modulation.
Mount jumper K1 and K2.
Check the signal at TP25.
The frequency of the signal is 10.7 MHz ± 2.5 kHz.
Adjust L7 for max. level if necessary.
Adjust L10 for max. level on TP10 if necessary (Voltage on TP10 is negative; adjust to min. negative level) by setting RF level to 30 dBμV

and removing K2.
Remove jumpers again.
If L7 and L10 have been adjusted they should be sealed again.

5. Control of AGC:

The receiver frequency is still 100.0 MHz.
Connect RF generator to the antenna input. Level is +20 dBμV, no modulation.
Jumper K2 remains removed and K1 is mounted.
Check that the level on TP10 is - 8.00 V ±200 mV at +20 dBμV. If necessary adjust AGC threshold R153 until TP10 reaches -8.00 V.
Check: TP8 app. +8.0 V
TP23 ≥ +4.5 V
Check the logic signals TUNAGC and PINATT. They must both be low, that is the level indication on the front displays 1.
Remove jumper K1.

6. Adjustment of Wideband Amplifier:

No modulation.
Check the DC voltage on TP10 and TP6 using the following table:

RF level	TP10	TP6
60 dBμV	-2.5 V ±1 V	+1.2 V ±1 V
40 dBμV	-4.8 V ±0.5 V	+7.4 V ±1.0 V
20 dBμV	-8.0 V ±0.2 V	> 12.0 V

Table 8.6 - DC voltage on TP10 and TP6

If necessary R 130 is adjusted according to the following instructions:

Increase the RF level to + 70 dBμV.
Turn "WIDEBAND ATTACK LEVEL ADJ", R130, completely clockwise. Note down the voltage on TP24.
Increase RF level 20 dB and adjust R130 to the same voltage on TP24 as before.
Now check the DC voltage on TP10 and TP6 again as shown above.

7. Check of Mono/Stereo Switching:

Set the RF level to + 10 dBμV. Increase the RF level and note down when the following three level indicators switches from LOW to HIGH:

a) MS 2 18 dBμV ±2 dB (Shift from 0 to 1 on RE 331 display)
b) TUNAG 40 dBμV ±3 dB (Shift from 1 to 2 in RE 331 display)
c) PINATT 58 dBμV ±3 dB (Shift from 2 to 3 in RE 331 display)

If necessary the M/S switch level can be adjusted:
Set the RF level to + 18 dBμV.
Measure on TP9 during the adjustment. No modulation.
Start by turning R145 completely counter clockwise.
Slowly turn R145 clockwise until TP9 goes negative.

8. Adjustment of Distortion:

Set the RF level to + 60 dBμV, ± 75 kHz deviation, 1 kHz.
(Use an RE 104 RF generator, as the distortion is adaquately low).
The receiver must be tuned correctly.
Measure the distortion by means of an RE 201 Audio Analyzer.

	Second harmonics	**Third harmonics**
Requirements:	≤ -62 dB (0.08%)	≤ -60 dB (0.1%)
Typical:	-70 dB (0.02%)	-66 dB (0.05%)

If necessary readjust L11 and L12:

Mount jumper K3.
Monitor the signal on TP26.
Adjust L11 for minimum second harmonic distortion (app. < 0.3%)

Jumper K3 is removed, and the distortion changes.
Adjust L12 for minimum second harmonic distortion (app. 0.3%)

Now adjust L11 for minimum second harmonic distortion (app. 0.05%).

If L11 and L12 have been adjusted they should be sealed again.

9. Check of Detuning Indication:

Set the RF level to + 50 dBμV, no modulation.
The receiver must be tuned correctly.

Find the offset frequencies where the signals OVER and UNDER changes (indicated in the RE 331 display as "<" and ">"). It should be 25 kHz ±10 kHz on both sides.

If necessary readjust R226:
Adjust offset level on TP26 to 0 V ± 10 mV by means of R226. Then check that TP16 is low (app. -13 V) and TP14 is high (app. + 13 V).
Once again check the offset frequencies where the detuning indicators change (25 kHz ±10 kHz on either side).

NOTE

If R226 has been readjusted the level adjustment using the R227 is no longer valid. Please readjust (see sub-section 11).

10. LF linearity:

Set the RF level to + 60 dBμV, ± 75 kHz deviation and the receiver frequency to 100 MHz.
Tune the receiver correctly and monitor the MPXOUT signal.
Check the LF linearity of the MPXOUT signal:

1 kHz ... 57 kHz	≤ ±0.1 dB	In the entire band
1 kHz ... 75 kHz	≤ ±0.3 dB	In the entire band
171 kHz attenuation	≥ 45 dB	
- 3 dB LF cutoff	≤ 1.5 Hz	
- 3 dB HF cutoff	≥ 110 kHz	

NOTE

If the LF generator and the mV-meter has lower specs than 0.1 dB accuracy you must start this measurement by calibrating the equipment.

If necessary adjust R249 so the level at 57 kHz modulation results in the same level as at 1 kHz modulation.

If necessary adjust the notches in the MPX filter again:

Set the RF level to + 60 dBμV, no modulation. 100 MHz receiver frequency.
Connect a LF generator to K7, app. 1 Vrms.
Monitor TP27.
Adjust L16 for minimum level at 171 kHz.
Adjust L13 for minimum level at 285 kHz.
If L13 and L16 have been readjusted please seal them again.

11. Adjustment of MPX Level:

Still 60 dBμV RF level and 100 MHz receiver frequency.
Apply 1.6% RDS modulation to the RF generator.
The measured RMS level on MPXOUT must be adjusted to 32.63 mV by means of LEVEL (R227) giving an indication in an RE 331 of - 24.5 dBu.

NOTE

When applying an LF signal to the RF generator the FM sensitivity of the generator should be taken into account: If the sensitivity is different from 54.38 mV/kHz level corrections are necessary.

±75 kHz deviation at 1 kHz modulation shall give +11.4 dBu measured at MPXOUT (2.88 Vrms).

12. Adjustment of Phase Response:

Connect a stereo coder to a RDS generator. The two units must be synchronized.
Connect the stereo coder to the RF generator and set RF level to +70 dBμV (please see Fig. 8.2 for the actual set-up).
Pilot level is set to standard (- 9.5 dBu) (measured at the scanner output).
The RDS generator is set to "CW" and the phase between pilot and CW is adjusted as shown in Fig. 8.1:

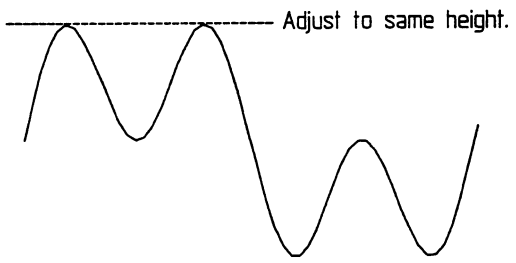

Fig. 8.1 - Oscilloscope Picture for Phase Adjustment

The phase of the RDS generator is adjusted so that the two "peaks" on the signal are of equal level (The signal is the sum of 19 kHz and 57 kHz).

On the RE 331 decoder you must switch between "Scanner" and "Front" while adjusting the modulation level to the RF generator until the level read in the display is the same within 1 dB (see Fig. 8.2 for the actual connections between the instruments).
It might be necessary to change the RDS level from the RDS generator when you change between the two sources, depending on the modulation sensitivity of the RF generator.

(The RF generator is not necessarily calibrated so that +11.4 dBu on the modulation input gives ±75 kHz deviation).

While maintaining the same RDS level, read on the RE 331 display, switch between "Scanner" and "Front" and measure the RDS-phase.

The phase difference between the two signals must be less than 0.5°.

If necessary the phase is adjusted using R217.

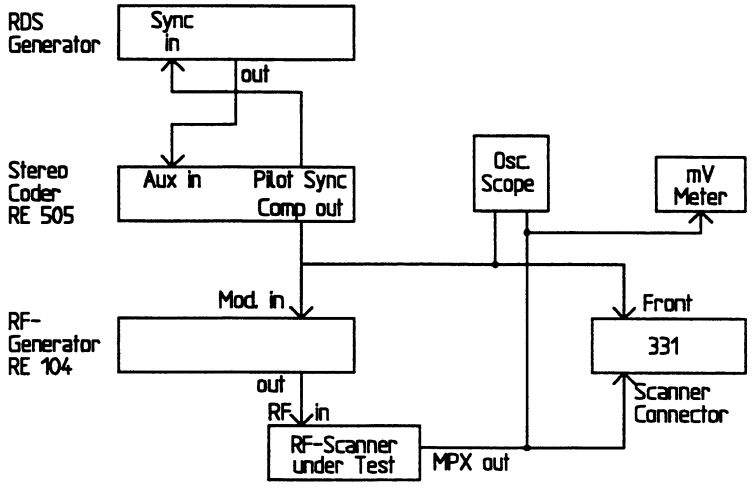

Fig. 8.2 - Test Setup for Phase Measurement

(The oscilloscope and the mV-meter are connected to the scanner output as a matter of convenience).

13. Adjustment of Stereo Decoder:

Start by adjusting the oscillator in the stereo decoder. Mount jumper K6 whereby you can measure the oscillator frequency at TP11.
Use a 1:10 probe and connect the frequency counter to CH1 output on the oscilloscope.

No modulation, +60 dBμV RF level.
The frequency measured should be 76 kHz ±50 Hz. If necessary readjust using R160.

Remove jumper K6 again.

Apply modulation using a stereo coder: 1 kHz in one channel the other without modulation. Pilot is on.

Adjust modulation level for 1 kHz sinewave (without pilot and in mono) to ±75 kHz (4.07 Vpp).
Then add 10% pilot level.

Check channel crosstalk with stereo generator in stereo and 1 kHz in one channel.

Adjust R177 if necessary for minimum crosstalk between TP18 and TP19. CR21 must be lit.

Maintain +60 dBμV.

Check the headphone outputs: At ±75 kHz deviation, 1 kHz modulation and no preemphasis and no pilot you should get app. 3 Vrms on K4 with volume control turned up completely.

Check that the residual pilot signal at 9 % pilot and full volume is less than 5 mV.

Check the pilot indicator:
Connect a tone generator to the RF generator's modulation input. Note down the level from the tone generator that yields 100% level (+11.4 dBu) on MPXOUT. Turn the LF generator down and set the frequency to 19 kHz ±1 Hz. Calculate the pilot level from the level of the signal applied to the RF generator.

Turn down level of the 19 kHz signal completely. CR21 should be turned off. Increase level till CR21 and pilot indication in display turns on. The level should be less than 5% pilot.

Reduce the level till CR21 and pilot indication on display turns off. Level should be more than 0.5% pilot.

Set pilot level to 10%.

Check that CR21 turns off when RF level is reduced to app. +18dBμV (Ref. Mono/Stereo shift).

Before you check the receiver's sensitivity make sure that all jumpers are removed.

14. Check of the Receiver's Sensitivity Curve:

NOTE

Take care that no interfering signal is present either from computers or other noisy equipment. Take care of ground loops in the test set-up. Perform the measurement where no signal is received from the surroundings (level on TP10 as negative as possible).

The level on the headphone output is measured using an RMS voltmeter (20 kHz bandwidth) as a function of the RF level both with and without modulation: Watch the signal using an oscilloscope at the same time so you can detect hum and interference.

a) ±75 kHz deviation, 1 kHz modulation, no preemphasis.
Mono, no pilot tone. Full volume.

Measure at the following RF levels (dBμV):
70, 60 , 50, 40, 30, 20, 10, 5, 0, -5.

b) Repeat the same measurements without modulation.

You can now calculate the difference between S+N (with modulation) and N (without modulation) in dB.
The values must as a minimum fulfil the following:

dBμV:	+70	+60	+50	+40	+30	+20	+15	+10	+5	+0	-5
(S+N)/N (dB):	≥70	≥70	≥70	≥69	≥63	≥54	≥49	≥44	≥36	≥16	≥3

15. Check of Image Rejection Ratio:

Receiver frequency: 100 MHz.
RF level is 0 dBμV, ±75 kHz deviation, 1 kHz modulation.

Note down the LF level on MPXOUT using a 1 kHz narrowband voltmeter.

Change RF frequency to 121.4 MHz. Increase RF level until you reach the same LF level as before.

The increase in dB is a measure of the image rejection ratio.

Requirement: ≥53 dB.

16. Check of Noise Floor:

RF level +60 dBμV, no modulation, 100 MHz RF frequency.

Noise on MPXOUT output is measured using a wideband RMS-meter.

Requirement: ≤4.5 mV, typically 3 mV.

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