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HygroPalm HP21 Hand-Held Indicator
User Guide

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Applicability:

This manual is valid for the HP21 with firmware version 1.x, where 1.x can be 1.0, 1.1 etc. Changes to the last digit of the version number reflect minor firmware changes that do not affect the manner in which the instrument should be operated.

1   Overview

The HP21 is a highly accurate hand-held indicator that displays relative humidity, temperature and the dew or frost point. The HP21 is perfect for spot checking HVAC installations, manufacturing and storage areas, and generally for all ambient air measurement within the temperature range of
-10 to 60°C (14 to 140 °F). The HP21 operates with a regular 9V alkaline battery.

Based on the ROTRONIC AirChip 3000 digital technology the HP21 offers the following user functions:

- User configurable settings
- Calculation of the dew or frost point
- Humidity temperature calibration and adjustment
- Simulator mode
- Automatic humidity sensor test and drift compensation
- Sensor failure mode
- Data recording

The ability for the user to easily update the AirChip 3000 firmware means that the HP21 can be kept up-to-date regarding any future functionality improvement.

2   General description

2.1   Power supply

The HP21 operates with a regular 9V alkaline battery

2.2   Measured parameters

The HP21 measures relative humidity with a ROTRONIC Hygromer® IN1 capacitive sensor and temperature with a Pt100 RTD.

2.3   Calculated parameters

Using the ROTRONIC HW4 software, the HP21 can be configured by the user to calculate either the dew point or the frost point.

2.4   Sensor protection (dust filter)

The HP21 is supplied with a Polyethylene filter to protect the sensors against dust particles and high air velocity.

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2.5   Service connector

The service connector (UART interface with a mini-USB type connector) allows connecting the HP21 either to a PC running the ROTRONIC HW4 software or to a probe input of another instrument that is compatible with the HygroClip 2 (HC2) probes. In both cases a service cable is required. See "Maintenance" for the location of the service connector and for the type of service cable to be used.

- Connecting the HP21 to a PC is used to configure the HP21, gain access to the HP21 functions such as humidity and temperature adjustment, read data from the HP21 on the PC and update the AirChip 3000 firmware.

- Connecting the HP21 to another instrument is useful only when the other instrument has its own display and keypad, and has a more powerful internal menu than the HP21 (example HP23 hand-held calibrator). This allows showing the data measured by the HP21 on the other instrument display and also allows using the other instrument internal menu to do for example a humidity and temperature adjustment of the HP21.

3   Functions

The HP21 functions fall into two main categories:

a) AirChip 3000 internal functions

- Temperature sensor signal conditioning
- Humidity sensor signal conditioning
- Sensor failure digital alarm

b) AirChip 3000 user functions

- Psychrometric calculations *[no calculation]*
- Out-of-limit values *[disabled]*
- Simulator mode *[disabled]*
- Automatic humidity sensor test and drift compensation *[disabled]*
- Sensor failure mode *[disabled]*
- Data recording *[off]*
- Humidity-temperature calibration and adjustment

Notes:

o   Where relevant, the function factory default is indicated in italics
o   For a general description of all AirChip 3000 functions see document **E-T-AC3000-DF-V1**
o   Enabling, configuring and using the AirChip 3000 user functions requires a PC with the HW4 software installed (version 2.1.0 or higher). See "Maintenance" for the location of the service connector and for the type of service cable to be used. Instructions are provided in the HW4 manuals: **E-M-HW4v2.1-Main, E-M-HW4v2.1-F2-004, E-M-HW4v2.1-DR-001** and **E-M-HW4v2.1-A2-001**.

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4   User configurable settings

Configuration of the HP21 by the user requires a PC with the ROTRONIC HW4 software (version 2.1.0 or higher) installed. See "Maintenance" for the location of the service connector and for the type of service cable to be used. Instructions are provided in the HW4 manual **E-M-HW4v2.1-F2-004**.

The following settings can be configured with the HW4 software:

Configurable Setting	Factory default
Temperature unit	°C, except USA: °F
Psychrometric calculation	Dew point
Display resolution	1 decimal
Display backlight	On Key Press
Trend indicator	Enabled
Allow menu access (internal menu)	Enabled
RS-485 address	0
Device name	Instrument model
Device write protection	Disabled

Notes:

o The factory default setting for dew / frost point calculation is frost point below freezing.
o Unauthorized access to the menu can be prevented by disabling the "Allow menu access" setting in HW4 Device Manager > Display

5   Operation

5.1   Display
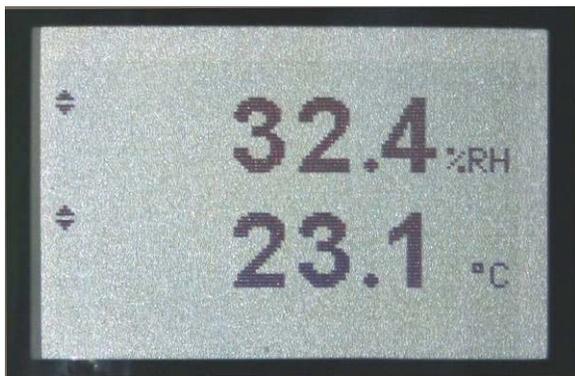
The LC display of the HP21 has a backlight which can be set to be on all the time or whenever a key is pressed. The backlight can also be disabled.

The upper line corresponds to relative humidity or dew / frost point and the bottom line corresponds to temperature.

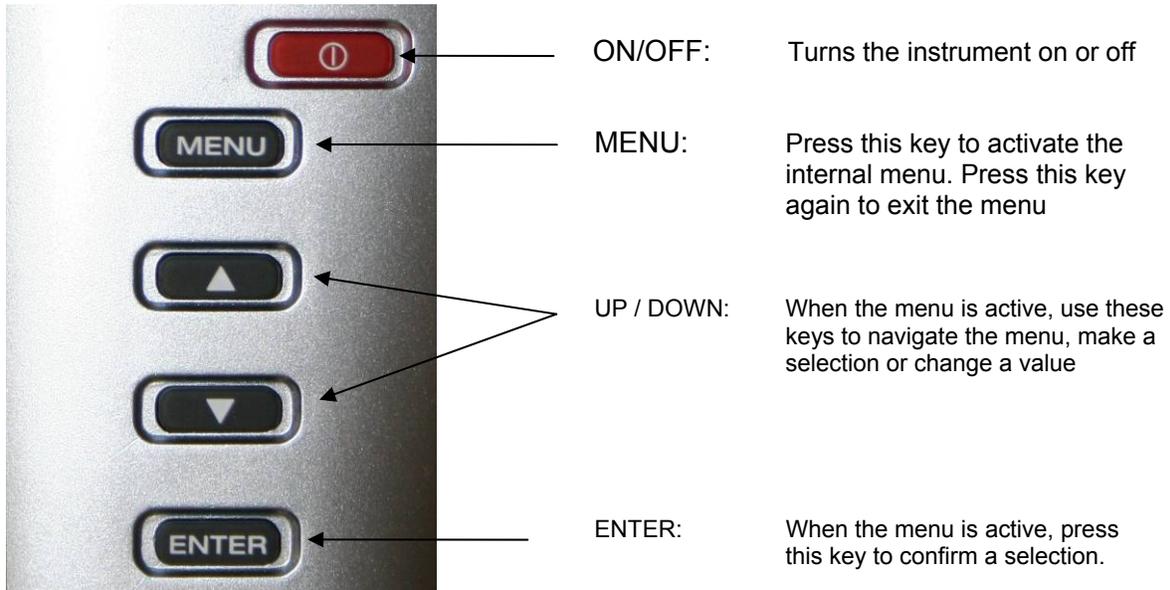The display can be configured to show a trend indicator on each line:

▲: increasing value
▼: decreasing value

In the event of an alarm the display shows the symbol **[!]** to the right of the value.

For instructions see the following HW4 manual: **E-M-HW4v2.1-F2-004**.

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5.2 Keypad

ON/OFF:	Turns the instrument on or off
MENU:	Press this key to activate the internal menu. Press this key again to exit the menu
UP / DOWN:	When the menu is active, use these keys to navigate the menu, make a selection or change a value
ENTER:	When the menu is active, press this key to confirm a selection.

5.3 Internal menu

Note: Unauthorized access to the menu can be prevented by disabling the "display menu" setting
(use the HW4 software > Device Manager > Display)

Main Menu	Menu Items	Selections / Information	Notes
Settings			
	Record	On / Off	Data recording (max. 2000 values)
	Unit	°C / °F	Temperature / dew or frost point
	Back Light	Key Press / On / Off	Display backlight mode
Device Information			
	Version	Firmware version	
	Serial Nbr	Serial number	
	Address	RS-485 address	
	Type	Device type	
	Name	Device name	User defined
	SensorTest	Humidity sensor status	Off / Good / SQ-Tuned / Bad
Humidity Adjust			
	RefValue	Humidity reference value	± 0.1 %RH steps
	<Adjust>		1-point adjustment only (offset)
Temperature Adjust			
	RefValue	Temperature reference value	± 0.1 °C steps
	<Adjust>		1-point adjustment only (offset)

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Notes:

o **Record:** both the recording mode (start / stop and the log interval cannot be changed from the menu and are as configured with the ROTRONIC HW4 software
o **SensorTest:** Off means that the humidity sensor has not been tested due to the configuration settings of the test. For a description of the automatic humidity sensor test and drift compensation (SQ-tuning) see documents **E-T-AC3000-DF-V1** and **E-M-HW4v2.1-F2-004**

5.4   Changing the parameters shown on the display

When the menu is not active, press the ENTER key to change which parameters are shown on the display:

o   Relative humidity and temperature
o   Dew / frost point and temperature (when calculated parameter is enabled)

5.5   Changing the temperature unit

The temperature unit of the HP21 (°C or °F) can be changed from the keypad (Menu > Settings > Unit).

- Press the MENU key to show the internal menu on the display
- With the menu item Settings highlighted, press the ENTER key
- With the menu item Unit highlighted, press the ENTER key
- Use the UP or DOWN key to change the temperature unit as desired
- Press the MENU key twice to exit the menu and return the HP21 to normal operation

The optional HW4 software can also be used to change the unit system:

5.6   Low battery indicator

When the battery is down to about 20% of its initial charge, "Low Battery" appears at the bottom of the display.

5.7   Practical advice for measuring humidity

The most common source of error when measuring relative humidity is a difference between the temperature of the probe and the temperature of the environment. At a humidity condition of 50 %RH, a temperature difference of 1°C (1.8 °F) typically results in an error of 3 %RH on relative humidity.

When using the HP21 hand-held indicator, it is good practice to monitor the display for temperature stability. The probe should be given sufficient time to equilibrate with the environment to be measured. The larger the initial temperature difference between the probe and the environment to be measured, the more time temperature equilibration requires. This time can be shortened, and errors avoided, by using the probe configuration that fits best for your application.

In extreme situations, condensation may occur on the sensors when the probe is colder than the environment. As long as the humidity / temperature limits of the humidity sensor are not exceeded, condensation does not alter the calibration of the sensor. However, the sensor has to dry out before it can provide a valid measurement.

Non-moving air is an excellent insulator. When there is no air movement, surprising differences in temperature and humidity can noted over short distances. Air movement at the probe generally results in measurements that are both faster and more accurate.

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6 Maintenance

6.1 Service cable

- Cable AC3006 converts UART (service connector) to USB and is used to connect the HP21 to a USB port of a PC running the ROTRONIC HW4 software. Prior to using this cable, the ROTRONIC USB driver must be installed on the PC. Both the driver and the installation instructions (document **E-M-HW4v2.1-Main**) are located on the HW4 CD.
- As an alternative, cable AC2001 is used to connect the HP21 to a probe input of the HP23 hand-held calibrator. For service purposes, the HP23 offers essentially the same functionality as the HW4 software.

6.2 Location of the service connector (mini USB type)

The service connector (UART interface) can be accessed without opening the enclosure after removing the protective red round cover.

6.3 Periodic calibration check

Both the Pt 100 RTD temperature sensor and associated electronics are very stable and should not require any calibration after the initial factory adjustment.

Long term stability of the ROTRONIC Hygromer humidity sensor is typically better than 1 %RH per year. For maximum accuracy, calibration of the HP21 should be verified every 6 to 12 months. Applications where the HP21 is exposed to significant pollution may require more frequent verifications.

a) Procedure for adjusting the HP21 from the keypad

The keypad of the HP21 allows a 1-point adjustment of temperature or humidity against a reference. A 1-point adjustment has the effect of adding the same offset to all measured values. A multi-point adjustment is not possible from the keypad and requires using either a PC with the HW4 software installed or the HP23 hand-held calibrator.

- When the parameter to be adjusted is stable, press the MENU key to show the internal menu on the display
- Use the DOWN key to select either H-Adjust or T-Adjust and press the ENTER key
- Make sure that the text line beginning with RefValue is highlighted and press the ENTER key
- Use the UP or DOWN key to change the reference value as desired
- Use the DOWN key to highlight the Adjust text line and press the ENTER key
- The HP21 confirms the adjustment with the message "Adjust OK"
- Press the MENU key twice to exit the menu and return the HP21 to normal operation

Notes:

- The calibration point is automatically deleted from the probe memory after an adjustment
- Because the HP21 has no real time clock, the date of the adjustment is not written to the HP21. If retaining the adjustment date is important, use the HW4 software to adjust the HP21.

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b) Procedure for adjusting the HP21 with the ROTRONIC HW4 software:

- Use cable AC3006 to connect the service connector of the HP21 to the USB port of a PC with the ROTRONIC HW4 software installed. Note that the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v2.1-Main**
- Start HW4 on the PC and search for the HP21(HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HP21 with HW4, expand the device tree to see the HP21 functions.
  Select **Probe Adjustment**.
- For further instructions see HW4 manual **E-M-HW4v2.1-A2-001**

6.4   Replacing the battery

To replace the battery, turn the latching button counter-clockwise and pull out the battery holder.

6.5   Cleaning or replacing the dust filter

Depending on the application, the dust filter may require cleaning from time to time, Cleaning should be done without removing the filter from the probe. Clean the filter with a fine brush. If this is not sufficient, the filter should be replaced. To do this, unscrew the filter from the probe. Before putting on a new dust filter, check the alignment of both sensors with the probe. The wires that connect the sensors to the probe are very thin and bend easily. If this happens, correct the alignment by holding the sensor very gently with a pair of small flat nosed pliers.

7   Firmware updates

Firmware updates will be available on the ROTRONIC website for downloading. Firmware files are given a name that shows both to which device the file applies and the version number of the firmware. All firmware files have the extension HEX. Procedure for updating the firmware:

- Use cable AC3006 to connect the service connector of the HP21 to the USB port of a PC with the ROTRONIC HW4 software installed. Note that the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v2.1-Main**
- Copy the firmware update file from the ROTRONIC website to the PC.
- Start HW4 software on the PC and search for the HP21 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HP21, expand the device tree to see the HP21 functions. Select Device Manager. In the Device Manager menu bar select Tools > Firmware Update. For instructions see document **E-M-HW4v2.1-F2-004**

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8 Technical data

8.1 Specifications

General	HP21
Device type	Humidity-temperature hand-held indicator with integral probe
Battery type	9 V alkaline
Low battery indication	Yes

Humidity measurement	HP21
Sensor	ROTRONIC Hygromer ® IN1
Measuring range	0…100 %RH
Measurement accuracy at 23 °C	±1.0 %RH
Repeatability	0.3 %RH
Long term stability	< 1 %RH / year
Sensor time constant	Typical 10 sec, 63% of a 35 to 80 %RH step change (1m/sec air flow at sensor)

Temperature measurement	HP21
Sensor	Pt100 RTD, IEC 751 1/3 class B
Measuring range	-10...60°C
Measurement accuracy at 23 °C	±0.2 °C
Repeatability	0.05°C
Long term stability	< 0.1°C / year
Sensor time constant	Typical 4 sec, 63% of a step change (1m/sec air flow at sensor)

Calculated parameters	HP21
Psychrometric calculations	Dew or frost point (user configurable setting)

Start-up time and data refresh rate	HP21
Start-up time	1.9s (typical)
Data refresh rate	1.7s (typical)

Service connector	HP21
Interface type	UART
Maximum service cable length	5 m (16.4 ft)

| General specifications	HP21
Display	LC, 1 or 2 decimals resolution, backlight, trend, alarm and low battery indication
Probe material	Polycarbonate
Probe dust filter material	Polyethylene
Housing material	ABS
Housing protection grade	IP 40
Overall dimensions	270 x 70 x 30 mm (10.63 x 2.76 x 1.17")
Probe dimensions	80 x 15 mm (3.15 x 0.59")
Weight	About 198 g (7.0 oz)

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Conformity with standards	HP21
CE / EMC immunity	EMC Directive 2004/108/EG: EN 61000-6-1: 2001, EN 61000-6-2: 2005 EN 61000-6-3: 2005, EN 61000-6-4: 2001 + A11
Solder type	Lead free (RoHS directive)
FDA / GAMP directives	compatible

Environmental limits	HP21
Storage and transit	-20…+70 °C / 0…100 %RH, non condensing
Operating limits at electronics	-10….60 °C (limited by LC display) 0…100 %RH, non condensing
Temperature limits at probe	Same as electronics
Maximum humidity at probe	Same as electronics
Maximum air velocity at probe	20 m/s (3,935 ft /min)
Critical environments	Humidity sensor: as per DV04-14.0803.02 - Critical chemicals

8.2   Dew point accuracy

The HP21 can be configured to calculate either the dew point or frost point based on the measurement of relative humidity and temperature. The accuracy of this conversion varies, depending on the humidity and temperature conditions as shown in the graph below:

DP/FP Accucary
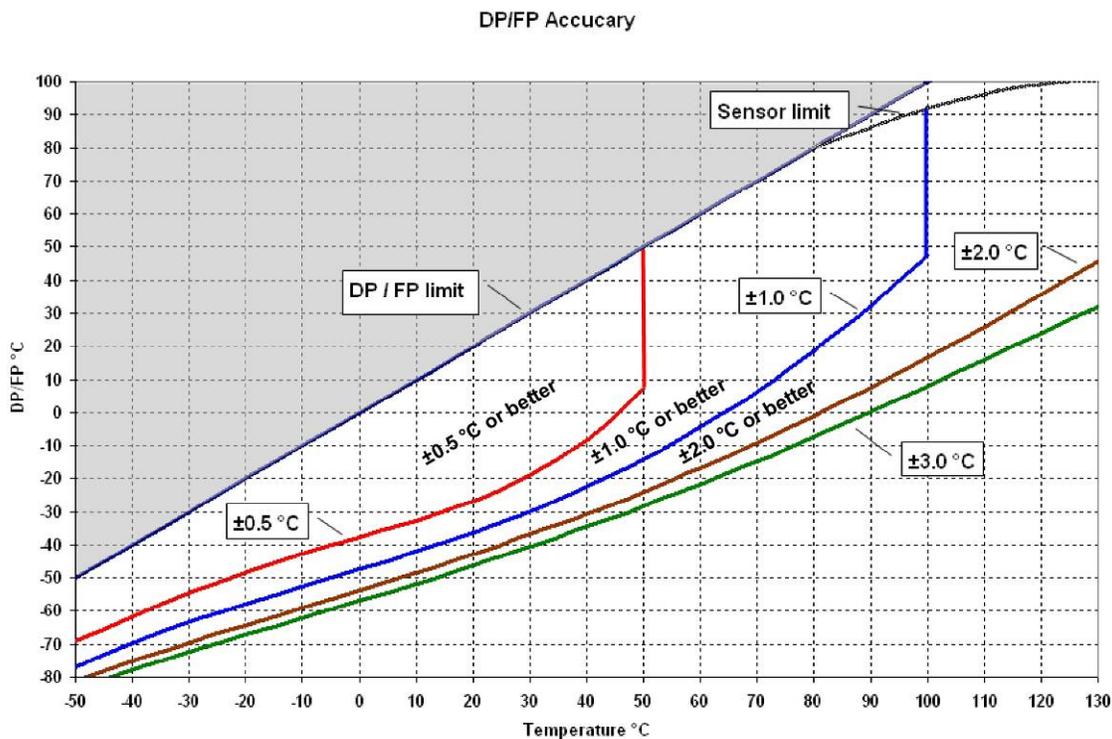
Example: at a temperature of 20 ˚C, a dew point value of -37 ˚C is measured with an accuracy of ± 1.0 ˚C or better.

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9 Accessories

9.1 Configuration software

The ROTRONIC HW4 software (version 2.1.0 or higher) allows configuring the HF4. HW4 is compatible with Windows XP, Vista and NT4 with SP6a or higher. For more details see separate instruction manual provided with the software.

Order Code	Description
HW4-E	HW4 software, Standard Edition (single user)

9.2 Service cables

Order Code	Description	
AC3006	Mini-USB service connector (UART) to a PC USB port. Cable electronics convert UART interface to USB interface	
AC2001	Mini-USB service connector (UART) to 7-pin probe connector of the HP23 hand-held calibrator.	

IMPORTANT: Prior to using cable AC3006, the ROTRONIC USB driver must be installed on the PC. Both the driver and the installation instructions (document **E-M-HW4v2.1-Main**) are located on the HW4 CD.

9.3 Calibration accessories

Order Code	Description
EA00-SCS	0.5 %RH humidity std, SCS cert., pack of 5
EA05-SCS	5 %RH humidity std, SCS cert., pack of 5
EA10-SCS	10 %RH humidity std, SCS cert., pack of 5
EA20-SCS	20 %RH humidity std, SCS cert., pack of 5
EA35-SCS	35 %RH humidity std, SCS cert., pack of 5
EA50-SCS	50 %RH humidity std, SCS cert., pack of 5
EA65-SCS	65 %RH humidity std, SCS cert., pack of 5
EA80-SCS	80 %RH humidity std, SCS cert., pack of 5
EA95-SCS	95 %RH humidity std, SCS cert., pack of 5
ER-15	Calibration device for 15mm diameter probes

For instructions regarding the ROTRONIC humidity standards and calibration devices see document **E-M-CalBasics**.

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9.4 Spare filters

Order Code		Slotted cap	Filter Insert	Notes
NSP-PCB-PE		Polycarbonate, black	Polyethylene	Standard filter insert
NSP-PCB-WM			Wire mesh	For applications requiring faster response time
NSP-PCB-TF			Teflon	High humidity, low air flow

10 Supporting documents

Document File Name	Contents
E-T-AC3000-DF-V1	AirChip 3000 Description and Main Functions
E-M-HW4v2.1-DIR	List of the HW4 manuals
E-M-HW4v2.1-Main	HW4 software version 2.1: General instructions and functions common to all devices
E-M-HW4v2.1-F2-004	HW4 software version 2.1: HP21 hand-held indicator Device configuration and AirChip 3000 functions
E-M-HW4v2.1-A2-001	HW4 software version 2.1: Probe Adjustment function AirChip 3000 devices
E-M-HW4v2.1-DR-001	HW4 software version 2.1: Data Recording Function AirChip 3000 Devices
E-M-AC3000-CP	AirChip 3000 Communication Protocol
E-M-CalBasics	Temperature and humidity calibration basics Instructions for using the ROTRONIC humidity standards
E-T-HumiDefs	Humidity Definitions
DV04-14.0803.02	Critical chemicals
E-T-HC2-Equivalence	Product equivalence with previous models

Note: All document file names have an extension corresponding to the document release number (example of a first release: E-M-HW4v2.1-Main_10). This extension is not shown in the above table.

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11 Document releases

Doc. Release	Date	Notes
_10	Jun. 27, 2008	Original release