MSQ-900 Operating Manual

Wavetek™ Series Field Meter

JDSU

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Section 1: General Information

1.1 Introduction

This operating manual is intended for introducing the design, functions, and basic instructions related to the operation and servicing of the MSQ-900.

MSQ-900 is designed for testing and adjustment of television and broadcasting distribution networks as well as of separate components of such networks, or other electronic devices. The MSQ-900 allows measurement of channel level, parameters of TV signal with analog and digital modulation of ITU-T J.83 Annex A/B/C standards (Annex A/B/C).

The MSQ-900 can be used both in a lab setting, powered by an external power source, and in the field, powered by batteries or a vehicle's cigarette lighter.

Performing regular maintenance procedures ensures the reliability of the MSQ-900. Refer to Section 5: MSQ-900 Configuration for the maintenance procedures and their scheduled intervals.

The following abbreviations are used in this manual:

PC - Personal Computer

ADC - Analog-to-Digital Converter

LCD - Liquid Crystal Display

IF - Intermediate Frequency

DVB-C - Digital Video Broadcasting - Cable

BER - Bit Error Ratio

MER - Modulation Error Ratio

QAM - Quadrature Amplitude Modulation

ITU-T J.83 - International standard of digital broadcasting

1.2 Safety Precautions

Before operating the MSQ-900, thoroughly inspect the product and carefully read the related documentation to get acquainted with all safety markings and instructions.

WARNING

Only trained service personnel aware of the hazards involved should perform repair on the MSQ-900.

CAUTION

Tuning the MSQ-900 and replacement of the components that influence the accuracy of measurements without service personnel is strictly prohibited, since the components used in the MSQ-900 are purpose-made and their replacement results in inaccurate operation of the MSQ-900. To prevent the possibility of mechanical damage to the MSQ-900, follow the instructions regarding the storage and transportation (see Section 8: Storage and Section 9: Transportation).

Section 2: General Description and Principles of Operation

2.1 Function

The MSQ-900 measures the video carrier level, V/A ratio and C/N ratio of analog channels and the channel power for digital channels. For ITU-T J.83 Annex A/B/C signals, the MSQ-900 performs measurements of the following reception quality parameters:

- **a** Modulation Error Ratio (MER)
- **b** Bit Error Ratio (BER) before and after Reed-Solomon decoder
- **c** constellation diagram (on PC screen).

MSQ-900 features automatic defining of the channel frequency, symbol rate, and modulation type settings. The MSQ-900 can be connected to a personal computer to access additional modes. The MSQ-900 allows the measurement of direct and alternating voltage of the remote power supply of the TV and broadcasting distribution networks.

Refer to Figure 1.1 and Figure 1.2 for pictures of the MSQ-900.

Figure 1.1

Figure 1.2

2.2 Environmental Conditions

Rated operating conditions:

- **a** ambient temperature from -10-50ºC (14-122ºF)
- **b** relative air humidity not greater than 90% at 25ºC (77ºF) temperature
- **c** atmospheric pressure 84-106 kPa (630-795 mm Hg)

2.3 Package Contents

The MSQ-900 package includes:

- **a** MSQ-900 MicroStealth QAM . . . . . 1 pc
- **b** Rubber Boot . . . . . 1 pc
- **c** NiMH, AA Batteries . . . . . 4 pcs
- **d** "F"-"F" Adapter . . . . . 1 pc
- **e** 12V/1.25A Charger . . . . . 1 pc
- **f** Reference Card . . . . . 1 pc
- **g** Quick Start Guide . . . . . 1 pc
- **h** Calibration Certificate . . . . . 1 pc

Section 3: Preparation for Operation

Visually inspect the exterior of your MSQ-900 to make sure it is free from any visible physical or mechanical damage.

Upon receipt of the package, check the availability of the items contained in it against the list provided (see Section 2.3 Package Contents).

If the MSQ-900 has been stored in an environment which exceeds the rated operating conditions, place the unit inside a temperature controlled facility corresponding to normal operating conditions of the analyzer for at least 2 hours prior to operation.

Section 4: Operation Procedure

4.1 Controls and Indicators

Figure 1.1 shows the location of controls, indicators and connectors. These elements have the following functions:

a «**F1**», «**F2**», «**F3**» function keys enable the commands corresponding to icons shown on the screen of MSQ-900

b «EXIT» key allows for returning to the previous menu level

c «**AUX**» key enables auxiliary functions

d «▲», «▼», «◀» and «▶» arrows allow to edit the current operation mode

e «ENTER» key enables the current command

f «⏻» key switches the power of MSQ-900 on/off

g «SHIFT» key enables auxiliary functions

h «**12V DC 600mA**» connector is for connection to an external power source

i «**USB**» connector is for connection to a computer

j «**INPUT**» connector is for signal input, "F"-male connector

4.2 Preparation for Measurements

Before operating your MSQ-900, carefully read this Operating Manual and familiarize yourself with the location of the controls and indicators of the MSQ-900 (Section 4.1 Controls and Indicators).

To operate the MSQ-900 using an external power source, connect the charger to the port located on the bottom of the MSQ-900 and then to the power source.

To operate your MSQ-900 in stand-alone mode, powered by the batteries, push and hold the « ⏻ » key until the LCD backlight turns on.

The following message appears on the screen (Figure 4.2.1):

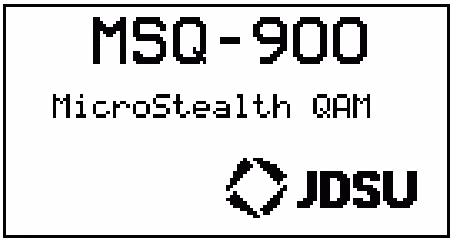

Figure 4.2.1

The screen displays the name and model of the MSQ-900. After approximately 1 second, the MSQ-900 opens the main mode selection menu (Figure 4.3.1), further referred to as Main menu.

When you turn on the MSQ-900 for the first time, the following Regional settings window appears on the screen (Figure 4.2.2).

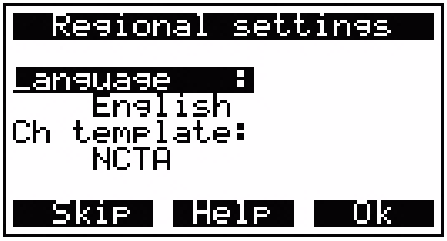

Figure 4.2.2

This mode allows you to select the channel template and language of the region where the MSQ-900 will be operated. You can select the following parameters by pressing the «▲», «▼», «◀» and «▶» arrows:

a channel template: China, PAL B/G, PAL Ireland, PAL UK, Secam D/K, Secam-L, NCTA;

b language: English, French, German, Spanish, Portugese and Chinese.

Press the «**F3**» **(Ok)** key to confirm your choice. The MSQ-900 activates normal operation mode with the selected channel template and language. The Regional setting menu only appears after first switching. If you need to change the regional settings or language, use SETUP mode (see Section 5.3 Setup).

To activate the help screen, press the «**F2**» **(Help)** key. Press the «EXIT» key to exit this menu.

Press the «**F1**» **(Skip)** key to exit the Regional settings window. The MSQ-900 enters the normal operation mode. It should be noted that in such cases, the Regional settings window appears again after subsequent switching of the MSQ-900.

4.3 Measurement Procedure

4.3.1 General Information

The MSQ-900 features an on-screen menu to select modes of operation. The icons of the menu correspond to various functions. The Main menu (Figure 4.3.1) appears on the screen after the MSQ-900 is powered up.

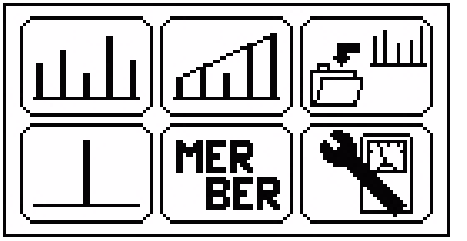

Figure 4.3.1

The Main menu shown in Figure 4.3.1 contains six icons corresponding to the following functions:

1 SCAN measurement. . . . .

2 TILT measurement . . . . .

3 AUTOTEST . . . . .

4 LEVEL measurement . . . . .

5 MER/BER measurement . . . . .

6 Configuration . . . . .

To select the desired function in the Main menu press the «▲» and «▼» arrows to move the corresponding icon to the bottom line of the screen. Then press the function key («**F1**», «**F2**», «**F3**») under the required icon. To return to the Main menu, press the «EXIT» key.

To open the Configuration menu, activate Configuration function. The Configuration menu appears on the screen (Figure 4.3.2).

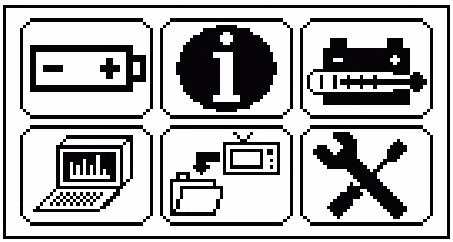

Figure 4.3.2

The Configuration menu shown in Figure 4.3.2 contains six icons corresponding to the following functions:

1 Battery Level Status . . . . .

2 About Device . . . . .

3 Setup . . . . .

4 PC Connection . . . . .

5 Channel Plan Settings . . . . .

6 Self-Test . . . . .

To return to the Main menu, press the « » key.

The MSQ-900 offers four modes to measure TV signal parameters:

- **a** TV channel level and signal power in frequency point, as well as alternating and direct voltage at the input of the MSQ-900 in **LEVEL** mode
- **b** TV channels level in **SCAN** mode
- **c** TV channels level tilt in **TILT** mode
- **d** QAM signal reception quality parameters in **MER/BER** mode
- **e** upstream spectrum in **UPSTREAM SCAN** mode

To activate the required mode (except UPSTREAM SCAN) in the Main menu (Figure 4.3.1), press the «▲» and «▼» arrows and the «**F1**» or «**F2**» function key to move the corresponding icon to the bottom line of the screen.

UPSTREAM SCAN mode is activated by pressing the «**F3**» function key in the **SCAN** mode.

To return to the Main menu, press the «EXIT» key.

4.3.2 LEVEL Measurement Mode

The icon in the Main menu refers to LEVEL measurement mode. In this mode the user can measure TV channel parameters and signal level in a frequency point.

The screen view in channel parameter measurement mode is shown in Figure 4.3.3 for the analog channel and in Figure 4.3.4 for the digital channel.

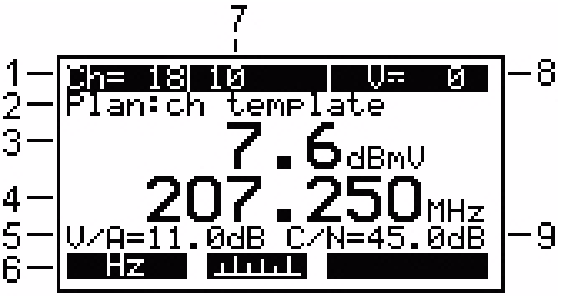

Figure 4.3.3

The following data is shown on the screen:

1 — channel number
2 — selected channel plan name
3 — channel level measured in dBmV, dBuV or dBm
4 — selected frequency in MHz
5 — V/A ratio in dB
6 — command line with commands activated by the «**F1**», «**F2**» or «**F3**» keys
7 — channel name
8 — direct voltage or effective alternating voltage at the input of the MSQ-900, at 50/60 Hz frequency, in V
9 — C/N ratio in dB

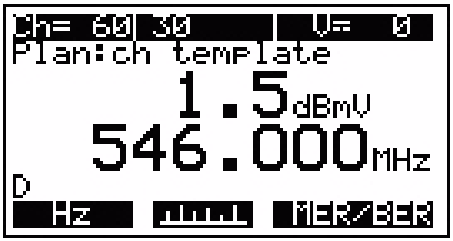

Figure 4.3.4

When digital channel level is measured you will see **D** message instead of V/A or C/N on the screen.

When you open LEVEL mode, the channel plan name is indicated by **Plan:** on the second line from the top while operating in LEVEL mode. If the channel plan has not been selected, in this position you will see **ch template**. When the LEVEL function is activated, the MSQ-900 measures the parameters of the TV channel which was last selected in one of the measurement modes. This mode is indicated by **Ch** shortcut in command line. The channel property DIGITAL/ANALOG corresponds to the selected channel plan. If the channel plan has not been selected, the modulation type is determined automatically.

Three parameters are measured for analog channels. Video carrier level is measured in the frequency point defined in accordance with the channel allocation standard for operation without channel plan. If a channel plan has been selected, the frequency point is taken from this channel plan. To determine V/A ratio, the MSQ-900 measures the audio carrier, which is defined in accordance with the channel allocation standard. The V/A value is displayed on the screen in position 5 (Figure 4.3.3).

To measure C/N ratio the MSQ-900 performs the measurement in the frequency point with the lowest content of the useful components of RF signal within the channel bandwidth. If a channel plan has been selected the measurement frequency is defined by the channel plan. If a channel plan has not been selected, it will be defined in accordance with the channel allocation standard. C/N ratio appears in position 9 (Figure 4.3.3). The C/N ratio is not measured when working with PAL B/G channel template without a selected channel plan. In this case position 9 is left empty. When working with selected channel plan C/N ratio can be switched on/off separately for each channel (Section 5.1.2 Channel Plan Editor).

For digital channels the MSQ-900 measures signal power within the channel bandwidth.

To perform this measurement the MSQ-900 uses the integration method. The MSQ-900 calculates the total signal power value by measuring the power within all of the channel bandwidths in 125 kHz increments. It then recalculates the total value into actual power.

To increase the accuracy of the measurement operating with a channel plan, set the digital channel parameters (Section 5.1.2 Channel Plan Editor) to their optimal values.

The range of voltage measurement at the MSQ-900 input is from 10 to 100 V. The absolute error of the measurement is less than ±1.5 V. The measured value of the voltage is indicated in position 8 (Figure 4.3.3). If the voltage is direct, **V=** appears on the screen, if it is alternating then **V~** appears.

To measure channel parameters, use the «◀» and «▶» arrows to select the required channel.

If no channel plan is selected, using the «◀» and «▶» arrows allows you to switch to any channel in accordance with the appropriate TV standard (Section 5.3 Setup). Once a signal is detected, the MSQ-900 automatically determines the channel type and the noise measurement frequency and digital channel bandwidth parameters. Perform measurements in accordance with these parameters.

If one of the channel plans has been selected (Section 4.2 Preparation for Measurements), the tuning is performed between the channels of the plan. In this case the channel name from the channel plan is shown in position 7.

You can access other measurement modes using function keys. The «**F1**» key activates the mode of signal level measurement in a frequency tune. The «**F2**» key opens SCAN mode (Section 4.3.3 SCAN Measurement Mode). The «**F3**» key opens MER/BER measurement mode (Figure 4.3.5) if the selected channel is digital.

Figure 4.3.5 shows the view of the screen in the mode of signal level measurement in a frequency tune.

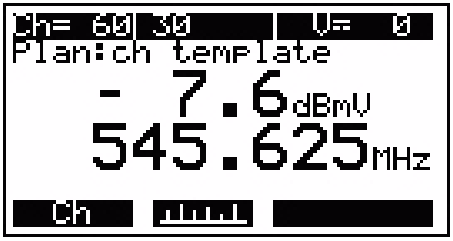

Figure 4.3.5

In this mode V/A ratio, C/N ratio as well as the **D** message are not displayed.

In frequency tune mode, the signal level measurement is taken at the selected frequency. This mode is indicated by Freq message in the command line. Tuning to the frequency is performed in 125 kHz increments using the «◀» and «▶» arrows.

Using the «**F1**» and «**F2**» function keys you can select channel parameter measurement mode or switch to SCAN mode (Section 4.3.3 SCAN Measurement Mode).

4.3.3 SCAN Measurement Mode

The icon in the Main menu refers to the SCAN measurement mode. This mode displays the signal levels in a bargraph. See Figure 4.3.6.

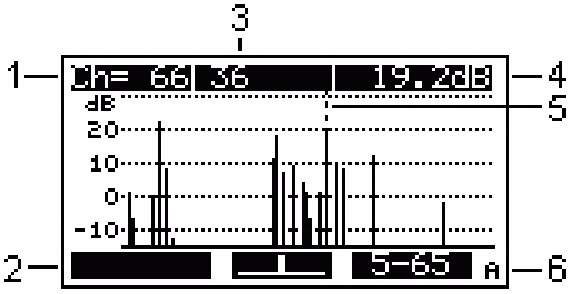

Figure 4.3.6

The following data is displayed on the screen:

1 — number of channel indicated by marker

2 — command line with commands activated by «**F1**», «**F2**» and «**F3**» keys

3 — channel name

4 — measured level of channel indicated by marker, in dBmV, dBuV or dBm

5 — marker

6 — channel status A/D (analog/digital)

Use the «◀» and «▶» keys to navigate the marker.

If no channel plan has been selected, all channels of the channel allocation standard are displayed on the screen. Channel modulation type is determined automatically when you open the mode and what is shown by the progress indicator (channels scanning). The modulation type of the channel indicated by the marker is shown in position 6 while the measurement is being performed.

If one of the channel plans has been selected, the scanning is only performed over the selected channels. Navigation by using the «◀» and «▶» keys is fulfilled only within the selected channel plan. The channel name is displayed in position 3, modulation type is displayed in position 6.

In SCAN mode the MSQ-900 uses an estimating method for determining the digital channel level. The estimating method measures the signal level in the central point of the channel and then recalculates it into a channel level value. This method helps accelerate the measurement process but gives additional error when the digital channel has high ripple.

The graph reference level shown in Figure 4.3.6 is automatically set to the channel with the maximum level.

Channels are represented on the graph according to the principle that each bar on the graph corresponds to one channel if their quantity in the selected channel plan or channel template (when operating without a channel plan) is not more than 112. In other cases adjacent channels with close level values are combined in pairs, and each bar on the graph corresponds to one channel pair. Bar height represents the level value of the first channel in the pair. Use the marker to see the exact level value of each channel in the pair.

Use the function keys to access other measurement modes. The «**F1**» key opens MER/BER measurement mode (Section 4.3.5 MER/BER Measurement Mode) if the selected channel is digital. The «**F2**» key opens LEVEL measurement mode (Section 4.3.2 LEVEL Measurement Mode). The «**F3**» key opens UPSTREAM SCAN measurement mode (Section 4.3.6 UPSTREAM Measurement Mode).

4.3.4 TILT Measurement Mode

The icon in the Main menu refers to TILT measurement mode. This mode displays signal levels as vertical bars and the tilt line between the peaks of the two selected channels. See Figure 4.3.7.

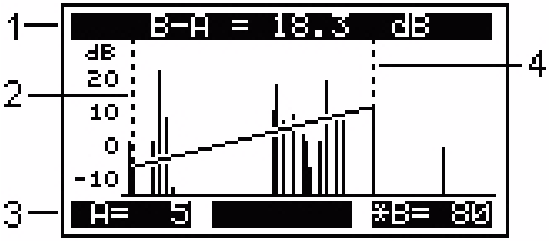

Figure 4.3.7

The following data is displayed on the screen:

1 — channel tilt value between A and B markers

2 — A marker

3 — marker setting command line with current status indication

4 — B marker

Use the «◀» and «▶» arrows to adjust the marker position and the «**F1**» and «**F3**» function keys to select the marker. The selection is indicated by the asterisk in the command line.

If no channel plan is selected, all the channels of the channel allocation standard are displayed on the screen. Channel modulation type is determined automatically when you open the mode and what is shown by the progress indicator (channels scanning).

If one of the channel plans has been selected, the scanning is performed only over the selected channels. Navigation by using the «◀» and «▶» arrows is only fulfilled within the selected channel plan.

The graph reference level shown in Figure 4.3.6 is automatically set to the channel with the maximum level. The marker positions are saved into the memory and restored once TILT measurement mode is opened again.

Channels are represented on the graph according to the same principle as in SCAN measurement mode (Section 4.3.3 SCAN Measurement Mode).

4.3.5 MER/BER Measurement Mode

The MER BER icon in the Main menu refers to the MER/BER measurement mode. This mode displays the table of the parameters featuring the input Annex A/B/C signal quality. See Figure 4.3.8.

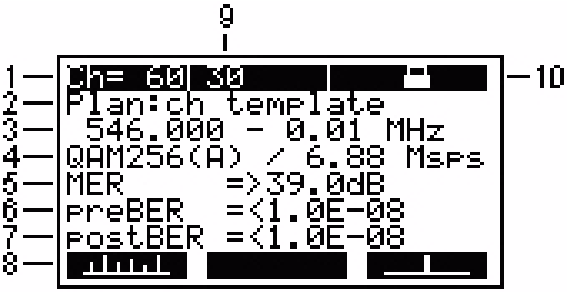

Figure 4.3.8

The following data is displayed on the screen:

1 — channel number

2 — selected channel plan name

3 — selected frequency and frequency shift in MHz

4 — signal modulation parameters (modulation type, standard and symbol rate)

5 — MER value in dB

6 — preBER value

7 — postBER value

8 — command line with commands activated by the «**F1**», «**F2**» and «**F3**» function keys

9 — channel name

10 — demodulator status

When this mode is activated or tuning to a channel is performed, the MSQ-900 starts input signal synchronization process, which is indicated by a progress bar in position 10. The lock icon appears in position 10 once synchronization is achieved. Modulation type, standard and symbol rate are presented in position 4. Some time later MER, preBER and postBER measured values appear in positions 5, 6, 7.

The low level icon blinks in position 10 if signal level value of the selected channel is insufficient. QAM Lock in this case is impossible.

When the MSQ-900 detects an input signal within upstream channel frequency range, in which the level is higher than the selected channel level, the warning icon appears and blinks in the command line above the «**F2**» function key. Press the «**F2**» function key to read the message informing you that presence of a signal in the upstream channel frequency range may significantly impair the measured channel parameters. Press the « EXIT » key to return to the measurement mode.

To measure channel parameters, select the required channel by « ◀ » and « ▶ » arrows.

If no channel plan is selected, use the « ◀ » and « ▶ » arrows to switch to any channel according to the selected channel template (Section 5.3 Setup). Once a signal is detected, the MSQ-900 automatically determines the modulation type, standard and symbol rate.

If one of the channel plans has been selected, the tuning is performed between the digital channels of the channel plan. In this case the channel name from the channel plan is shown in position 9. The channel parameters are taken from the channel plan. If the selected channel plan does not include any digital channels, tuning to channels is not performed.

You can access other measurement modes using the function keys. The «**F1**» key activates SCAN measurement mode (Section 4.3.3 SCAN Measurement Mode). The «**F3**» key opens LEVEL measurement mode (Section 4.3.2 LEVEL Measurement Mode).

4.3.6 UPSTREAM Measurement Mode

UPSTREAM spectrum measurement mode is accessed from the SCAN measurement mode by pressing the «**F3**» function key. This mode displays the upstream channel spectrum within the range of 5-65 MHz. See Figure 4.3.9.

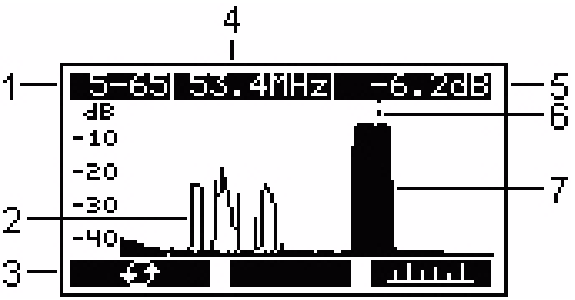

Figure 4.3.9

The following data is displayed on the screen:

1 — spectrum representation frequency range in MHz

2 — peak level trace

3 — command line with commands activated by «**F1**», «**F2**» and «**F3**» function keys

4 — frequency point indicated by marker (value is rounded up to 0.1 MHz)

5 — instantaneous level of the frequency point indicated by marker (is represented in accordance with the selected measurement units dBuV, dBmV or dBm)

6 — marker

7 — instantaneous level trace

Use the «◀» and «▶» arrows to adjust the marker position.

Each frequency point corresponds to frequency bandwidth of 0.625 MHz. To perform signal power measurement, the MSQ-900 uses the integration method. The MSQ-900 calculates the total signal power value by measuring the power within all of the channel bandwidths in 125 kHz increments. It then recalculates the total value into actual power value.

The spectrum graph indicates the following traces for each frequency point:

- **a** instantaneous level of frequency point represented by a bar (height of the bar corresponds to the level value)
- **b** peak level value of the frequency point represented by a line

Press the «**F1**» function key to clear peak level trace.

Press the «**F3**» function key to return to SCAN measurement mode.

4.3.7 Channel Autotest

The Channel Autotest function provides automation of measurement and result recording procedures. The memory capacity allows you to save up to 95 Channel Autotest files (with maximum number of 160 channels). The MSQ-900 allows you to view the saved data in stand-alone mode or using a PC and the MSQ-PC application.

4.3.7.1 General Information

The Channel Autotest allows you to measure parameters of the TV channels within a channel plan, check the cable network parameters against the limit plan, and save the check results into memory. This function allows you to view the measurement results and the errors in different parameters, as well as download the data onto your PC for further processing and report preparation.

4.3.7.2 Channel Autotest File Manager

The icon in the Main menu refers to Channel Autotest File Manager mode. This mode allows you to view, delete, and create new Autotest files. See Figure 4.3.10.

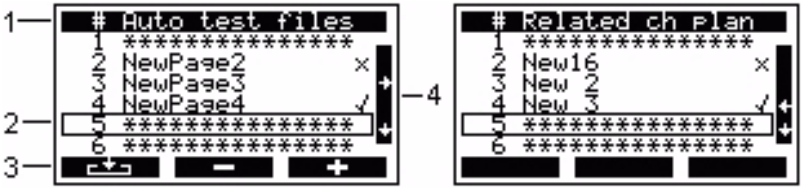

Figure 4.3.10

The following data is displayed on the screen:

1 — table header line

2 — selected line

3 — command line with commands activated by «**F1**», «**F2**» and «**F3**» function keys

4 — scroll bar

The top row of the table (position 1) divides the table into columns. The first column represents the file numbers from 1 to 95. The second column is the file name. The third column is the result of test measurements compared to the limit plan. Figure 4.3.10 represents the list of the channel plan names corresponding to Autotest files. The bottom line (position 3) shows the commands that can be activated by the function keys. Press the «◀» and «▶» arrows to switch between the views of the screen and the «▲», «▼» arrows to select the required file. The selection is framed (position 2).

The following is a list of available commands:

1 «**F1**» key to view, update and check the selected file against the limit plans.

2 «**F2**» key to delete the selected file or clear all the files

3 «**F3**» key to create a new Autotest file

4.3.7.3 Channel Autotest Operation

To view a Channel Autotest file, press the «**F1**» function key. Scanning data table appears on the screen (Figure 4.3.11).

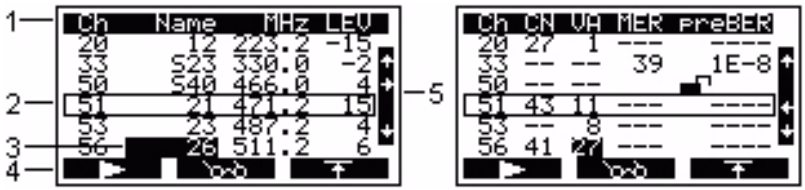

Figure 4.3.11

The following data is displayed on the screen:

1 — table header line

2 — selected line

3 — channel with an error which is highlighted

4 — command line with commands activated by «**F1**», «**F2**» and «**F3**» function keys

5 — scroll bar

Two views of the table are available for basic and additional parameters. Use the «◀» and «▶» arrows to switch between these views. The top line of the table (position 1) divides the table into columns. In the basic parameters screen (Figure 4.3.11) the columns are as follows:

1 The first column is the channel number.

2 The second column is the channel name.

3 The third column is the video carrier frequency for analog channels or central frequency for digital channels (with rounding up to 0.1 MHz).

4 The fourth column is video carrier level or digital channel level in dBuV, dBmV or dBm depending on the preset units.

In the additional parameters screen (Figure 4.3.11) the columns are as follows:

1 The first column is the channel number.

2 The second column represents C/N ratio (in dB).

3 The third column is V/A ratio (in dB).

4 The fourth column displays MER (in dB) or EVM (in %).

5 The fifth column will display preBER values. For digital channels you will see «---» message in the second and third columns, and for analog channels «---» message in the fourth and fifth columns.

If the noise measurement has been disabled for one of the analog channels, «---» message is displayed in the second column for this channel. If QAM demodulator synchronization with digital channel has not been achieved during its measurement, the no lock icon appears in the fourth and fifth columns.

The bottom line (position 4) contains the commands that are activated by the function keys.

Press the «▲», «▼» arrows to select the required frequency point. The selection is framed (position 2).

The following is a list of available commands:

1 «**F1**» key to measure the Autotest file

2 «**F2**» key to view the measurement results in SCAN measurement mode (Section 4.3.3 SCAN Measurement Mode)

3 «**F3**» key to view the limit plan parameters

To start file scanning, press the «**F1**» function key. Scanning process is indicated by a progress bar. If before digital channel measurement, the MSQ-900 detects an input signal within the upstream channel frequency range, whose level is higher than the selected digital channel level, a request for confirmation to proceed with the digital channel measurement appears on the screen (Figure 4.3.12). Press the «**F1**» function key to continue the measurement. Press the «**F3**» function key to stop it. In this case all digital channels are considered unsynchronized. If an input signal in upstream channel is detected only during digital channel measurement, a warning message appears on the screen (Figure 4.3.13) after the measurement is performed.

Figure 4.3.12

Figure 4.3.13

After the scanning is completed, the new values appear in the measurement result field of the screen. If the channel name is highlighted in an inverse color (position 3), this indicates errors have been detected in this channel during the check against the limit plan. Incorrect parameters are also highlighted in an inverse color.

To identify the errors, view the measurements limits by pressing the «**F3**» function key. The table of limit plan parameters appears on the screen (Figure 4.3.14).

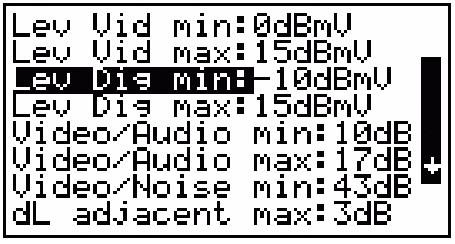

Figure 4.3.14

This table represents the parameters to use for verifying the measurement results. The parameters can only be edited using a PC. The table contains 13 parameters:

1 **Lev Vid Min.** The minimum value of video carrier level for analog channel. Default value: 0 dBmV.

2 **Lev Vid Max.** The maximum value of video carrier level for analog channel. Default value: 15 dBmV.

3 **Lev Dig Min.** The minimum value of digital channel level. Default value: -10 dBmV.

4 **Lev Dig Max.** The maximum value of digital channel level. Default value: 15 dBmV.

5 **Video/Audio min.** The minimum value of V/A ratio. Default value: 10 dB.

6 **Video/Audio max.** The maximum value of V/A ratio. Default value: 17 dB.

7 **Video/Noise min.** The minimum value of C/N ratio. Default value: 43 dB.

8 **dL adjacent max.** The maximum value of ratio between the adjacent channel levels. Default value: 3 dB.

9 **Video/Dig max.** The maximum value of ratio between analog and digital channel levels. Default value: 25 dB.

10 **MER(QAM64) min.** The minimum value of MER for QAM64 modulation. Default value: 28 dB.

11 **MER (QAM128) min.** The minimum value of MER for QAM128 modulation. Default value: 30 dB.

12 **MER(QAM256) min.** The minimum value of MER for QAM256 modulation. Default value: 32 dB.

13 **preBER max.** The maximum value of preBER. Default value: 1E-6. Values available: 1E-4, 1E-5, 1E-6, 1E-7, 1E-8, off. If the off value is chosen, preBER parameter is not measured when the Autotest file is measured.

To check an Autotest file against an individual parameter, select the parameter by using the «▲» and «▼» arrows and pressing the «EXIT» key. This returns you to the file table. The frequency points which failed the check against the selected parameter, are highlighted with the channel names in an inverse color. To check the file against some other parameter, you need to open the limit plan manager again and make a new selection.

Press the «EXIT» key to exit this mode. In confirmation request dialog press «**F1**» to save the results or «**F3**» to abort without saving.

4.3.7.4 Channel Autotest File Erasing

To erase a Channel Autotest file, select the required file and press the «**F2**» function key. The confirmation request dialog appears. To cancel erasing, press the «**F2**» function key. To confirm erasing of the selected file, press the «**F1**» function key. To confirm erasing of all the files, press the «**F3**» function key.

4.3.7.5 Channel Autotest File Creating

To create a new Channel Autotest file, select the required file and press the «**F3**» function key. Channel plan selection screen opens. Press «▲» and «▼» arrows to select the channel plan to be scanned. Press «**ENTER**». The limit plan selection screen appears. Press the «▲» and «▼» arrows to select the limit plan to be used for the check. Press «**ENTER**». The MSQ-900 can store up to 10 limit plans prepared on a PC and uploaded in its memory.

The screen displays the Autotest table with initial values (Figure 4.3.11). Then you can scan, check against a limit plan and save the file into memory as described in Section 4.3.7.3 Channel Autotest Operation.

Section 5: MSQ-900 Configuration

5.1 Channel Plans

5.1.1 General Information

The MSQ-900 offers a Channel Plan Editor. The memory capacity allows you to save up to 16 channel plans (up to 160 frequency points per plan), and allows users to edit saved channel plans both on the unit itself and using the MSQ-PC.

5.1.2 Channel Plan Editor

The icon in the configuration menu refers to this mode. The mode allows you to view, edit, delete and create channel plans. See Figure 5.1.1.

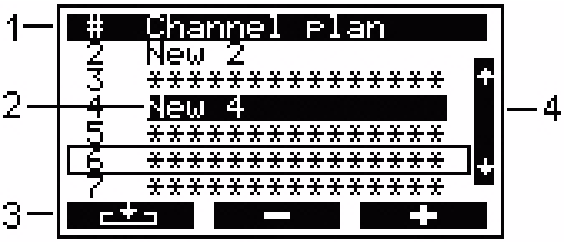

Figure 5.1.1

The following data is displayed on the screen:

1 — table header line

2 — activated channel plan

3 — command line with commands activated by «**F1**», «**F2**» and «**F3**» function keys

4 — scroll bar

The first column is contains a plan index number. The second column is a plan name of up to 15 characters in length. This name is assigned by the user during creating and can later be edited by the MSQ-PC program. If the channel plan is not available, it is indicated by ********** message. If a channel plan has been activated in Setup (Section 5.3 Setup), its name is highlighted in an inverse color (position 2).

Use the «▲», «▼»arrows to select a channel plan from 1 to 16 index number. The selected channel plan is framed.

The following is a list of available commands:

1 «**F1**» key to view and edit the selected channel plan

2 «**F2**» key to delete the selected channel plan or clear all the plans

3 «**F3**» key to create a new channel plan in automatic mode

5.1.2.1 Channel Plan Editing

To view and edit a channel plan, select the required plan and press the «**F1**» function key. You will see the channel plan table. See Figure 5.1.2.

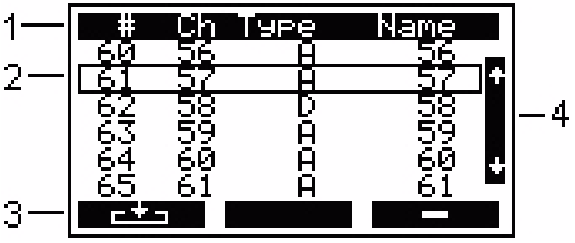

Figure 5.1.2

The following data is displayed on the screen:

1 — table header line

2 — selected line

3 — command line with commands activated by «**F1**», «**F2**» and «**F3**» function keys

4 — scroll bar

The table represents a list of channels comprising the channel plan. The top line divides the table into columns. The first column is the index of frequency point (from 1 to 160). The second column is the number of the TV channel covering the frequency point. The third column is the channel modulation type, A or D (analog or digital). The fourth column is the channel name up to 6 characters. The bottom line shows the commands that can be activated by the function keys. These commands are as follows:

1) «**F1**» key to view and edit the selected frequency point

2) «**F3**» key to delete the selected frequency point

To edit a frequency point, select the required channel by using the «▲» and «▼» arrows (the selected line is framed, position 2), then press the «**F1**» function key. The table of frequency point parameters appears. See Figure 5.1.3.

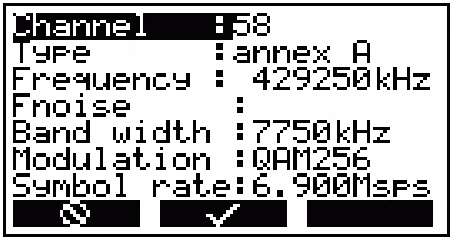

Figure 5.1.3

The following seven parameters are available for editing:

Channel: channel number according to the current channel template

Type: channel type: analog, Annex A, Annex B, Annex C, Annex --- (digital channel with unknown modulation type or having other modulation then QAM)

Frequency: frequency of the video carrier for analog channel or central frequency for digital channel

Fnoise: frequency shift for C/N ratio measurement for analog channels. Can be adjusted from -8000 to +8000 kHz in 125 kHz increments. You can turn off the noise measurement for a channel by setting frequency shift value as 0. In this case "off" value is presented in the table

Band width: channel bandwidth (for digital channels). Can be adjusted from 5000 to 8000 kHz in 125 kHz increments

Modulation: modulation type of digital channel. Available values are QAM64, QAM128 and QAM256. The «---» symbol indicates unknown modulation type

Symbol rate: symbol rate of digital channel. Can be adjusted from 5 to 7 Msps for Annex A channels and from 5 to 6 Msps for Annex C channels. For Annex B channels symbol rate is fixed at 5.057 Msps for QAM64 and 5.361 for QAM256

The initial values of the parameters are set during automatic detection of a channel plan and can be manually edited by using the frequency point editing function.

When you create a new channel plan (Section 5.1.2.3 Channel Plan Creating) channel parameters are set according the following rules:

1 For analog channels frequency is set to video carrier frequency of the channel. The noise measurement is disabled for PAL B/G channel template, for other templates frequency shift for noise measurement is set to -1125 kHz.

2 For digital channels frequency is set to central frequency of the channel. For Annex B and C channels, bandwidth is set to 5750 kHz, and for Annex A channels to 7750 kHz. If synchronization with channel has not been achieved, channel bandwidth is determined automatically.

To fine tune a parameter, select it by using the «▲», «▼» arrows, and then scroll to the required values by using the «◀», «▶» arrows.

To save the frequency point, press the «**F2**» function key. To stop the function without saving changes, press the «**F1**» function key. Always check all of the parameters after the channel plan has been set. It is more convenient to determine the parameters in the spectrum measurement mode using a PC. In the case of incorrect or non-optimal settings, fine tune the parameter manually. Otherwise, it can lead to errors in channel parameters measurement.

Pressing the «EXIT» key confirms saving any changes and exiting the mode. You should consider that when you save changes to or delete a channel plan, the channel Autotest pages which are related to the plan is deleted.

To delete the selected frequency point, press the «**F3**» function key.

5.1.2.2 Channel Plan Erasing

To erase a channel plan, select the required channel plan and press the «**F2**» function key. The confirmation request dialog appears. To stop erasing, press the «**F3**» function key. To confirm erasing of the plan, press the «**F1**» function key.

5.1.2.3 Channel Plan Creating

To create a new channel plan in auto mode, supply the signal to the RF input of the MSQ-900, select position of the plan in the table and press the «**F3**» function key. After the MSQ-900 has completed scanning all of the TV channels, it switches to channel plan edit mode (Section 5.1.2.1 Channel Plan Editing). Edit the channel plan parameters if needed and save the plan into the memory.

5.2 Self-Test Mode

5.2.1 General Information

The icon refers to this mode. The self-test mode allows you to check the performance of the components of MSQ-900 and its functional condition. See Figure 5.2.1.

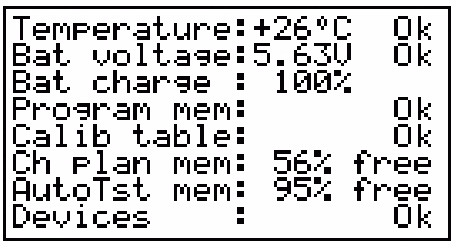

Figure 5.2.1

The table represents the following parameters to be checked:

1 **Temperature.** Temperature inside the MSQ-900

2 **Bat voltage.** Voltage of the battery

3 **Bat charge.** Battery level status

4 **Program mem.** Firmware status

5 **Calib table.** Calibration table status

6 **Ch plan mem.** Channel plan memory status

7 **AutoTst mem.** Channel Autotest memory status

8 **Devices.** Internal devices status

5.2.2 Temperature

The function checks the temperature inside the MSQ-900. Temperature is the main environmental factor that influences the accuracy of measurements. Use the temperature parameter to check the accuracy of measurements of the signal level. If the temperature value is within the allowed range of -10-50ºC (14-122ºF), then **Ok** status is displayed at the end of the parameter line. If the temperature is not within this allowed range, **Ok** status is not displayed. If temperature «---» value is displayed, this indicates the temperature measuring device is faulty. In this case, contact the service center.

5.2.3 Battery Level Status

The battery voltage and battery level status parameters allow you to check the battery condition. Perform this check when operating in stand-alone mode (power supply switched off). If the measured battery voltage is higher than 4.6 V, **Ok** status is indicated, if the voltage is lower than 4.6 V, **Low** status is indicated. The voltage is then be recalculated into the battery level status value in percent, which helps estimate the time remaining for the MSQ-900 to operate. It should be noted that with the decrease of ambient temperature the battery capacity also decreases. Take this into account when estimating the operating time of the MSQ-900.

5.2.4 Firmware Status

This function checks the firmware status of your MSQ-900. The **Ok** status displays if no errors are detected. The **Error** status displays if an error is detected. If an error is detected, reinstall the firmware.

5.2.5 Channel Plan and Channel Autotest Memory Status

This function shows the free memory in percent for each memory type.

5.2.6 Internal Device Status

This program checks the condition of the MSQ-900 components. The **Ok** status displays if no errors are detected. The **Error** status displays if an error is detected. If an error is detected, contact the service center.

5.3 Setup

The icon in the Main menu refers to this mode. The setup mode allows you to modify the general parameters of the MSQ-900. See Figure 5.3.1.

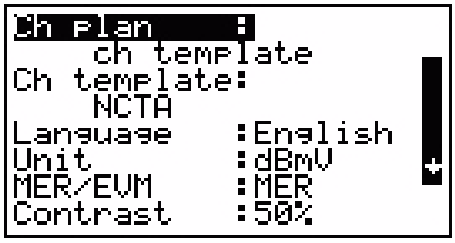

Figure 5.3.1

The table represents the following settings:

1 **Ch plan.** Select channel plan from the available (Section 5.1.2 Channel Plan Editor). If a channel plan is not selected, Ch template is displayed

2 **Ch template.** Select channel template. Available settings: China, PAL B/G, PAL Ireland, PAL UK, Secam D/K, Secam-L, NCTA

3 **Language.** Select language. Available settings: English, Français, Deutsch, Español, Portuguese

4 **Unit.** Select measurement units for the signal level: dBuV, dBmV, dBm

5 **MER/EVM.** Select MER (dB) or EVM (%)

6 **Contrast.** Set LCD contrast from 0 to 100%

7 **Display.** Select display mode. Available settings are normal - white characters in the blue background and reverse - blue characters in white background

8 **Sound.** Select key pressing sound. Available settings are off - silent and type1, type2, type3 - three types of sound

5.4 Information

The icon refers to this mode. The Information function allows you to determine the MSQ-900 model, serial number, modification and firmware version. See Figure 5.4.1.

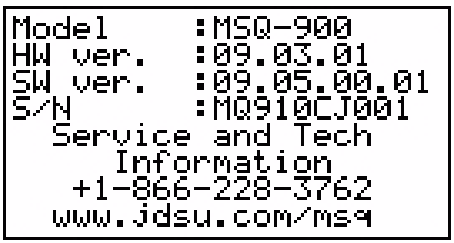

Figure 5.4.1

The data for your MSQ-900 is displayed in the upper part of the screen:

1 **Model.** MSQ-900 model

2 **HW ver.** Hardware version

3 **SW ver.** Firmware version

4 **S/N.** MSQ-900 serial number

The service center telephone number and a link to the web page describing the MSQ product is located in the lower part of the screen.

5.5 Battery Operation

One battery measures 14.5 x 49.5 mm and has a battery capacity rating of no less than 1600 mAh and no more than 1900 mAh.

To determine the battery level status, use the self-test function of the MSQ-900 (Section 5.2.3 Battery Level Status). When the effective charge level of the battery drops to the critical point you hear a warning beep. This indicates the time of operation until total battery discharge is a few minutes.

To charge the batteries in a charger, turn the MSQ-900 off. Open the cover of the battery compartment using a screwdriver. Carefully remove the batteries. Charge the batteries in a charger appropriate to the battery type you are using.

When installing the batteries into the battery compartment, make sure the polarity of batteries is correct. Close the battery compartment.

WARNING

Incorrect installation of the batteries may lead to damage to the MSQ-900 or the batteries. Do not use alkaline batteries or batteries of any other type than specified.

To charge the batteries without removing them from the MSQ-900, connect your MSQ-900 to an external 12 V DC power source or to the vehicle's 12 V cigarette lighter socket. The MSQ-900 switches on in operating mode.

The MSQ-900 determines the optimal mode of battery charging based on battery charge status.

The icon in the configuration menu refers to the charging manager function. See Figure 5.5.1.

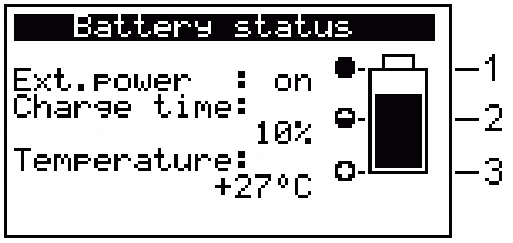

Figure 5.5.1

The screen displays the following three parameters:

1 **Ext.power.** Availability of external power source. If powered from an external power source, the value is «**on**». If powered by the batteries, the value is «**off**».

2 **Charge time.** Charging time in percent

3 **Temperature.** Temperature in battery compartment (the value is shown only if the MSQ-900 is powered from an external power source).

Battery charging begins automatically when an external power source is connected to the MSQ-900. The protection circuit cuts off the charging process when the temperature in the battery compartment is higher than 55ºC (131ºF). It is important to not charge the batteries when the ambient temperature is more than 35-40ºC (95-104ºF). The temperature value starts blinking on the screen when the temperature is higher than 50ºC (122ºF). We do not recommend charging the batteries under such conditions, because they will not be able to gain full charge in high temperature. If you perform measurements during charging, the charging time may be significantly increased. Charging progress is indicated in the right-hand side of the screen as a filling battery.

If no external power supply is used, the indicator shows the battery level status. See Figure 5.5.1.

1 — fully charged

2 — partly charged

3 — fully discharged

Section 6: Maintenance

Follow the instructions in this Operating Manual for the proper operation, storage and shipment of the MSQ-900.

Perform preventive inspections covering check of controls, reliability of assembly, and the keypad condition after the warranty period has expired and annually after that.

Section 7: Troubleshooting

Defect detection: The MSQ-900 fails to switch on in stand-alone mode.

1 *Possible reason:* Extremely low charge, malfunction, or improper installation or missing of one or more of the batteries.

Methods of correction: To check the MSQ-900 condition, connect the Mains Adapter. If the MSQ-900 switches on, check the battery voltage in self-test mode (Section 5.2.3 Battery Level Status). Low voltage (less than 4.4 V) is evidence that one or more batteries are discharged or malfunctioning. Voltage that is higher than normal (greater than 7 V) indicates that one or more batteries are malfunctioning. The batteries should be charged in case they are low (Section 5.5 Battery Operation) or replaced if they are malfunctioning.

2 *Possible reason:* Firmware failure.

Methods of correction: Reinstall the firmware.

Defect detection: The MSQ-900 fails to switch on in stand-alone mode, but the LCD backlight is on.

1 *Possible reason:* The program has frozen.

Methods of correction: Push and hold the « ⏻ » key for 5 seconds. The MSQ-900 turns off. Release the key and turn the MSQ-900 on again.

Defect detection: High error at level measurements in some or all of the channels.

1 *Possible reason:* Increased wear of the RF input adapter.

Method of correction: Replace the RF input adapter with a known good adapter.

2 *Possible reason:* Incorrect channel plan setting, making the MSQ-900 tune to an offset video carrier point.

Method of correction: Adjust the channel plan (Section 5.1.2.1 Channel Plan Editing).

3 Possible reason: Incorrect selection of the TV standard.

Method of correction: Check the parameters of the selected TV standard using an external PC.

Section 8: Storage

Store the MSQ-900 at temperatures between -20-40ºC (-4-104ºF), with a maximum non-condensing relative humidity of no more than 90% at 30ºC (86ºF).

Section 9: Transportation

Ship the MSQ-900 in any closed vehicle at temperatures from -20-40ºC (-4-104ºF), with a maximum non-condensing relative humidity of no more than 90% at 30ºC (86ºF) and atmospheric pressure of 84-106.7 kPa (630 to 800 mm Hg).

Cargo holds, railway cars, containers, and truck beds, utilized for shipment of the MSQ-900 should be free from any traces of cement, coal, and corrosive chemicals. When shipped by air the MSQ-900 should be kept in aircraft sealed compartments.

Test and Measurement Regional Sales

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