TL-3524
USER`S MANUAL

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 Non TSO approved

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We will evaluate your suggestion and provide an update.

Record of revision

Revision	Revision date	Description	ECO#	Insertion date	By
A	1/6/03	Initial Release	---		
B	1/7/04	Language correction	0001		

TABLE OF CONTENTS

1. GENERAL DESCRIPTION

1.1. INTRODUCTION

This manual describes the physical, mechanical and electrical features and functions of the TL-3524 Altimeter.

1.2. INSTRUMENT DESCRIPTION

The Altimeter incorporates the new generation of a precise sensor with the temperature and altitude calibration, which enables measuring the altitude immediately after turning the instrument on, without having to wait a few minutes. Another part of the Altimeter is an encoder of the altitude for any transponder, see the table, page 8-1.
The TL-3524 incorporates a 10.000 line long-term memory and SchecK memory (see page 7-1) for storing the measured values at 0.1 to 60 second sample rate.
The TL-3524 enables the pilot to keep the set altitude. In case of exceeding the set altitude, the pilot will be warned by the acoustic or visual signalization. It is also possible to set the MDA, the approach altitude and the transition altitude. When reaching the transition altitude, a message will show on the display.
If the alarm warning has be activated either by the lack of oxygen or by high altitude, the instrument will display a Service message after the next turn-on to inform the user that the altitude has been exceeded.
The User button can be programmed in the main set-up for the quick display of the maximum reached altitude or for the display of the currently set barometric pressure.
It is possible to download the measured values from the instrument via the serial cable RS-232c into your PC.

1.3. TECHNICAL SPECIFICATIONS

The producer guarantees all stated technical parameters only when the instrument is installed by an authorized service or an aircraft manufacturer.

1.3.1 Physical characteristics

Width	71mm (2.795 inches)
Height	67mm (2.637 inches)
Depth	92mm (3.622 inches) including connectors with cover
Panel hole	57mm (2.244 inches) diameter
TL-3524 Weight	0.30 kg (0.66 lbs)
TL-3524 Harness	0.05 kg (0.11 lbs)

1.3.2 General Specifications

Operating Temperature Range	**-20°C to +70°C**
Humidity	**95% non-condensing**
Altitude Range	**4600 meters max.**
Power Range	**10.0 to 32.0 Volts**
Max. Signalization	**30 Volts, 1 Ampere**
Power Consumption	**0.15 Ampere @ 14 VDC**
Backlight Consumption	**0.08 Ampere max when ext. power is used**
Vibration	**5 to 500 Hz**
Show Rate (LCD Refresh)	**1 second**

1.3.3 Long-term Memory and Communication

Storing Rate	**1 to 60 seconds user selectable**
Memory Capacity	**Scheck® method**
Stored Values	**Altitude**
Data Saved Endurance	**30 years**
Rolling Memory life-time	**550 000 hours @ 1 second storing rate**
Communication	**RS-232c**
Communication Speed	**38400 bps**

1.3.4 Encoder

Type of encoder	**Mode C**
Strobe signal from the transponder	**Positive pulse 10 to 32 Volts (if positive pulse is applied, the output encoding data is enabled)**

1.3.5 Instrument Measured Range / Resolution

Altitude&encoder	**-350m to 9700m @ 1013,25 mbar / 1m (-1150ft to 31.950ft @ 29.92inHg / 2ft)**

1.4. LIMITED CONDITIONS

1.5. LIMITED WARRANTY

The TL elektronic company warrants this product to be free from defects in materials and manufacture for three years from the date of purchase. TL elektronic will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labour. The customer is, however, responsible for any transportation costs. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF ENCHANT ABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL TL ELEKTRONIC BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

To obtain warranty service, call the TL elektronic Customer Service (+420 49 548 23 92) for a returned merchandise tracking number. The unit should be securely packaged with the tracking number clearly marked on the outside of the package and sent freight prepaid and insured to a TL elektronic warranty service station. A copy of the original sales receipt is required as the proof of purchase for warranty repairs. TL elektronic retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion.

SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

1.6. LIMITED OPERATION

This product is not TSO approved as a flight instrument, therefore, the manufacturer will not be held responsible for any damage caused by its use.
The encoder output is only a complement of the Altimeter; therefore, the manufacturer is responsible neither for using this output, nor for any possible legal consequences resulting from its use.

2. INSTALLATION

2.1 INTRODUCTION

Careful planning and consideration of the suggestions in this section are required to achieve the desired performance and reliability from the TL-3524.

2.2 RACK CONSIDERATION

Plan a location that gives the pilot complete and comfortable access to the entire keypad and that is plainly visible from the pilot's perspective. Check that there is adequate depth for the rack in the instrument panel. A location away from heating vents or other sources of heat generation is optimal.

2.3 INSTALLATION INTO PANEL

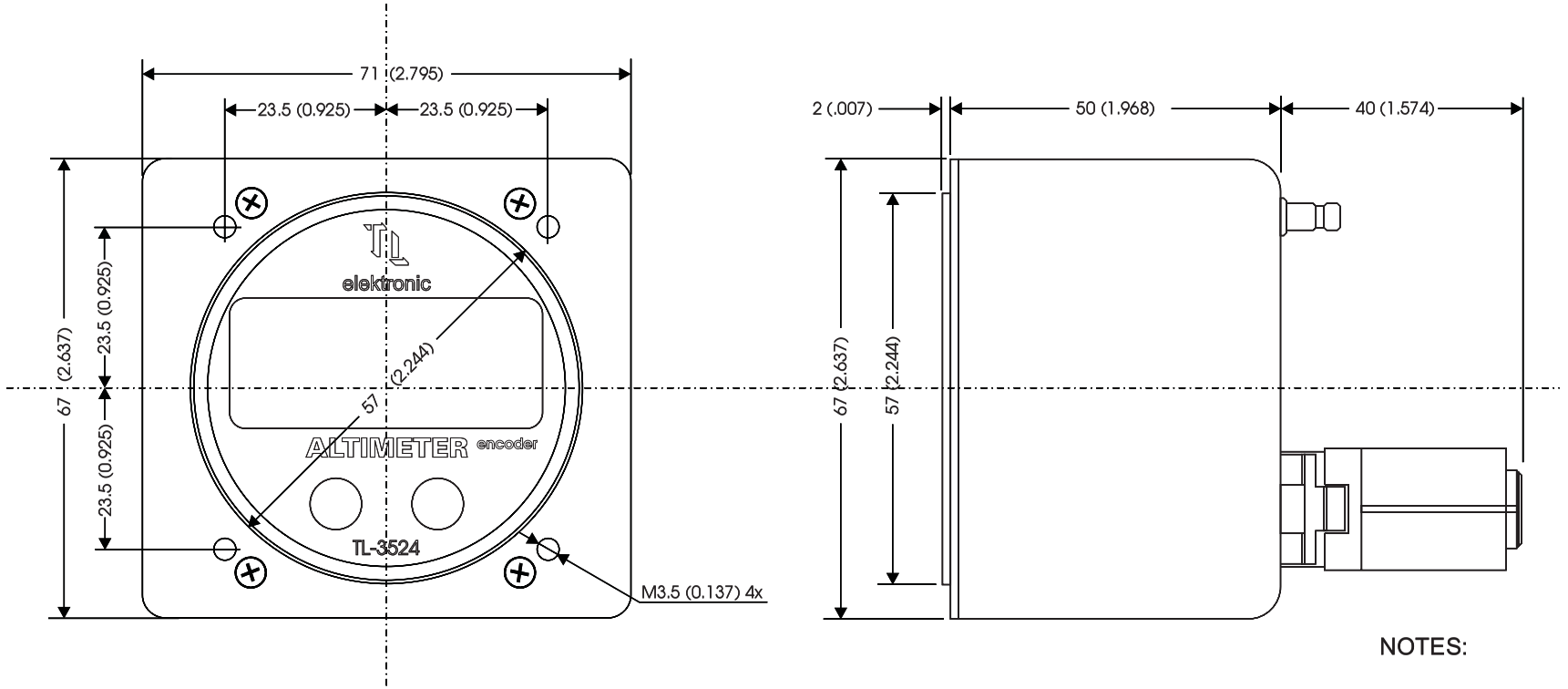
⚠ **Connect the cables into the connector and use the connector cover. Secure the incoming leads to prevent their effect on the connector in the vertical direction.**

⚠ **Connect the static pressure hose into the fitting. Secure the incoming leads to prevent their effect on the hose in the vertical and horizontal direction.**

2.4 STATIC PRESSURE CONNECTION

⚠ **The TL-3524 is calibrated in the factory to the pressure datum according to the National Bureau of Standards. When the TL-3524 has been installed in the aircraft it must be calibrated to the primary flight altimeter according to Advisory Circular 43-6A so as to comply with FAR91.36(b) and FAR 91.172 (see the calibration procedure, page 5-9).**

Mounting Rack Dimension



NOTES:

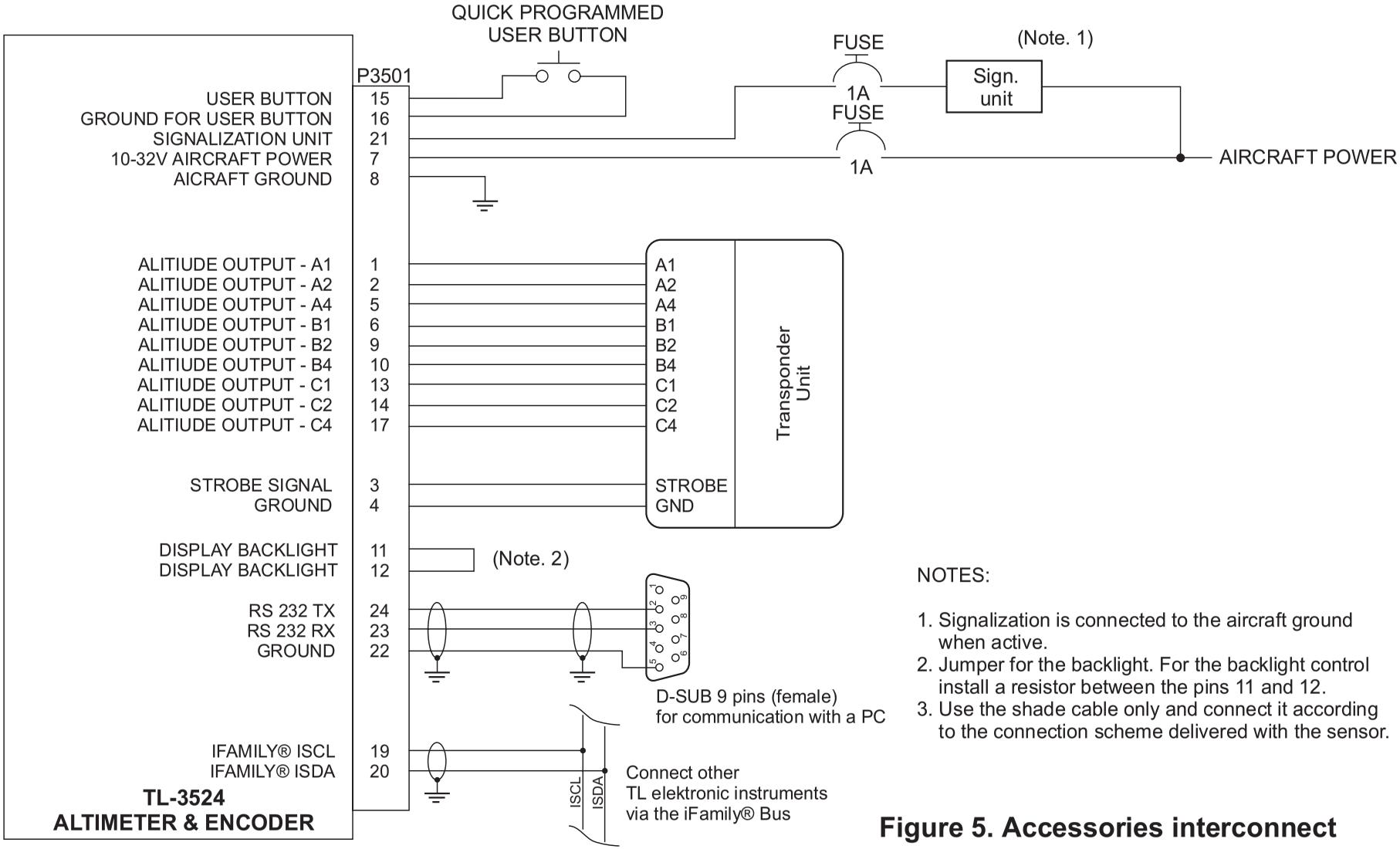
1. Dimension: mm (INCH)
2. Unit weight: 0.3 kg (0.66 lbs)
3. Mounting Rack & Hardware weight: 0.05 kg (0.11 lbs)

Figure 4. Rack Dimension

3.1 PIN FUNCTION LIST

Pin	Pin Name	I/O
1	Transponder -A1	Out
2	Transponder - A2	Out
3	Transponder - STROBE signal	In
4	Ground for transponder	- -
5	Transponder - A4	Out
6	Transponder - B1	Out
7	Aircraft power	In
8	Aircraft ground	- -
9	Transponder - B2	Out
10	Transponder - B4	Out
11	Input for backlight	In
12	Internal source for backlight	Out
13	Transponder - C1	Out
14	Transponder - C2	Out
15	Input for User button	In
16	Ground for User button input	- -
17	Transponder - C4	Out
18	Do not connect! - reserved for transponder - D4	Out
19	iFamily® communication ISCL	I/O
20	iFamily® communication ISDA	I/O
21	Signalization unit	Out
22	Ground for PC communication (RS-232)	- -
23	RXD from PC (RS-232)	In
24	TXD to PC (RS-232)	Out

Accessories Interconnect

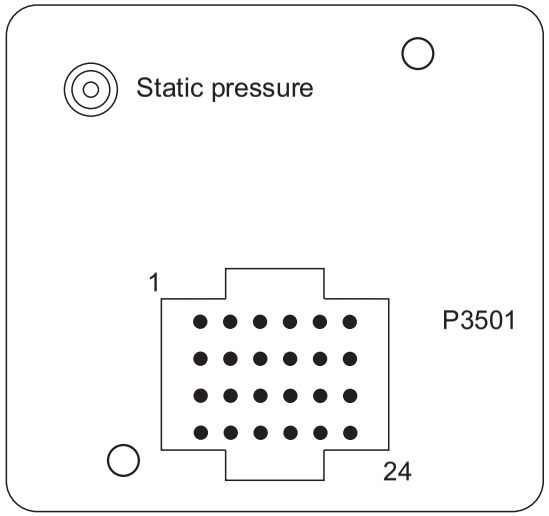


NOTES:

1. Signalization is connected to the aircraft ground when active.
2. Jumper for the backlight. For the backlight control install a resistor between the pins 11 and 12.
3. Use the shade cable only and connect it according to the connection scheme delivered with the sensor.

Figure 5. Accessories interconnect

Rear view of connector plate



NOTES:

1. Secure the incoming leads to prevent their effect on the connector in the vertical direction.
2. Secure the incoming hose to prevent their effect on the fitting in the vertical and horizontal direction.

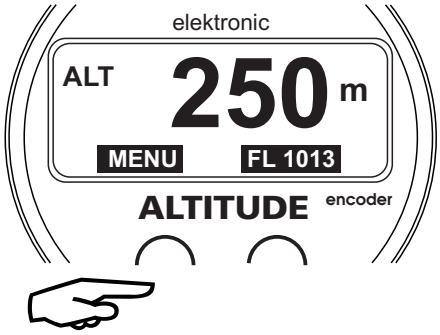
Figure 6. Connectors locate

4. NAV-MENU DESCRITION

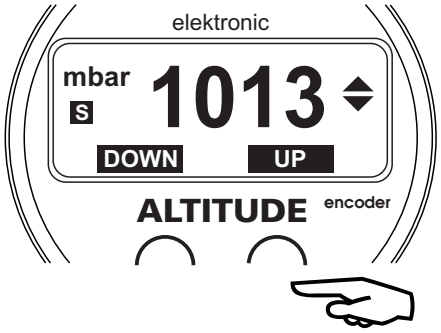
4.1 How to Control Instrument via NAV-MENU

There are black labels on the display. Each is affiliated to the left and the right button. Before pressing a button, read the information on the label. Its functions are different in every menu.

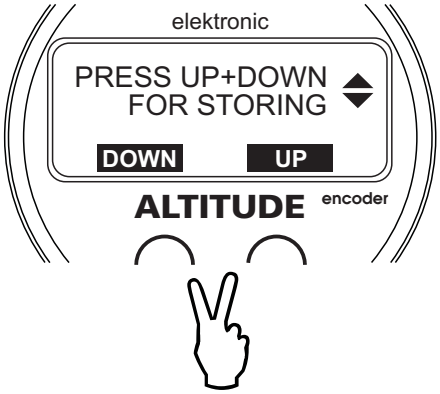
The left label is for the Left button.



The right label is for the Right button.



To store a value into the memory, press both buttons simultaneously. Release the buttons when the setting arrows vanish.



5 INSTRUMENT SETUP

5.1 First Instrument Turn-on

Before the Altimeter starts to indicate, you must do the basic setting of language, contrast, units, etc. After the first turn-on of the instrument, the „FIRST SETUP“ message will show on the display. This set-up must be completed to continue.

5.2 Main Set-up Functions Description

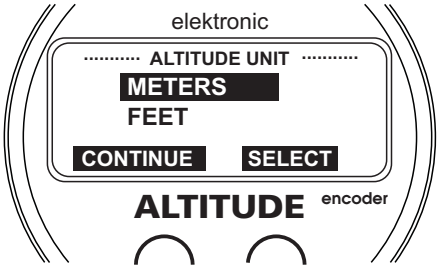
Table of the instrument configuration steps is shown below (Initial - firmware version 1.0).

0	LANGUAGE	Select your language for communication with the instrument.
1	DISPLAY CONTRAST	Select the contrast of the display.
2	PASSWORD	Select your password.
3	ALTITUDE UNIT	Select your local unit for altitude.
4	AIR PRESSURE UNIT	Select your local unit for barometric pressure.
5	DISP. PRECISION	Set the resolution of altitude that will show on the display.
6	CALIBRATION	Do the calibration of altitude acc. to FAR 91.36, 91.172 FAA advisory circular 43-6A.
7	TRANSITION ALT.	Set your local transition altitude.
8	STROBE MODE	Enable or disable the strobe signal to the transponder.
9	OXYGEN WARNING	Select **OFF** = if your cockpit is pressurized, **ON** = if your cockpit is not pressurized.
10	USER BUTTON	Program your button for these functions: **SHOW MAX. ALT** = shows the maximum altitude of acceleration when the button is pressed, **SHOW QNH or FL** = shows the set barometric pressure when the button is pressed.
11	VOICE WARNING	Enable or disable the voice warning into the headphones (only with use of our Intercom TL-2424 or Voice Module).
12	INST. ON-LINE	Check the connected instruments from the TL elektronic iFamily® that are On-Line.

All information on this page is subject to change without prior notice. Download the latest version of the manual from www.tl-elektronic.com and compare with you version of firmware.

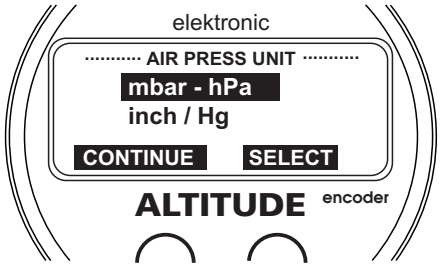
5.3 How to Select Altitude Units

For selecting the altitude units, use the „Select“ button in the Set-up menu. The selected unit is shown inversely on the black background. When the unit has been selected, press the „Continue“ button for storing and step to the next configuration.



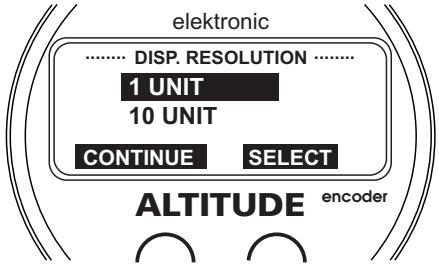
5.4 How to Select Barometric Pressure Units

For selecting the barometric pressure units, use the „Select“ button in the Set-up menu. The selected unit is shown inversely on the black background.When the unit has been selected, press the „Continue“ button for storing and step to the next configuration.



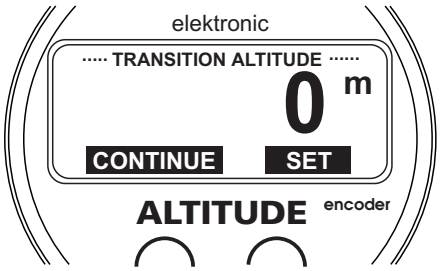
5.5 Show Altitude in 1 or 10 Unit Resolution

Select the display of altitude either in units or in tens of meters (feet). If you select tens, the last displayed number will be 0. The reason is to prevent disturbing caused by the continuous changes of altitude.

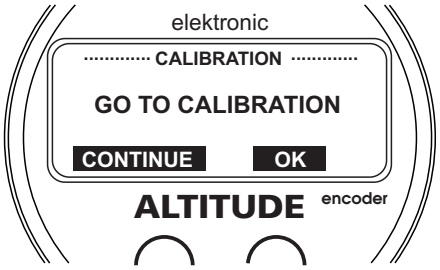


5.6 How to Select Default Transition Altitude

Set your local transition altitude in this menu. This altitude will be checked all the time. When reaching this altitude, the message will show on the display, see point 6-9.

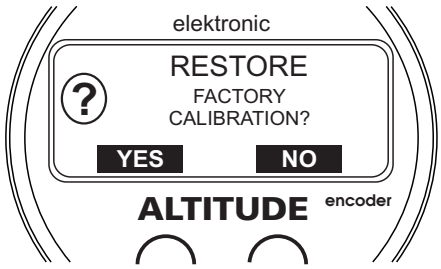


5.7 Go to Calibration



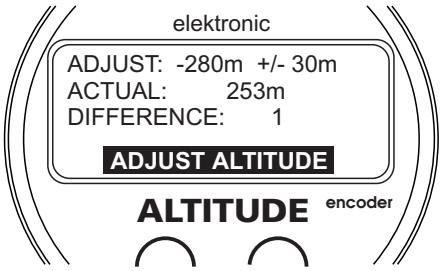
A pitot-static system test equipment is required to perform the following calibration procedures. The TL-3524 is calibrated in the factory to the pressure datum according to the National Bureau of Standards. When the TL-3524 has been installed in the aircraft it must be calibrated to the primary flight altimeter according to Advisory Circular 43-6A so as to comply with FAR 91.36(b) and FAR 91.172.

5.8 Restore Factory Calibration



Any time you can go back to the factory calibration done according to the pressure datum traceable to the National Bureau of Standards.

5.9 Do Your Calibration



1. The calibration should be done with both the primary flight altimeter and the TL-3524 at the same ambient temperature within the range of +15 to +35°C (+55 to +95°F). The power supplied to the TL-3524 should be of the same nominal voltage as the power of the aircraft, to which it is to be installed.

2. Connect the power to the TL-3524 for at least 5 minutes before proceeding with the calibration.

3. With the primary flight altimeter set to 1013,25mBar (29.92 in hg), increase the system pressure supplied by the pitot-static test equipment until the primary flight altimeter indicates -280m +/-30m (-918ft +/-100ft) as the minimum altitude.

4. Compare the altitude shown on the display with the instant altitude and if required, adjust the difference value by the „UP“ and „DOWN“ buttons for adjusting the instant altitude to the primary flight altimeter. Press both buttons for storing the set value.

5. Decrease the system pressure until the primary flight altimeter indicates 9500m +/- 30m (30750ft +/- 100ft).

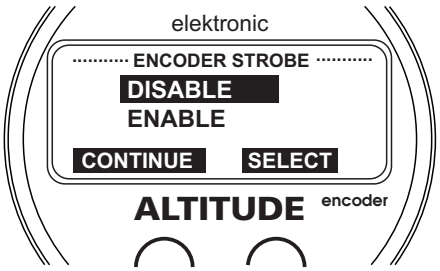
6. Compare the altitude shown on the display with the instant altitude and if required, adjust the difference value by the „UP“ and „DOWN“ buttons for adjusting the instant altitude to the primary flight altimeter. Press both buttons for storing the set value.

7. Repeat the steps 3 to 6 until the accuracy of 15m (+/- 50ft) is obtained for both increasing and decreasing the pressure at both the maximum and minimum calibration altitude.

8. Install a label that corresponds with the maximum altitude, to which the TL-3524 was calibrated, on the instrument panel below the primary flight altimeter. The FAR 91.217 requires the correspondence check to be performed. The AC43-6B provides guidance for acceptable methods to accomplish this.

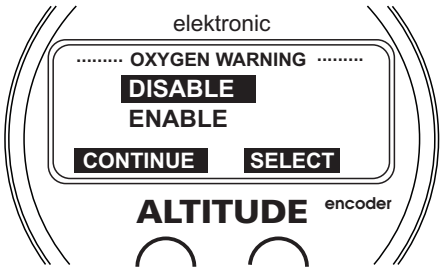
5.10 Strobe Signal of Transponder

Some transponders have the strobe signal that activates or deactivates the outputs of the TL-3524. If the pin no.3 on the connector P3524 is plugged in, select „ENABLE“. If the pin no.3 is not plugged in, select „DISABLE“.



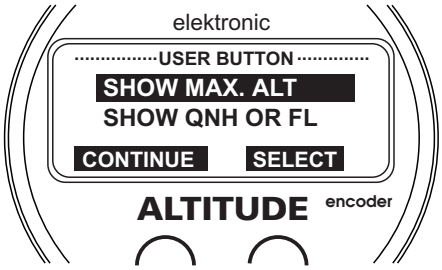
5.11 Oxygen Warning

If you fly higher than 3.800m (12.500ft) above the sea level, your cockpit should be pressurized in compliance with JAR-OPS 1.775. If you want to be informed that the oxygen is required, select „ENABLE“. The altitude for signalization in the instrument is default to 3.800m (12.500ft). If you do not want to be informed that the oxygen is required, select „DISABLE“.



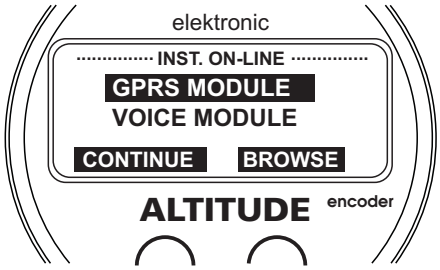
5.12 User Button

When pressed, the external User button offers you the possibility of programming to quick show or quick switch to the selected menu. After releasing the button, you will get back the measured value indication. For example - if you have set SHOW QNH or FL, after pressing the button you can monitor barometric pressure.

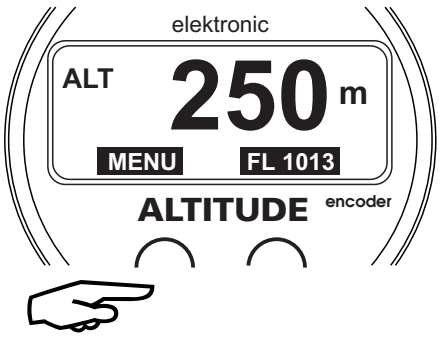


5.13 iFamily® and Other Connecting Devices

As the first of aircraft instruments, the TL-3524 offers you the possibility of connecting with other instruments from the TL elektronic family, in order to gain simultaneous recording of the measured values, mass PC download of all connected instruments etc. via one cable.
If some other instruments or the GPS are connected to the reserved inputs, this menu shows each connected instrument. It also enables checking the connected instruments and devices.



6. OPERATIONAL MANUAL



6.1. Left Menu Description

The left main menu shows the information about the alert altitude, the MDA, the transition altitude etc. according to the table below.

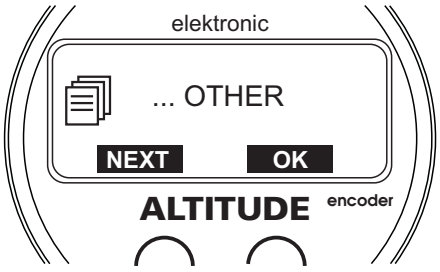
Left menu (Initial firmware version 1.0)

First	Second	Description
ALERT		Alert altitude
MDA		MDA
TA		Transition altitude
	MAX	Long-term memory of the maximum reached altitude
	DELETE	Delete the long-term memory of the maximum altitude
	EXIT	Exit from the second menu

All information on this page is subject to change without prior notice. Download the latest version of the manual from www.tl-elektronic.com and compare with you version of firmware.

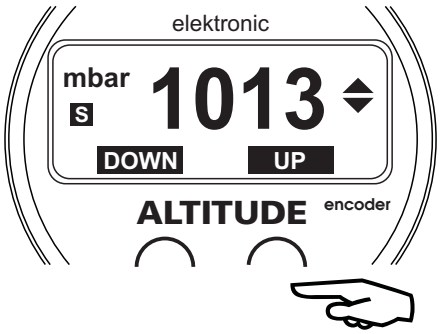
6.1.1 Second Menu

The „OTHER“ dialog will show on the display after pressing the left button. If you press „YES“ in this dialog, the instrument will go to the second menu where you can get the information about the maximum reached altitude etc.



6.2 Right Menu Description

The right menu shows the information about the set barometric pressure according to the table below.



Right Menu (Initial firmware version 1.0)

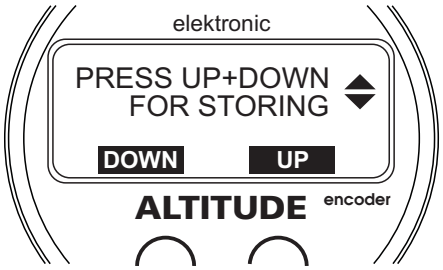
First	Second	Description
FL or QNH		Set FL (flight level at the National Bureau of Standards) or QNH barometric pressure

All information on this page is subject to change without prior notice. Download the latest version of the manual from www.tl-elektronic.com and compare with you version of firmware.

Setting the barometric pressure: While holding the button „UP“ or „DOWN“, the barometric pressure value always stops when reaching the value stated by the National Bureau of Standards (1013,25hPa / 29.92.inHg). In this case you have to press or hold the button „UP“ or „DOWN“ again. The inverted symbol [S] (on the black background) will show on the display.

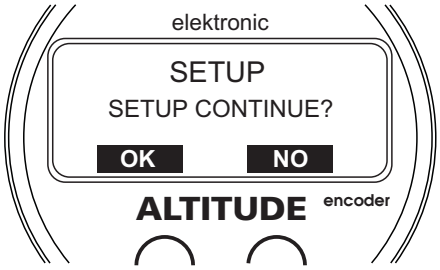
6.2.1 Exit from the Right Menu

The set value of barometric pressure and the exit from the right menu is after pressing both buttons simultaneously. Release the buttons when the setting arrows vanish.



6.3 How to Change Configuration

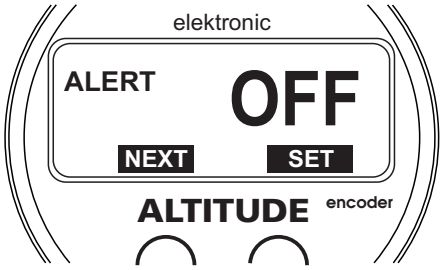
If you want to change e.g. units or contrast, press and hold both buttons and turn the instrument on. The „SETUP“ message will show on the display. Press „OK“ and go to the Instrument Setup.



Note, that any unauthorized change of the values in the Setup can cause damage to the instrument. An incorrect change of the setup can endanger your life and lives of your passengers.

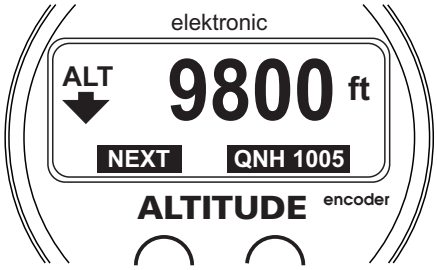
6.4 Set Alert Warning

By pressing the button „MODE“ a few times, you enter this menu where you can set the altitude you want to keep. This setting is necessary to be done always after turning the instrument on or off. The instrument stores the latest set datum, which will be shown on the display when being set the next time.

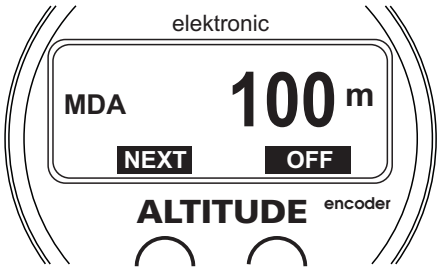


6.5 How Alert Warning Works

If your aircraft is more than 50m (165ft) above or below the set altitude, the instrument will activate the acoustic or visual signalization. In the left part of the display an up or down arrow will show. The arrow demonstrates the direction the aircraft should follow in order to keep the set altitude.

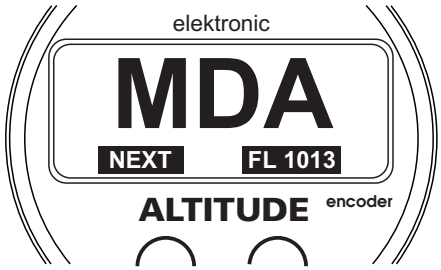


6.6 Set MDA or Approach Altitude



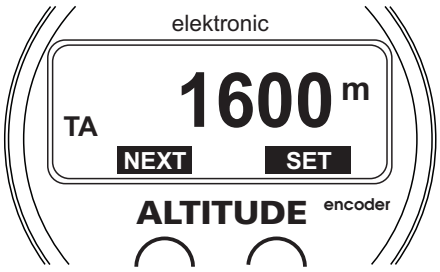
By pressing the button „MODE“ a few times, you enter this menu where you can set the altitude for the MDA or the approach altitude. This setting is necessary to be done always after turning the instrument on or off. The instrument stores the latest set datum that will be shown on the display when being set the next time.

6.7 MDA or Approach Warning



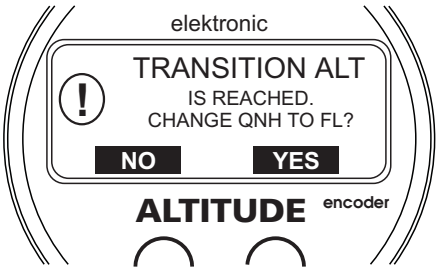
If your aircraft reaches the MDA or the approach altitude, the instrument will activate the acoustic or visual signalization and this message will show on the display repeatedly in regular intervals. You can disable the signalization (including the „MDA“ message) any time by pressing the left, the right or the User button.

6.8 Set Different Transition Altitude



For example, if your are in another country where the transition altitude differs from the one default in the Setup Mode, according to the point 5-6, you can change the altitude in this menu.
Note that if you turn the instrument off and on, the altitude will be set again to the default value, according to the point 5-6.

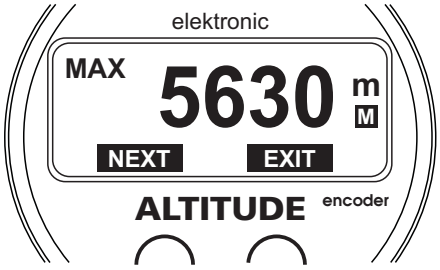
6.9 „TRANSITION ALTITUDE REACHED“ Message



If you reach the transition altitude, the instrument will activate the acoustic or visual signalization and this message will show on the display. If you want the instrument to change the barometric pressure automatically from the QNH to the National Bureau Standard (FL) 1013,25hPa (29.92inHg), press the button „YES“.

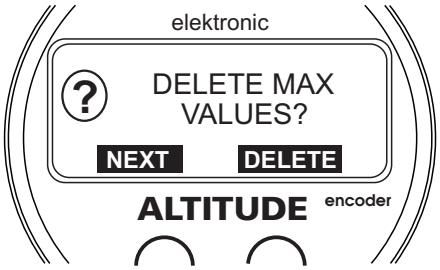
6.10 Memory of Maximum Reached Altitude

The inverted symbol [M] (on the black background) shown on the right indicates that the maximum reached altitude from the long-term memory is displayed.



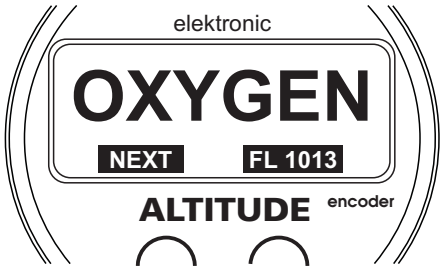
6.11 Delete Long-term Memory of Altitude

The long-term memory of the maximum reached altitude can be deleted in this menu.



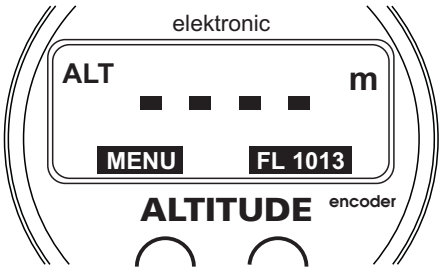
6.12 „OXYGEN“ Message

If your aircraft reaches the altitude where the oxygen is required and if you have selected „ENABLE“ in the Setup Menu, according to the point 5-12, the instrument will activate the acoustic or visual signalization.
The message „OXYGEN“ will show on the display in regular intervals. You can disable this signalization any time by pressing the left, the right or the User button. The message „OXYGEN“ will show on the display repeatedly in regular intervals until the altitude decreases below 3.800m (12.500ft).



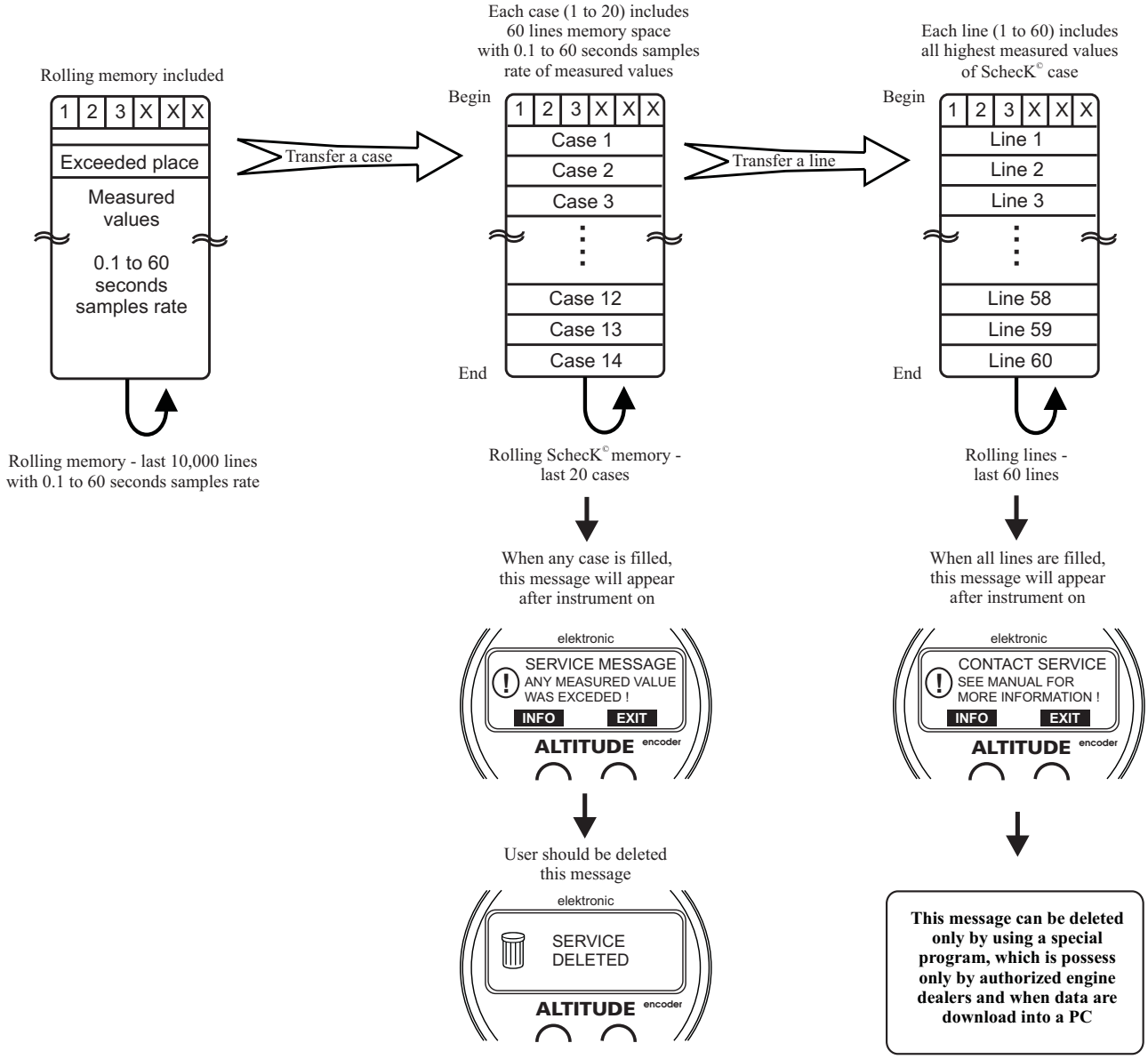
6.13 Measuring Altitude out of Range

When the altitude measured by the sensor is out of range, the symbol [----] will show on the display.

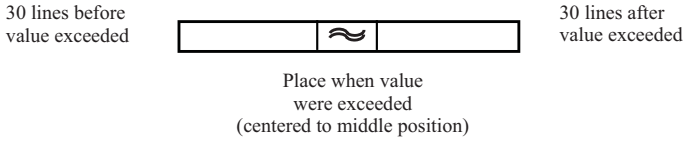


7.1 SchecK® memory description

The TL-3524 includes a 10,000 lines long-term memory and SchecK memory for storing of measured values in the 0.1 to 60 second sample rate. The measured data you can download via standard PC serial cable RS-232 into Laptop or Personal Computer.



Cases 1 to 20 include 60 lines of exceeded limit values and engine hours when the values were exceeded.



In this version it is possible to read last 20 exceeded records at total operational time.

8.1 Transponder Connection

The data transfer to the transponder is accomplished by connecting the data lines to their corresponding pins on the transponder.

	A1	A2	A4	B1	B2	B4	C1	C2	C4	STROBE
PIN 1	14	13	15	19	17	16	21	18	20	Disable
PIN 2	16	15	14	17	19	18	22	21	20	Disable
PIN 5	1	2	3	14	15	16	17	18	19	Disable
PIN 6	4	6	8	9	10	11	3	5	7	Disable
PIN 9	A	B	C	D	E	F	H	J	K	Disable
PIN 10	12	10	7	6	5	4	8	11	9	Disable
PIN 13	7	5	3	12	13	14	8	6	4	2
PIN 14	3	5	6	9	11	12	10	4	7	Disable
PIN 17	4	5	6	7	8	9	10	11	12	3
PIN 3	6	7	9	4	1	2	3	8	10	Disable
	M	K	J	E	C	B	D	L	H	Disable
	G	H	J	K	L	M	P	R	S	Disable
	6	7	8	9	10	11	12	13	14	5
	9	10	11	12	13	17	18	19	20	Disable
	7	6	8	12	10	9	14	11	13	5
	2	4	8	9	10	11	1	3	5	12
	7	6	13	9	10	11	14	16	12	19
	5	17	16	15	2	14	3	4	18	12
	13	31	12	33	14	32	16	34	15	Disable
	K	C	W	T	L	D	P	F	Z	Disable

ARC RT359A/459A/859A
BECKER ATC 2000/3401
BECKER ATC 4401
BENDIX TRP-2060/2061/660
BENDIX TR541A/641B
COLLINS TDR-950/950L
EDO-AIRE RT-777
GARMIN 320/320A/327
GENAVE BETA 5000
KING KT76/78
KING KT76A/78A/76C/79
KING 750A
KING KT75
MICROAIR T2000
NARCO AT50/50A/150
NARCO AT5/6/6A
RADAIR 250
TERRA TRT250/250D
UPS/APPLLO SL70
WILCOX 1014A

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