ภาคผนวก ค

Prompt Technical Services Limited

3rd Floor, 555, Paul Tower, Vibhavadi Rangsit road, Tungsonghong, Laksi, Bangkok 10210

Tel: +66 2984 6111 (Auto Line), Fax: +66 2984 6123   www.prompt.co.th

ISO9001 : 2008

Quotation

TO : กรมการปกครอง(วังไชยา) 442 ถนน นครสวรรค์ แขวง สี่แยกมหานาค เขต ดุสิต กรุงเทพมหานคร 10300	**Reference** : Q-21012
ATTN : อธิบดีกรมการปกครอง	**DATE** : 19/11/2021
REF :	**TEL NO** :
SUBJECT : โครงการจัดหาระบบฐานข้อมูลหัวกระสุนปืนและปลอกกระสุนปืน ศูนย์ปฏิบัติการฯ จังหวัดราชบุรี	**FAX NO** :

Item	Qty	Unit	Description	Unit/Price	Total
1	12	ชุด	เครื่องคอมพิวเตอร์ สำหรับงานประมวลผล แบบที่ 2 : สำหรับเครื่องลูกข่ายระบบบริหารจัดการฐานข้อมูล และเชื่อมโยงข้อมูล (DataLink Workstation)	30,000	360,000
2	1	ชุด	อุปกรณ์ป้องกันเครือข่าย (Next Generation Firewall) แบบที่ 1	240,000	240,000
3	1	ชุด	อุปกรณ์ค้นหาเส้นทางเครือข่าย (Router)	44,000	44,000
4	2	ชุด	อุปกรณ์กระจายสัญญาณ (L2 Switch) ขนาด 24 ช่อง แบบที่ 2	21,000	42,000
5	12	ชุด	เครื่องพิมพ์ Multifunction เลเซอร์ หรือ LED สี	15,000	180,000
6	1	ชุด	ตู้สำหรับจัดเก็บเครื่องคอมพิวเตอร์และอุปกรณ์ แบบที่ 2 (ขนาด 42U)	22,000	22,000
7	2	ชุด	คอมพิวเตอร์แท็ปเล็ต แบบที่ 2	20,000	40,000
8	12	ชุด	ชุดโปรแกรมระบบปฏิบัติการสำหรับเครื่องคอมพิวเตอร์ ที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย	3,800	45,600
9	12	ชุด	ชุดโปรแกรมจัดการสำนักงาน ที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย	12,000	144,000
10	2	ชุด	ชุดเครื่องนำเข้าข้อมูลภาพปลอกกระสุนปืนระบบสามมิติพร้อมโปรแกรมการใช้งาน (3D Brass Capture)	9,847,500	19,695,000
11	2	ชุด	ชุดเครื่องนำเข้าข้อมูลภาพหัวกระสุนปืนระบบสามมิติพร้อมโปรแกรมการใช้งาน (3D Bullet Capture)	17,927,500	35,855,000
12	1	ชุด	ชุดเครื่องวิเคราะห์เครื่องกระสุนปืนพร้อมโปรแกรมการใช้งาน (Ballistic Data Analysis)	7,500,000	7,500,000
13	1	ชุด	ชุดจัดเก็บข้อมูลสำหรับระบบฐานข้อมูลทางนิติวิทยาศาสตร์พร้อมโปรแกรมการใช้งาน (Data Concentrator System)	8,500,000	8,500,000
14	1	ชุด	เครื่องสำรองไฟฟ้าขนาด 40 kVA	1,381,000	1,381,000
15	24	เดือน	ค่าใช้จ่ายสำหรับวงจรเช่า (Leased Line)	9,800	235,200
16	1	ชุด	แท็งก์ยิงเก็บปลอกกระสุนปืน และลูกกระสุนปืน พร้อมอุปกรณ์ระบบ	3,750,000	3,750,000
17	1	ชุด	โต๊ะพร้อมเก้าอี้สำหรับเครื่องคอมพิวเตอร์และเครื่องพิมพ์ ชั้น 1-2	88,200	88,200
18	1	ชุด	ตู้จัดเก็บหัวกระสุนปืนและปลอกกระสุนปืน พร้อมอุปกรณ์สนับสนุนการเก็บตัวอย่างหัวกระสุนปืนและปลอกกระ	890,000	890,000
19	1	งาน	งานติดตั้งระบบ	850,000	850,000
20	1	งาน	ค่าฝึกอบรมพร้อมคู่มือ	295,000	295,000
21	1	งาน	ค่าใช้จ่ายของเจ้าหน้าที่ประจำโครงการ	2,700,000.00	2,700,000
			Total	THB ฿	82,857,000

Terms & Conditions :

Quoted   : Thai Baht Included VAT 7%

Payment Term

Delivery Time : 14 month after Signed contracts

Validity   : 90 days from date to propose quotation

Note

Best Regards

Prompt Technical Services Limited

Nitit Chuayraksa

Account Engineer

ES solutions

บริษัท อีเอส โซลูชั่น จำกัด สำนักงานใหญ่
ES SOLUTIONS CO.,LTD. Head Office

39/51-52 หมู่ 4 ต.บึงคำพร้อย อ.ลำลูกกา จ.ปทุมธานี 12150
39/51-52 Moo 4 Buengkhamphroi, Lamlukka , Pathumthani 12150

QUOTATION / ใบเสนอราคา

นามผู้รับ : กรมการปกครอง วังไชยา(นางเลิ้ง) ถนนนครสวรรค์	**เลขที่ / QT No. :** ES - 641118
Name : แขวงสวนจิตรลดา เขตดุสิต กรุงเทพมหานคร10300	**วันที่ / Date :** 18 / 11 / 64
	ผู้ติดต่อ : บริษัท อีเอส โซลูชั่น จำกัด
	Contact :

โครงการ / Project : โครงการจัดหาระบบฐานข้อมูลหัวกระสุนปืนและปลอกกระสุนปืน ศูนย์ปฏิบัติการฯ จังหวัดราชบุรี

1/2

บริษัทฯ มีความยินดีขอเรียนเสนอราคาสินค้ามาเพื่อพิจารณา ดังรายละเอียดดังต่อไปนี้ / We are pleased to quote you for term & condition as follows:-

ลำดับ Item	รายการ Description	จำนวน QTY		ราคา / หน่วย Unit Price	จำนวนเงิน Amount
1	เครื่องคอมพิวเตอร์ สำหรับงานประมวลผล แบบที่ 2 : สำหรับเครื่องลูกข่ายระบบบริหาร จัดการฐานข้อมูลและเชื่อมโยงข้อมูล (DataLink Workstation)	12	ชุด	30,000	360,000
2	อุปกรณ์ป้องกันเครือข่าย (Next Generation Firewall) แบบที่ 1	1	ชุด	240,000	240,000
3	อุปกรณ์ค้นหาเส้นทางเครือข่าย (Router)	1	ชุด	44,000	44,000
4	อุปกรณ์กระจายสัญญาณ (L2 Switch) ขนาด 24 ช่อง แบบที่ 2	2	ชุด	21,000	42,000
5	เครื่องพิมพ์ Multifunction เลเซอร์ หรือ LED สี	12	ชุด	15,000	180,000
6	ตู้สำหรับจัดเก็บเครื่องคอมพิวเตอร์และอุปกรณ์ แบบที่ 2 (ขนาด 42U)	1	ชุด	22,000	22,000
7	คอมพิวเตอร์แท็ปเล็ต แบบที่ 2	2	ชุด	20,000	40,000
8	ชุดโปรแกรมระบบปฏิบัติการสำหรับเครื่องคอมพิวเตอร์ ที่มีลิขสิทธิ์ถูกต้องตามกฎหม	12	ชุด	3,800	45,600
9	ชุดโปรแกรมจัดการสำนักงาน ที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย	12	ชุด	12,000	144,000
10	ชุดเครื่องนำเข้าข้อมูลภาพปลอกกระสุนปืนระบบสามมิติพร้อมโปรแกรมการใช้งาน (3D Brass Capture)	2	ชุด	10,500,000.00	21,000,000
11	ชุดเครื่องนำเข้าข้อมูลภาพหัวกระสุนปืนระบบสามมิติพร้อมโปรแกรมการใช้งาน (3D Bullet Capture)	2	ชุด	17,950,000.00	35,900,000
12	ชุดเครื่องวิเคราะห์เครื่องกระสุนปืนพร้อมโปรแกรมการใช้งาน (Ballistic Data Analysis)	1	ชุด	7,950,000	7,950,000

กำหนดการยืนราคา : Validity	60 วัน		
กำหนดการจัดส่งสินค้า : Delivery time	420 วัน	บริษัท / ห้างฯ ยินดีสั่งซื้อสินค้าตามรายการและเงื่อนไขข้างต้น	
เงื่อนไขการชำระเงิน : Terms of Payment		ลงชื่อ .... ผู้สั่งซื้อ	

บริษัทฯ หวังเป็นอย่างยิ่งว่าคงจะได้รับการพิจารณาสั่งซื้อจากท่านในเร็ววันนี้

We hope our offer complies with your wishes and look forward to your order from you soon

Yours Faithfully,

(Mr. Prasan Puyati)
Manager

(....)

ตำแหน่ง ....

วันที่ ....

QUOTATION / ใบเสนอราคา

นามผู้รับ : กรมการปกครอง วังไชยา (นางเลิ้ง) ถนนนครสวรรค์

Name : แขวงสวนจิตรลดา เขตดุสิต กรุงเทพมหานคร10300

เลขที่ / QT No. : ES - 641118

วันที่ / Date : 18 / 11 / 64

ผู้ติดต่อ : บริษัท อีเอส โซลูชั่น จำกัด

Contact :

โครงการ / Project : โครงการจัดหาระบบฐานข้อมูลหัวกระสุนปืนและปลอกกระสุนปืน ศูนย์ปฏิบัติการฯ จังหวัดราชบุรี

2/2

บริษัทฯ มีความยินดีขอเรียนเสนอราคาสินค้ามาเพื่อพิจารณา ดังรายละเอียดดังต่อไปนี้ / We are pleased to quote you for term & condition as follows:-

ลำดับ Item	รายการ Description	จำนวน QTY		ราคา / หน่วย Unit Price	จำนวนเงิน Amount
13	ชุดจัดเก็บข้อมูลสำหรับระบบฐานข้อมูลทางนิติวิทยาศาสตร์พร้อมโปรแกรมการใช้งาน (Data Concentrator System)	1	ชุด	9,650,000	9,650,000
14	เครื่องสำรองไฟฟ้าขนาด 40 kVA	1	ชุด	1,500,000	1,500,000
15	ค่าใช้จ่ายสำหรับวงจรเช่า (Leased Line)	24	เดือน	9,900	237,600
16	แท็งก์ยิงเก็บปลอกกระสุนปืน และลูกกระสุนปืน พร้อมอุปกรณ์ระบบ	1	ชุด	3,750,000	3,750,000
17	โต๊ะพร้อมเก้าอี้สำหรับเครื่องคอมพิวเตอร์และเครื่องพิมพ์ ชั้น 1-2	1	ชุด	88,200	88,200
18	ตู้จัดเก็บหัวกระสุนปืนและปลอกกระสุนปืน พร้อมอุปกรณ์สนับสนุนการเก็บตัวอย่าง หัวกระสุนปืนและปลอกกระสุนปืน	1	ชุด	890,000	890,000
19	งานติดตั้งระบบ	1	ชุด	850,000	850,000
20	ค่าฝึกอบรมพร้อมคู่มือ	1	ชุด	295,000	295,000
21	ค่าใช้จ่ายของเจ้าหน้าที่ประจำโครงการ	1	ชุด	2,700,000.00	2,700,000
	TOTAL				85,928,400
	VAT 7 %				
	NET TOTAL				**85,928,400**

กำหนดการยืนราคา : 60 วัน
Validity

กำหนดการจัดส่งสินค้า : 420 วัน
Delivery time

เงื่อนไขการชำระเงิน :
Terms of Payment

บริษัทฯ หวังเป็นอย่างยิ่งว่าคงจะได้รับการพิจารณาสั่งซื้อจากท่านในเร็ววันนี้

We hope our offer complies with your wishs and we look forward to your order from you soon

Yours Faithfully,

(Mr. Prasan Puyati)
Manager

บริษัท / ห้างฯ ยินดีสั่งซื้อสินค้าตามรายการและเงื่อนไขข้างต้น

ลงชื่อ .... ผู้สั่งซื้อ

(....)

ตำแหน่ง ....

วันที่ ....

Quotation

บริษัท ดิจิตอล อินสทรูเมนท์ จำกัด

Digital Instrument Co.,Ltd. (สำนักงานใหญ่)   เลขประจำตัวผู้เสียภาษี 0105546075766

Digital Instrument Co.,Ltd.
18th Anniversary

45 Soi Ngamwongwan 19, Bangkrasor, Muang Nonthaburi, Nonthaburi 11000

Tel: 02 - 589 - 7588 , 02 - 589 - 7609   Fax . 02 - 589 - 7904

www.digitalinstrument.co.th   E-mail : info@digitins.com

| To : | กรมการปกครอง วังไชยา(นางเลิ้ง) ถนนนครสวรรค์ แขวงสวนจิตรดา เขตดุสิต กรุงเทพมหานคร 10300 | Quote No.: | DI-SA 752/2021 |
| Subject: | โครงการจัดหาระบบฐานข้อมูลหัวกระสุนปืนและปลอกกระสุนปืน ศูนย์ปฏิบัติการฯ จังหวัดราชบุรี | Quote Date: | |

Item	Code	Description	Qty	Unit Price (Baht)	Amount (Baht)
1		เครื่องคอมพิวเตอร์ สำหรับงานประมวลผล แบบที่ 2 : สำหรับเครื่องลูกข่าย ระบบบริหารจัดการฐานข้อมูลและเชื่อมโยงข้อมูล (DataLink Workstation)	12	30,000.00	360,000.00
2		อุปกรณ์ป้องกันเครือข่าย (Next Generation Firewall) แบบที่ 1	1	240,000.00	240,000.00
3		อุปกรณ์ค้นหาเส้นทางเครือข่าย (Router)	1	44,000.00	44,000.00
4		อุปกรณ์กระจายสัญญาณ (L2 Switch) ขนาด 24 ช่อง แบบที่ 2	2	21,000.00	42,000.00
5		เครื่องพิมพ์ Multifunction เลเซอร์ หรือ LED สี	12	15,000.00	180,000.00
6		ตู้สำหรับจัดเก็บเครื่องคอมพิวเตอร์และอุปกรณ์ แบบที่ 2 (ขนาด 42U)	1	22,000.00	22,000.00
7		คอมพิวเตอร์แท็บเล็ต แบบที่ 2	2	20,000.00	40,000.00
8		คอมพิวเตอร์แท็บเล็ต Tablet	12	3,800.00	45,600.00
9		ชุดโปรแกรมระบบปฏิบัติการสำหรับเครื่องคอมพิวเตอร์ ที่มีลิขสิทธิ์ถูกต้อง	12	12,000.00	144,000.00
10		ชุดเครื่องนำเข้าข้อมูลภาพปลอกกระสุนปืนระบบสามมิติพร้อมโปรแกรมการ (3D Brass Capture)	2	10,000,000.00	20,000,000.00
11		ชุดเครื่องนำเข้าข้อมูลภาพหัวกระสุนปืนระบบสามมิติพร้อมโปรแกรมการใช้ (3D Bullet Capture)	2	18,200,000.00	36,400,000.00
12		ชุดเครื่องวิเคราะห์เครื่องกระสุนปืนพร้อมโปรแกรมการใช้งาน (Ballistic Da	1	7,520,000.00	7,520,000.00
13		ชุดจัดเก็บข้อมูลสำหรับระบบฐานข้อมูลทางนิติวิทยาศาสตร์พร้อมโปรแกรม (Data Concentrator System)	1	9,800,000.00	9,800,000.00
14		เครื่องสำรองไฟฟ้าขนาด 40 kVA	1	1,620,000.00	1,620,000.00
15		ค่าใช้จ่ายสำหรับวงจรเช่า (Leased Line)	24	11,000.00	264,000.00
16		แท็งก์ยิงเก็บปลอกกระสุนปืน และลูกกระสุนปืน พร้อมอุปกรณ์ระบบ	1	3,750,000.00	3,750,000.00
17		โต๊ะพร้อมเก้าอี้สำหรับเครื่องคอมพิวเตอร์และเครื่องพิมพ์ ชั้น 1-2	1	88,200.00	88,200.00
18		ตู้จัดเก็บหัวกระสุนปืนและปลอกกระสุนปืน พร้อมอุปกรณ์สนับสนุนการเก็ หัวกระสุนปืนและปลอกกระสุนปืน	1	890,000.00	890,000.00

Quotation

Digital
Instrument Co.,Ltd.
18th Anniversary

บริษัท ดิจิตอล อินสทรูเมนท์ จำกัด

Digital Instrument Co.,Ltd. (สำนักงานใหญ่) เลขประจำตัวผู้เสียภาษี 0105546075766

45 Soi Ngamwongwan 19, Bangkrasor, Muang Nonthaburi, Nonthaburi 11000

Tel: 02 - 589 - 7588 , 02 - 589 - 7609   Fax . 02 - 589 - 7904

www.digitalinstrument.co.th   E-mail : info@digitins.com

To :	กรมการปกครอง วังไชยา(นางเลิ้ง) ถนนนครสวรรค์	Quote No.:	DI-SA 752/2021
	แขวงสวนจิตรดา เขตดุสิต กรุงเทพมหานคร 10300		
Subject:	โครงการจัดหาระบบฐานข้อมูลหัวกระสุนปืนและปลอกกระสุนปืน ศูนย์ปฏิบัติการฯ จังหวัดราชบุรี	Quote Date:	

Item	Code	Description	Qty	Unit Price (Baht)	Amount (Baht)
19		งานติดตั้งระบบ	1	850,000.00	850,000.00
20		ค่าฝึกอบรมพร้อมคู่มือ	1	295,000.00	295,000.00
21		ค่าใช้จ่ายของเจ้าหน้าที่ประจำโครงการ	1	2,700,000.00	2,700,000.00
				Total	85,294,800.00
		แปดสิบห้าล้านสองแสนเก้าหมื่นสี่พันแปดร้อยบาทถ้วน		**Grand Total**	85,294,800.00

Term & Conditions

1. ราคานี้รวมภาษีมูลค่าเพิ่ม 7% แล้ว
2. กำหนดส่งมอบสินค้า   420 วัน
3. กำหนดยืนราคา   60 วัน
4. ระยะเวลาสิ้นสุดโครงการ   14 เดือน

ขอแสดงความนับถือ

Digital
Instrument Co.,Ltd.

(นางสาวชัญญาพัทธ์ ศรีโภคา)
ผู้จัดการฝ่ายขาย

- มีหน่วยความจำหลัก (RAM) ชนิด DDR4 หรือดีกว่า มีขนาดไม่น้อยกว่า 4 GB
- มีหน่วยจัดเก็บข้อมูล ชนิด SATA หรือ ดีกว่า ขนาดความจุไม่น้อยกว่า 1 TB หรือชนิด Solid State Drive ขนาดความจุไม่น้อยกว่า 250 GB จำนวน 1 หน่วย
- มี DVD-RW หรือดีกว่า จำนวน 1 หน่วย
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 1 ช่อง
- มีช่องเชื่อมต่อ (Interface) แบบ USB 2.0 หรือดีกว่า ไม่น้อยกว่า 3 ช่อง
- มีแป้นพิมพ์และเมาส์
- มีจอแสดงภาพขนาดไม่น้อยกว่า 19 นิ้ว จำนวน 1 หน่วย

8. เครื่องคอมพิวเตอร์ สำหรับงานประมวลผล แบบที่ 2 * (จอแสดงภาพขนาดไม่น้อยกว่า 19 นิ้ว) ราคา 30,000 บาท
คุณลักษณะพื้นฐาน
- มีหน่วยประมวลผลกลาง (CPU) ไม่น้อยกว่า 6 แกนหลัก (6 core) โดยมีความเร็วสัญญาณนาฬิกาพื้นฐานไม่น้อยกว่า 3.0 GHz และมีเทคโนโลยีเพิ่มสัญญาณนาฬิกาได้ในกรณีที่ต้องใช้ความสามารถในการประมวลผลสูง จำนวน 1 หน่วย
- หน่วยประมวลผลกลาง (CPU) มีหน่วยความจำแบบ Cache Memory รวมในระดับ (Level) เดียวกัน ขนาดไม่น้อยกว่า 12 MB
- มีหน่วยประมวลผลเพื่อแสดงภาพ โดยมีคุณลักษณะอย่างใดอย่างหนึ่ง หรือดีกว่า ดังนี้
    1) เป็นแผงวงจรเพื่อแสดงภาพแยกจากแผงวงจรหลักที่มีหน่วยความจำขนาดไม่น้อยกว่า 2 GB หรือ
    2) มีหน่วยประมวลผลเพื่อแสดงภาพติดตั้งอยู่ภายในหน่วยประมวลผลกลาง แบบ Graphics Processing Unit ที่สามารถใช้หน่วยความจำหลักในการแสดงภาพขนาดไม่น้อยกว่า 2 GB หรือ
    3) มีหน่วยประมวลผลเพื่อแสดงภาพที่มีความสามารถในการใช้หน่วยความจำหลักในการแสดงภาพขนาดไม่น้อยกว่า 2 GB
- มีหน่วยความจำหลัก (RAM) ชนิด DDR4 หรือดีกว่า มีขนาดไม่น้อยกว่า 8 GB
- มีหน่วยจัดเก็บข้อมูล ชนิด SATA หรือดีกว่า ขนาดความจุไม่น้อยกว่า 2 TB หรือ ชนิด Solid State Drive ขนาดความจุไม่น้อยกว่า 480 GB จำนวน 1 หน่วย
- มี DVD-RW หรือดีกว่า จำนวน 1 หน่วย
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 1 ช่อง
- มีช่องเชื่อมต่อ (Interface) แบบ USB 2.0 หรือดีกว่า ไม่น้อยกว่า 3 ช่อง
- มีแป้นพิมพ์และเมาส์
- มีจอแสดงภาพขนาดไม่น้อยกว่า 19 นิ้ว จำนวน 1 หน่วย

9. เครื่องคอมพิวเตอร์ All In One สำหรับงานสำนักงาน ราคา 17,000 บาท
คุณลักษณะพื้นฐาน
- มีหน่วยประมวลผลกลาง (CPU) ไม่น้อยกว่า 2 แกนหลัก (2 core) โดย มีความเร็วสัญญาณนาฬิกาพื้นฐานไม่น้อยกว่า 2.2 GHz จำนวน 1 หน่วย
- หน่วยประมวลผลกลาง (CPU) มีหน่วยความจำแบบ Cache Memory รวมในระดับ (Level) เดียวกัน ขนาดไม่น้อยกว่า 4 MB
- มีหน่วยความจำหลัก (RAM) ชนิด DDR4 หรือดีกว่า มีขนาดไม่น้อยกว่า 4 GB

14. คอมพิวเตอร์แท็ปเล็ต แบบที่ 2 ราคา 20,000 บาท

คุณลักษณะพื้นฐาน

- มีหน่วยประมวลผลกลาง (CPU) ไม่น้อยกว่า 4 แกนหลัก (4 core)
- มีหน่วยความจำหลัก (RAM) ที่มีขนาดไม่น้อยกว่า 2 GB
- มีหน่วยความจำขนาดไม่น้อยกว่า 32 GB
- มีหน้าจอสัมผัสขนาดไม่น้อยกว่า 9.7 นิ้ว และมีความละเอียดไม่น้อยกว่า 2,048 x 1,536 Pixel
- สามารถใช้งานได้ไม่น้อยกว่า Wi-Fi (802.11b, g, n, ac), Bluetooth และ GPS
- มีอุปกรณ์เชื่อมต่อระบบ 4G หรือดีกว่า แบบติดตั้งภายในตัวเครื่อง (built-in)
- มีอุปกรณ์การเขียนที่สามารถใช้งานร่วมกับอุปกรณ์คอมพิวเตอร์แท็ปเล็ต
- มีกล้องด้านหน้าความละเอียดไม่น้อยกว่า 1.2 Megapixel
- มีกล้องด้านหลังความละเอียดไม่น้อยกว่า 8 Megapixel

15. อุปกรณ์สำหรับจัดเก็บข้อมูลแบบภายนอก (External Storage) ราคา 570,000 บาท

คุณลักษณะพื้นฐาน

- เป็นอุปกรณ์ที่ทำหน้าที่จัดเก็บข้อมูลแบบภายนอก (External Storage) ซึ่งสามารถทำงานในระบบ SAN (Storage Area Network) ได้
- มีส่วนควบคุมอุปกรณ์ (Controller) แบบ Dual Controller
- มีหน่วยจัดเก็บข้อมูล ชนิด SATA หรือ SAS หรือดีกว่า ขนาดความจุไม่น้อยกว่า 600 GB และมีความเร็วรอบไม่น้อยกว่า 10,000 รอบต่อนาที จำนวนไม่น้อยกว่า 12 หน่วย
- สามารถติดตั้ง Hard Disk ได้สูงสุด 24 หน่วย
- สามารถทำงาน แบบ Raid ไม่น้อยกว่า Raid 0, 1, 5

16. ค่าเช่าระบบจัดเก็บ Log File ระบบเครือข่าย แบบที่ 1 ราคา 16,000 บาทต่อเดือน

คุณลักษณะพื้นฐาน

- สามารถจัดเก็บ Log File จากอุปกรณ์ ไม่น้อยกว่า 5 อุปกรณ์
- สามารถจัดเก็บ Log File ได้ไม่น้อยกว่า 90 วัน
- กำหนดเวลา (NTP: Network Time Protocol) ให้กับอุปกรณ์เพื่อไม่ให้เกิดความคลาดเคลื่อนกับเวลามาตรฐาน
- สามารถจัดเก็บ Log File ได้ตามพระราชบัญญัติว่าด้วยการกระทำผิดเกี่ยวกับคอมพิวเตอร์ฉบับที่มีผลบังคับใช้

17. ค่าเช่าระบบจัดเก็บ Log File ระบบเครือข่าย แบบที่ 2 ราคา 30,000 บาทต่อเดือน

คุณลักษณะพื้นฐาน

- สามารถจัดเก็บ Log File จากอุปกรณ์ ไม่น้อยกว่า 10 อุปกรณ์
- สามารถจัดเก็บ Log File ได้ไม่น้อยกว่า 90 วัน
- กำหนดเวลา (NTP: Network Time Protocol) ให้กับอุปกรณ์เพื่อไม่ให้เกิดความคลาดเคลื่อนกับเวลามาตรฐาน
- สามารถจัดเก็บ Log File ได้ตามพระราชบัญญัติว่าด้วยการกระทำผิดเกี่ยวกับคอมพิวเตอร์ฉบับที่มีผลบังคับใช้

- สามารถจัดเก็บ log file ได้ถูกต้อง ตรงตามพระราชบัญญัติว่าด้วยการกระทำผิดเกี่ยวกับคอมพิวเตอร์ ฉบับที่มีผลบังคับใช้ โดยได้รับรองมาตรฐานการจัดเก็บและรักษาความปลอดภัยของ log file ที่ได้มาตรฐาน เช่น มาตรฐานของศูนย์อิเล็กทรอนิกส์และคอมพิวเตอร์แห่งชาติ (มศอ. 4003.1-2560) เป็นต้น
- สามารถทำการสำรองข้อมูล (Data Backup) ไปยังอุปกรณ์จัดเก็บข้อมูลภายนอก เช่น Tape หรือ DVD หรือ External Storage เป็นต้น ได้
- สามารถจัดเก็บข้อมูลเหตุการณ์ต่อวินาที (Events per Seconds) ได้ไม่น้อยกว่า 7,000 eps

21. อุปกรณ์จัดเก็บ Log File ระบบเครือข่าย แบบที่ 3 ราคา 850,000 บาท
   คุณลักษณะพื้นฐาน
   - เป็นอุปกรณ์ Appliance หรืออุปกรณ์คอมพิวเตอร์ที่ได้มาตรฐาน สามารถเก็บรวบรวมเหตุการณ์ (logs or Events) ที่เกิดขึ้นในอุปกรณ์ที่เป็น appliances และ non-appliances เช่น Firewall, Network Devices ต่าง ๆ, ระบบปฏิบัติการ, ระบบ appliances, ระบบเครือข่าย และระบบฐานข้อมูล เป็นต้น ได้อย่างน้อย 15 อุปกรณ์ต่อระบบ โดยสามารถแสดงผลอยู่ภายใต้รูปแบบ (format) เดียวกันได้
   - มีระบบการเข้ารหัสข้อมูลเพื่อใช้ยืนยันความถูกต้องของข้อมูลที่จัดเก็บตามมาตรฐาน MD5 หรือ SHA-1 หรือดีกว่า
   - สามารถเก็บ Log File ในรูปแบบ Syslog ของอุปกรณ์ เช่น Router, Switch, Firewall, VPN, Server เป็นต้น ได้
   - สามารถบริหารจัดการอุปกรณ์ผ่านมาตรฐาน HTTPS, Command Line Interface และ SSH ได้
   - สามารถจัดเก็บ log file ได้ถูกต้อง ตรงตามพระราชบัญญัติว่าด้วยการกระทำผิดเกี่ยวกับคอมพิวเตอร์ ฉบับที่มีผลบังคับใช้ โดยได้รับรองมาตรฐานการจัดเก็บและรักษาความปลอดภัยของ log file ที่ได้มาตรฐาน เช่น มาตรฐานของศูนย์อิเล็กทรอนิกส์และคอมพิวเตอร์แห่งชาติ (มศอ. 4003.1-2560) เป็นต้น
   - สามารถทำการสำรองข้อมูล (Data Backup) ไปยังอุปกรณ์จัดเก็บข้อมูลภายนอก เช่น Tape หรือ DVD หรือ External Storage เป็นต้น ได้
   - สามารถจัดเก็บข้อมูลเหตุการณ์ต่อวินาที (Events per Seconds) ได้ไม่น้อยกว่า 20,000 eps

22. อุปกรณ์ป้องกันเครือข่าย (Next Generation Firewall) แบบที่ 1 ราคา 240,000 บาท
   คุณลักษณะพื้นฐาน
   - เป็นอุปกรณ์ Firewall ชนิด Next Generation Firewall แบบ Appliance
   - มี Firewall Throughput ไม่น้อยกว่า 2 Gbps
   - มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 5 ช่อง
   - มีระบบตรวจสอบและป้องกันการบุกรุกรูปแบบต่างๆ อย่างน้อย ดังนี้ Syn Flood, UDP Flood, ICMP Flood, IP Address Spoofing, Port Scan, DoS or DDoS, Teardrop Attack, Land Attack, IP Fragment, ICMP Fragment เป็นต้นได้
   - สามารถทำการกำหนด IP Address และ Service Port แบบ Network Address Translation (NAT) และ Port Address Translation (PAT) ได้
   - สามารถ Routing แบบ Static, Dynamic Routing ได้
   - สามารถบริหารจัดการอุปกรณ์ผ่านมาตรฐาน HTTPS หรือ SSH ได้เป็นอย่างน้อย
   - สามารถเก็บและส่งรายละเอียดและตรวจสอบการใช้งาน (Logging/Monitoring) ในรูปแบบ Syslog ได้
   - สามารถใช้งานตามมาตรฐาน IPv6 ได้

23. อุปกรณ์ป้องกันเครือข่าย (Next Generation Firewall) แบบที่ 2 ราคา 1,000,000 บาท
    คุณลักษณะพื้นฐาน
    - เป็นอุปกรณ์ Firewall ชนิด Next Generation Firewall แบบ Appliance
    - มี Firewall Throughput ไม่น้อยกว่า 30 Gbps
    - มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 8 ช่อง
    - สามารถตรวจสอบและป้องกันการบุกรุกรูปแบบต่างๆ อย่างน้อย ดังนี้ Syn Flood, UDP Flood, ICMP Flood, IP Address Spoofing, Port Scan, DoS or DDoS, Teardrop Attack, Land Attack, IP Fragment, ICMP Fragment เป็นต้นได้
    - สามารถทำการกำหนด IP Address และ Service Port แบบ Network Address Translation (NAT) และ Port Address Translation (PAT) ได้
    - สามารถทำงานลักษณะ Transparent Mode ได้
    - สามารถ Routing แบบ Static, Dynamic Routing ได้
    - มี Power Supply แบบ Redundant หรือ Hot Swap จำนวน 2 หน่วย
    - สามารถบริหารจัดการอุปกรณ์ผ่านมาตรฐาน HTTPS หรือ SSH ได้เป็นอย่างน้อย
    - สามารถเก็บและส่งรายละเอียดและตรวจสอบการใช้งาน (Logging/Monitoring) ในรูปแบบ Syslog ได้
    - สามารถใช้งานตามมาตรฐาน IPv6 ได้

24. อุปกรณ์ป้องกันและตรวจจับการบุกรุก (Intrusion Prevention System) แบบที่ 1 ราคา 430,000 บาท
    คุณลักษณะพื้นฐาน
    - เป็นอุปกรณ์ (Hardware Appliance) ที่ออกแบบมาเพื่อป้องกันการบุกรุกทางเครือข่าย (Intrusion Prevention System)
    - สามารถตรวจจับวิธีการบุกรุกและป้องกันเครือข่ายได้อย่างน้อย ดังนี้ Signature matching, Protocol/Packet Anomalies, Statistical anomalies หรือ Application anomalies, Overflow, Worm, Virus, Backdoor Program, Trojan Horse, Port Scanning, Spy ware, Packet Analysis, DOS, DDOS
    - สามารถทำงานได้อย่างน้อย 1 Segments ใน IPS mode
    - มีความเร็วในการตรวจจับ (IPS Throughput) ไม่น้อยกว่า 600 Mbps
    - สามารถบริหารจัดการอุปกรณ์ผ่านมาตรฐาน HTTPS หรือ SSH ได้เป็นอย่างน้อย
    - สามารถเก็บและส่งรายละเอียดและตรวจสอบการใช้งาน (Logging/Monitoring) ในรูปแบบ Syslog ได้
    - สามารถใช้งานตามมาตรฐาน IPv6 ได้

25. อุปกรณ์ป้องกันและตรวจจับการบุกรุก (Intrusion Prevention System) แบบที่ 2 ราคา 1,400,000 บาท
    คุณลักษณะพื้นฐาน
    - เป็นอุปกรณ์ (Hardware Appliance) ที่ออกแบบมาเพื่อป้องกันการบุกรุกทางเครือข่าย (Intrusion Prevention System)
    - สามารถทำงานได้ในโหมด Passive และ In-line หรือ ดีกว่า

27. อุปกรณ์ป้องกันการบุกรุกจดหมายอิเล็กทรอนิกส์ (e-Mail Security) ราคา 350,000 บาท

คุณลักษณะพื้นฐาน

- เป็นอุปกรณ์เพื่อใช้ในการตรวจจับและป้องกัน SPAM และ Virus ของ e-Mail โดยเฉพาะ
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 2 ช่อง
- สามารถทำงานในรูปแบบของ SMTP relay ได้เป็นอย่างน้อย
- สามารถรองรับผู้ใช้งานได้ไม่น้อย 500 บัญชีผู้ใช้งาน
- สามารถเข้าบริหารจัดการตัวอุปกรณ์ผ่าน HTTPS หรือ SSH หรือดีกว่า
- สามารถส่งข้อมูล Log File ในรูปแบบ Syslog ได้เป็นอย่างน้อย
- สามารถใช้งานตามมาตรฐาน IPv6 ได้

28. ตู้สำหรับจัดเก็บเครื่องคอมพิวเตอร์และอุปกรณ์ แบบที่ 1 (ขนาด 36U) ราคา 18,000 บาท

คุณลักษณะพื้นฐาน

- เป็นตู้ Rack ปิด ขนาด 19 นิ้ว 36U โดยมีความกว้างไม่น้อยกว่า 60 เซนติเมตร ความลึกไม่น้อยกว่า 80 เซนติเมตร และความสูงไม่น้อยกว่า 179 เซนติเมตร
- ผลิตจากเหล็กแผ่นเคลือบสังกะสีแบบชุบด้วยไฟฟ้า (Electro-galvanized steel sheet)
- มีช่องเสียบไฟฟ้า จำนวนไม่น้อยกว่า 10 ช่อง
- มีพัดลมสำหรับระบายความร้อน ไม่น้อยกว่า 2 ตัว

29. ตู้สำหรับจัดเก็บเครื่องคอมพิวเตอร์และอุปกรณ์ แบบที่ 2 (ขนาด 42U) ราคา 22,000 บาท

คุณลักษณะพื้นฐาน

- เป็นตู้ Rack ปิด ขนาด 19 นิ้ว 42U โดยมีความกว้างไม่น้อยกว่า 60 เซนติเมตร ความลึกไม่น้อยกว่า 110 เซนติเมตรและความสูงไม่น้อยกว่า 200 เซนติเมตร
- ผลิตจากเหล็กแผ่นเคลือบสังกะสีแบบชุบด้วยไฟฟ้า (Electro-galvanized steel sheet)
- มีช่องเสียบไฟฟ้า จำนวนไม่น้อยกว่า 12 ช่อง
- มีพัดลมสำหรับระบายความร้อน ไม่น้อยกว่า 2 ตัว

30. ตู้สำหรับจัดเก็บเครื่องคอมพิวเตอร์และอุปกรณ์ แบบที่ 3 (ขนาด 42U) ราคา 130,000 บาท

คุณลักษณะพื้นฐาน

- เป็นตู้ Rack ปิด ขนาด 19 นิ้ว 42U โดยมีความกว้างไม่น้อยกว่า 60 เซนติเมตร ความลึกไม่น้อยกว่า 110 เซนติเมตร และความสูงไม่น้อยกว่า 200 เซนติเมตร
- ผลิตจากเหล็กแผ่นเคลือบสังกะสีแบบชุบด้วยไฟฟ้า (Electro-galvanized steel sheet)
- มีช่องเสียบไฟฟ้า จำนวนไม่น้อยกว่า 12 ช่อง
- มีพัดลมสำหรับระบายความร้อน ไม่น้อยกว่า 2 ตัว
- มีประตูหน้าเป็นแบบโลหะที่มีรูพรุน
- มีจอภาพ อุปกรณ์สลับสัญญาณ (KVM Switch) และ แป้นพิมพ์พร้อมแผ่นสัมผัส (touch pad) ที่ถูกออกแบบ และติดตั้งอยู่ภายในตู้ Rack

31. อุปกรณ์กระจายสัญญาณ (L2 Switch) ขนาด 16 ช่อง ราคา 2,800 บาท
คุณลักษณะพื้นฐาน
- มีลักษณะการทำงานไม่น้อยกว่า Layer 2 ของ OSI Model
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 16 ช่อง
- มีสัญญาณไฟแสดงสถานะของการทำงานช่องเชื่อมต่อระบบเครือข่ายทุกช่อง

32. อุปกรณ์กระจายสัญญาณ (L2 Switch) ขนาด 24 ช่อง แบบที่ 1 ราคา 6,000 บาท
คุณลักษณะพื้นฐาน
- มีลักษณะการทำงานไม่น้อยกว่า Layer 2 ของ OSI Model
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 24 ช่อง
- มีสัญญาณไฟแสดงสถานะของการทำงานช่องเชื่อมต่อระบบเครือข่ายทุกช่อง

33. อุปกรณ์กระจายสัญญาณ (L2 Switch) ขนาด 24 ช่อง แบบที่ 2 ราคา 21,000 บาท
คุณลักษณะพื้นฐาน
- มีลักษณะการทำงานไม่น้อยกว่า Layer 2 ของ OSI Model
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 24 ช่อง
- มีสัญญาณไฟแสดงสถานะของการทำงานช่องเชื่อมต่อระบบเครือข่ายทุกช่อง
- รองรับ Mac Address ได้ไม่น้อยกว่า 16,000 Mac Address
- สามารถบริหารจัดการอุปกรณ์ผ่านทางโปรแกรม Web Browser ได้

34. อุปกรณ์กระจายสัญญาณ (L3 Switch) ขนาด 24 ช่อง ราคา 120,000 บาท
คุณลักษณะพื้นฐาน
- มีลักษณะการทำงานไม่น้อยกว่า Layer 3 ของ OSI Model
- สามารถค้นหาเส้นทางเครือข่ายโดยใช้โปรโตคอล (Routing Protocol) RIPv2, OSPF ได้เป็นอย่างน้อย
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 24 ช่อง
- มีช่องสำหรับรองรับการเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 1/10 Gbps (SFP/SFP+) จำนวนไม่น้อยกว่า 2 ช่อง
- มีสัญญาณไฟแสดงสถานะของการทำงานช่องเชื่อมต่อระบบเครือข่ายทุกช่อง
- รองรับ Mac Address ได้ไม่น้อยกว่า 16,000 Mac Address
- สามารถบริหารจัดการอุปกรณ์ผ่านทางโปรแกรม Web Browser ได้
- สามารถส่งข้อมูล Log File ในรูปแบบ Syslog ได้เป็นอย่างน้อย
- สามารถใช้งานตามมาตรฐาน IPv6 ได้

35. อุปกรณ์กระจายสัญญาณไร้สาย (Access Point) แบบที่ 1 ราคา 5,400 บาท
คุณลักษณะพื้นฐาน
- สามารถใช้งานตามมาตรฐาน (IEEE 802.11b, g, n, ac) ได้เป็นอย่างน้อย
- สามารถทำงานที่คลื่นความถี่ 2.4 GHz และ 5 GHz

- สามารถเข้ารหัสข้อมูลตามมาตรฐาน WPA และ WPA2 ได้เป็นอย่างน้อย
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวน
  ไม่น้อยกว่า 1 ช่อง
- สามารถทำงานได้ตามมาตรฐาน IEEE 802.3af หรือ IEEE 802.3at (Power over Ethernet)
- สามารถบริหารจัดการอุปกรณ์ผ่านทางโปรแกรม Web Browser ได้

36. อุปกรณ์กระจายสัญญาณไร้สาย (Access Point) แบบที่ 2 ราคา 23,000 บาท
    คุณลักษณะพื้นฐาน
    - สามารถใช้งานตามมาตรฐาน (IEEE 802.11b, g, n, ac) ได้เป็นอย่างน้อย
    - สามารถทำงานที่คลื่นความถี่ 2.4 GHz และ 5 GHz
    - สามารถเข้ารหัสข้อมูลตามมาตรฐาน WPA และ WPA2 ได้เป็นอย่างน้อย
    - มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวน
      ไม่น้อยกว่า 1 ช่อง
    - สามารถทำงานได้ตามมาตรฐาน IEEE 802.3af หรือ IEEE 802.3at (Power over Ethernet)
    - สามารถรับสัญญาณขาเข้าไม่น้อยกว่า 3 ช่องสัญญาณ และส่งสัญญาณขาออกไม่น้อยกว่า 3
      ช่องสัญญาณ (3x3 MIMO)
    - รองรับการบริหารจัดการผ่านระบบควบคุมเครือข่ายไร้สาย (Wireless Controller)
    - สามารถบริหารจัดการอุปกรณ์ผ่านมาตรฐาน HTTP หรือ HTTPS หรือ SSH ได้เป็นอย่างน้อย

37. อุปกรณ์ค้นหาเส้นทางเครือข่าย (Router) ราคา 44,000 บาท
    คุณลักษณะพื้นฐาน
    - มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวน
      ไม่น้อยกว่า 2 ช่อง
    - มีสัญญาณไฟแสดงสถานะของการทำงานช่องเชื่อมต่อระบบเครือข่ายทุกช่อง
    - มีหน่วยความจำแบบ Flash (Flash Memory) ขนาดไม่น้อยกว่า 256 MB
    - สามารถค้นหาเส้นทางเครือข่ายโดยใช้โปรโตคอล (Routing Protocol) BGP, OSPFv2, OSPFv3,
      RIP-1, RIP-2, RIPng, Static IPv4 Routing และ Static IPv6 Routing ได้เป็นอย่างน้อย
    - สามารถส่งข้อมูล Log File แบบ Syslog ได้เป็นอย่างน้อย
    - สามารถใช้งานตามมาตรฐาน IPv6 ได้

38. อุปกรณ์กระจายการทำงานสำหรับเครือข่าย (Link Load Balancer) ราคา 210,000 บาท
    คุณลักษณะพื้นฐาน
    - เป็นอุปกรณ์ (Hardware Appliance) ที่ออกแบบมาเพื่อใช้กระจายการทำงานสำหรับเครือข่าย
      โดยเฉพาะ
    - มี Throughput สูงสุดไม่น้อยกว่า 400 Mbps
    - มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100/1000 Base-T หรือดีกว่า จำนวน
      ไม่น้อยกว่า 6 ช่อง
    - สามารถบริหารจัดการอุปกรณ์ผ่านมาตรฐาน HTTPS ได้เป็นอย่างน้อย
    - สามารถใช้งานตามมาตรฐาน IPv6 ได้

- มีช่องเชื่อมต่อ (Interface) แบบ USB 2.0 หรือดีกว่า จำนวนไม่น้อยกว่า 1 ช่อง
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 1 ช่อง
- มีถาดใส่กระดาษได้ไม่น้อยกว่า 250 แผ่น
- สามารถใช้ได้กับ A4, Letter, Legal และ Custom

52. เครื่องพิมพ์ Multifunction เลเซอร์ หรือ LED สี ราคา 15,000 บาท
คุณลักษณะพื้นฐาน
- เป็นอุปกรณ์ที่มีความสามารถเป็น Printer, Copier และ Scanner ภายในเครื่องเดียวกัน
- มีความละเอียดในการพิมพ์ไม่น้อยกว่า 600x600 dpi
- มีความเร็วในการพิมพ์ขาวดำสำหรับกระดาษ A4 ไม่น้อยกว่า 18 หน้าต่อนาที (ppm)
- มีความเร็วในการพิมพ์สีสำหรับกระดาษ A4 ไม่น้อยกว่า 18 หน้าต่อนาที (ppm)
- มีหน่วยความจำ (Memory) ขนาดไม่น้อยกว่า 256 MB
- สามารถสแกนเอกสาร ขนาด A4 (ขาวดำ และ สี) ได้
- มีความละเอียดในการสแกนสูงสุด ไม่น้อยกว่า 1,200x1,200 dpi
- มีถาดป้อนเอกสารอัตโนมัติ (Auto Document Feed)
- สามารถถ่ายสำเนาเอกสารได้ทั้งสีและขาวดำ
- สามารถทำสำเนาได้สูงสุดไม่น้อยกว่า 99 สำเนา
- สามารถย่อและขยายได้ 25 ถึง 400 เปอร์เซ็นต์
- มีช่องเชื่อมต่อ (Interface) แบบ USB 2.0 หรือดีกว่า จำนวนไม่น้อยกว่า 1 ช่อง
- มีช่องเชื่อมต่อระบบเครือข่าย (Network Interface) แบบ 10/100 Base-T หรือดีกว่า จำนวนไม่น้อยกว่า 1 ช่อง หรือ สามารถใช้งานผ่านเครือข่ายไร้สาย Wi-Fi (IEEE 802.11b, g, n) ได้
- มีถาดใส่กระดาษได้ไม่น้อยกว่า 150 แผ่น
- สามารถใช้ได้กับ A4, Letter, Legal และ Custom

53. เครื่องพิมพ์วัตถุ 3 มิติ ราคา 40,000 บาท
คุณลักษณะพื้นฐาน
- ใช้วิธีขึ้นรูปชิ้นงาน 3 มิติ แบบ Fused Filament Fabrication (FFF) หรือ Fused Deposition Modeling (FDM) หรือ Stereolithography (SLA) หรือดีกว่า
- มีพื้นที่ผลิตชิ้นงานอย่างใดอย่างหนึ่ง ดังนี้
    1) ในกรณีพื้นที่ผลิตชิ้นงานเป็นรูปแบบสี่เหลี่ยม ต้องมีขนาดความกว้างไม่น้อยกว่า 200 มิลลิเมตร ความยาวไม่น้อยกว่า 150 มิลลิเมตร และความสูงไม่น้อยกว่า 150 มิลลิเมตร หรือ
    2) ในกรณีพื้นที่ผลิตชิ้นงานเป็นรูปแบบวงกลม ต้องมีขนาดเส้นผ่านศูนย์กลางไม่น้อยกว่า 16 มิลลิเมตร และความสูงไม่น้อยกว่า 24 มิลลิเมตร
- สามารถขึ้นรูปชิ้นงานโดยมีความละเอียดที่ขนาดไม่มากกว่า 0.1 มิลลิเมตรต่อชั้น (Layer) ได้
- ความเร็วในการพิมพ์สูงสุดไม่น้อยกว่า 70 มิลลิเมตรต่อวินาที
- มีช่องเชื่อมต่อแบบ SD-Card Reader หรือ USB หรือดีกว่า
- สามารถใช้กับวัสดุประเภท Acrylonitrile-Butadiene-Styrene (ABS) หรือ Polylactic Acid (PLA) หรือ Nylon ได้
- สามารถพิมพ์ชิ้นงานจากไฟล์ชนิด STL หรือ OBJ ได้

- สามารถเชื่อมต่อระบบเครือข่ายอินเทอร์เน็ตได้
- ติดตั้งซอฟต์แวร์ระบบปฏิบัติการที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย จำนวน 1 ลิขสิทธิ์
- มีระบบป้องกันไวรัสคอมพิวเตอร์พร้อมใช้งาน
- มีระบบป้องกันการบุกรุกเครือข่าย (Firewall) พร้อมใช้งาน
- รองรับการใช้งานผ่านระบบเครือข่ายแบบ IPv6
- มีการดำเนินการสำรองเครื่องคอมพิวเตอร์แม่ข่ายเสมือน (Virtual Machine Backup) ที่ให้บริการเช่า

69. ค่าเช่าใช้บริการระบบ Cloud Server แบบที่ 2 ราคา 18,000 บาทต่อเดือน (ราคาค่าเช่านี้ไม่รวมราคา
การให้บริการรับส่งข้อมูล (Data Transfer) เข้าสู่ระบบ)

คุณลักษณะพื้นฐาน
- มีหน่วยประมวลผลกลาง (CPU) จำนวนไม่น้อยกว่า 4 แกนหลัก (core)
- มีหน่วยความจำหลัก (RAM) ขนาดไม่น้อยกว่า 8 GB
- มีหน่วยจัดเก็บข้อมูล (Storage) ขนาดความจุไม่น้อยกว่า 1 TB
- สามารถเชื่อมต่อระบบเครือข่ายอินเทอร์เน็ตได้
- มีระบบจัดการฐานข้อมูล (RDBMS) พร้อมใช้งานที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย จำนวน 1 ลิขสิทธิ์
- ติดตั้งซอฟต์แวร์ระบบปฏิบัติการที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย จำนวน 1 ลิขสิทธิ์
- มีระบบป้องกันไวรัสคอมพิวเตอร์พร้อมใช้งาน
- มีระบบป้องกันการบุกรุกเครือข่าย (Firewall) พร้อมใช้งาน
- รองรับการใช้งานผ่านระบบเครือข่ายแบบ IPv6
- มีการดำเนินการสำรองเครื่องคอมพิวเตอร์แม่ข่ายเสมือน (Virtual Machine Backup) ที่ให้บริการเช่า

70. ชุดโปรแกรมระบบปฏิบัติการสำหรับเครื่องคอมพิวเตอร์ และเครื่องคอมพิวเตอร์โน้ตบุ๊ก แบบสิทธิการใช้
งานประเภทติดตั้งมาจากโรงงาน (OEM) ที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย ราคา 3,800 บาทต่อชุด

71. ชุดโปรแกรมระบบปฏิบัติการสำหรับเครื่องคอมพิวเตอร์แม่ข่าย (Server) สำหรับรองรับหน่วย
ประมวลผลกลาง (CPU) ไม่น้อยกว่า 16 แกนหลัก (16 core) ที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย
ราคา 28,000 บาทต่อชุด

72. ชุดโปรแกรมจัดการสำนักงาน ที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย ราคา 12,000 บาทต่อชุด

73. ชุดโปรแกรมป้องกันไวรัส ราคา 700 บาทต่อปี (สำหรับเครื่องคอมพิวเตอร์ฯ 1 เครื่อง)

อุปกรณ์กรณีไม่มีราคาตามเกณฑ์ฯ และไม่แสดงราคาในเว็บไซต์

๑. ชุดเครื่องนำเข้าข้อมูลภาพปลอกกระสุนปืนระบบ ๓ มิติ พร้อมโปรแกรมการใช้ (๓D Brass Capture)

IBIS BRASSTRAX

The fastest, most accurate way to acquire cartridge case evidence

The BRASSTRAX acquisition station enables entry of cartridge case information onto an IBIS network. BRASSTRAX captures high-resolution 2D images and precise 3D topographic information of significant regions of interest. This includes the breech face and firing pin impressions on the primer and ejector mark for centerfire cartridge cases. For rimfire cartridge cases, the firing pin impression is captured. A detailed reference image of the complete head is also captured.

Most of the acquisition process is fully automated to minimize user input and reduce operator variability. Automation of image focus, image lighting, and region of interest outlining, ensures consistent image quality for visualization and uniformity for optimal comparisons.

BRASSTRAX features:

- Automated flowback and washout detection
- Automated self-test and adjustment
- Hands-off operation allows multitasking
- Multiple magnification levels
- Full range of calibers: .17 to .50 and from .410 bore to 10-gauge for shot shells
- Detailed online help and user guides
- Multiple light sources, including a patented ring light

ข้อมูลจากเว็บไซต์ : https://www.ultra-forensictechnology.com/en/our-products/ballistic-identification/brasstrax

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

๒. ชุดเครื่องนำเข้าข้อมูลภาพหัวกระสุนปืนระบบสามมิติพร้อมโปรแกรมการใช้งาน
(๓D Bullet Capture)

IBIS BULLETTRAX

The world's most advanced bullet acquisition station

BULLETTRAX is the bullet acquisition component of IBIS. It digitally captures the surface of a bullet in 2D and 3D, providing a topographic model of the marks around its circumference.

The BULLETTRAX acquisition station enables entry of bullet information onto an IBIS network. It provides the microscopic surface details and macroscopic shape of bullets, and uses intelligent surface-tracking technology to automatically adapt to deformations on damaged and fragmented bullets.

The acquisition process is fully automated after an initial user setup. This reduces the amount of operator training required, and produces consistent image quality and optimal correlation performance.

BULLETTRAX features:

- **Custom-designed 3D sensor technology**: The sensor captures high-definition 3D topography at the submicron level providing consistent image quality and optimal correlation performance for the specific characteristics of bullets. The sensor is tolerant towards imperfect mounting and ensures a high acquisition-completion rate.
- **Acquisition of Damaged and Pristine Bullets**: The new BULLETTRAX is equipped with intelligent surface tracking that automatically adapts to deformations of damaged and fragmented bullets. Pristine and damaged bullets can be acquired in 11 – 13 minutes. Conventional, polygonal and unrifled bullets in all calibers ranging from 0.17 to 0.50 can be acquired.
- **Simple Bullet Mounting Process**: The mounting jig makes it easy to precisely mount pristine bullets on the stubs. A set of 10 customized stubs facilitates easy mounting of bullets of various calibers as well as damaged bullets that are typically difficult to mount.
- **Pilot cameras**: Two pilot cameras provide a real-time view of the mounted bullet. This allows for easy repositioning and direct image adjustments and eliminates the guesswork in positioning and navigating the bullet surface. The mounted bullet is set up for acquisition in a few clicks.
- **Wide Field of View**: The field of view captures 2.8 mm surface area of the base of the bullet which provides more surface information to view and analyze. The large viewing context is especially useful for damaged bullets with a deformed base.
- **Intuitive user interface**: The interface is very intuitive and takes the user through the process step-by-step. Combined with the simple bullet mounting and acquisition process, it significantly increases operational efficiency and allows users to rapidly attain and maintain proficiency.

ข้อมูลจากเว็บไซต์ : https://www.ultra-forensictechnology.com/en/our-products/ballistic-identification/bullettrax
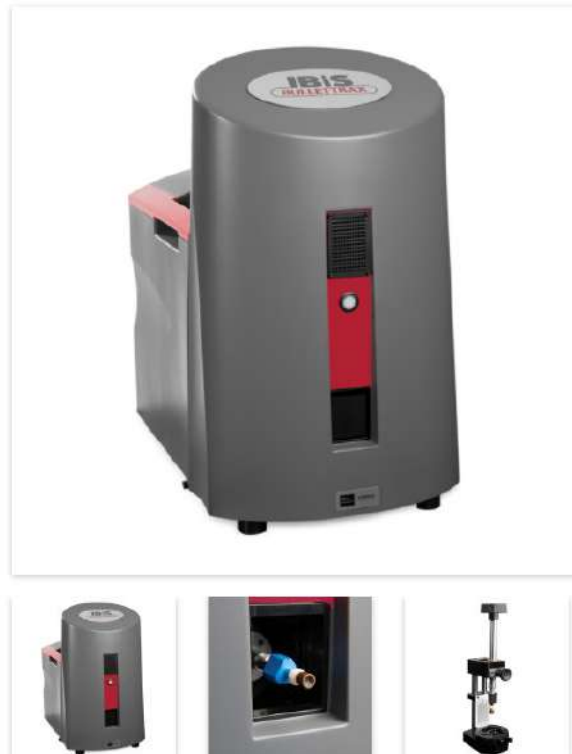
ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

๓. ชุดเครื่องวิเคราะห์เครื่องกระสุนปืนพร้อมโปรแกรมการใช้งาน (Ballistic Data Analysis)

IBIS MATCHPOINT

MATCHPOINT is the firearm expert's analysis station for reviewing potential matches from IBIS correlation algorithms.

High-resolution 2D images and precise 3D topography offer remarkable viewing capabilities and useful alternatives when analyzing cartridge case and bullet markings.

An extensive array of viewers and functions assist with the identification of similar candidates. High-level analysis of correlation results and visual comparisons allow rapid elimination of non-matches. Powerful visualization tools go beyond conventional comparison microscopes to ease the recognition of high-confidence matches. Indeed, MATCHPOINT increases identification success rates while reducing efforts required for ultimate confirmations.

Bullets acquired using BULLETTRAX are viewed as sharply focused, continuous wraparound images. BULLETTRAX can even produce an image strip in 2D, 3D or a mix of both. This simplifies comparison of damaged bullets and is useful for high-level phase alignment before comparing finer markings. The combination of the enhanced surface markings and realistic bullet shape reduce efforts to locate and highlight key markings on bearing surfaces of polygonal and smoothbore bullets.

Cartridge cases acquired using BRASSTRAX are viewed based on multiple regions of interest in 2D, 3D or a mix of both. Indeed, one or more region can hold the key to finding a match. 3D information provides remarkable advantages for comparison of cartridge cases.

MATCHPOINT features:

- Cartridge case side-by-side viewer
- Cartridge Case MultiViewer
- 3D enhancements
- Independent regions of interest
- Bullet side-by-side viewer
- Bullet MultiViewer
- Bullet shape viewing
- Cross-section profiles
- Score analysis
- Reports and printouts
- "Reshaping" of a deformed bullet to more closely resemble a pristine reference bullet

ข้อมูลจากเว็บไซต์ : https://www.ultra-forensictechnology.com/en/our-products/ballistic-identification/matchpoint

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

๔. ชุดจัดเก็บข้อมูลสำหรับระบบฐานข้อมูลทางนิติวิทยาศาสตร์พร้อมโปรแกรมการใช้งาน
(Data Concentrator System)

IBIS DATA CONCENTRATOR

Storage and management

The Data Concentrator stores data collected from multiple BRASSTRAX and BULLETTRAX acquisition stations. For each acquired exhibit, the Data Concentrator automatically extracts image signatures, generates correlation requests – which are processed by the Correlation Engine – and stores correlation results. The Data Concentrator is the connection point for MATCHPOINT analysis station users who perform correlation reviews and produce reports.

ข้อมูลจากเว็บไซต์ : https://www.ultra-forensictechnology.com/en/our-products/ballistic-identification/data-concentrator

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

๕. เครื่องสำรองไฟฟ้าขนาด ๔๐ kVA

๕.๑ Leonics UTT-๔๐๓

LEONICS®

UTT-series

Three Phase True Online UPS

Smart Protection
- Static bypass
- Manual maintenance bypass
- Zero time transfer
- EMI protection
- Surge, over charge, over discharge, overload, and short circuit protection

Power Display and Management
- LED indicator and LCD display with control panel (10kVA- 30kVA model)
- LED indicator and large touchscreen LCD (40kVA - 120kVA model)
- Intelligent battery management
- Hot swappable battery
- Extended backup time (option)

Communication
- RS-232, RS-485 port and dry contacts
- SNMP/HTTP monitor capability (option)

Saving
- High efficiency > 98% in Eco mode
- Front opening door for easy access and maintenance

Safety
- Emergency Power Off function (EPO)

Reliable Power Quailty
- Input voltage 380 Vac (L-L) with -40% to 25%
- Input frequency 50 Hz/60 Hz
- Output voltage 380 Vac (L-L) ± 1%
- Output frequency 50 Hz/60 Hz ± 3 Hz adjustable

High Reliability
- True on-line double conversion technology
- Modular design with high MTBF and low MTTR
- Horizontal modularity parallel redundant configuration up to 6 units
- Full digital control with three DSPs including IGBT rectifier, inverter and charger
- Digital circulating current control technology
- Intelligent self-diagnose function

ข้อมูลจากเว็บไซต์ : http://www.leonics.co.th/support/brochure/UTT-๑๙๙.pdf

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

SG Series UPS - 60 Hz, 10-750kVA

TCO Whitepaper

Delivering Best-in-Class Efficiency with eBoost Technology

The GE SG Series is one of the most efficient and reliable Three Phase UPS Systems, providing best-in-class output performance and critical power protection for your data center needs. The SG Series UPS solutions are designed and optimized to provide high efficiency at part load conditions. The SG Series UPS assures low input current harmonic distortion and best-in-class output voltage regulation and dynamic response. This helps customers save operational costs while implementing environmentally-friendly solutions.

Best-in-Class Efficiency with Lower Total Cost of Ownership
- Up to 99% operating efficiency with written efficiency guarantees
- eBoost operation minimizes efficiency losses providing annual power & cooling savings up to $300k for 5MW data center
- eBoost line conditioning & voltage regulation via Bypass Inductor patented design
- Innovative product technologies that boost efficiency, reliability and lengthen battery life

Easier Installation and Configuration Flexibility
- Top or bottom cable access
- Matching battery and maintenance bypass cabinet for easy configuration
- Front Maintainability Design reduces mean time to repair (MTTR)

Scalable Solution
- Scalable Solution
- Redundant Parallel Architecture (RPA) provides reliability, redundancy and scalability
- Parallel up to 6 UPS Modules
- Long history of experience with Redundant Parallel Architecture (RPA) which increases system reliability by eliminating single point of failures

ข้อมูลจากเว็บไซต์ : http://www.geindustrial.com/products/uninterruptible-power-supplies-ups-three-phase/sg-series-ups-60-hz-๑๐-๗๕๐kva

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

๕.๓ Eaton ๙๓๕๕ UPS

ข้อมูลจากเว็บไซต์ : http://powerquality.eaton.com/Products-services/Backup-Power-UPS/๙๓๕๕.aspx?cx=๒๒

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

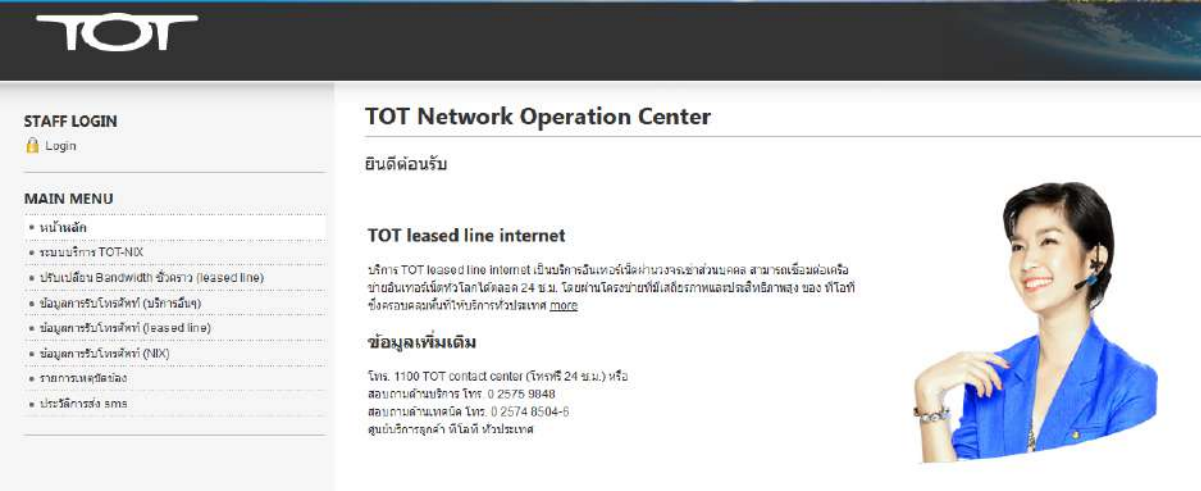๖. แท้งค์ยิงเก็บปลอกกระสุนปืน และลูกกระสุนปืน พร้อมอุปกรณ์และติดตั้ง

ข้อมูลจากเว็บไซต์ : www.emt.com.tr/bulletrecoverywatertanksystememt.pdf

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

๗. ค่าใช้จ่ายสำหรับวงจรเช่า (Leased Line)

๗.๑ TOT

ข้อมูลจากเว็บไซต์ : http://noc.totisp.net/

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

๗.๒ CAT

ข้อมูลจากเว็บไซต์ : http://www.cat.net.th/corporate/

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

๗.๓ CS LOXINFO

ข้อมูลจากเว็บไซต์ : https://www.csloxinfo.com/leased-line/

ราคาจากเว็บไซต์ : ไม่มีราคาในเว็บไซต์

ข้อมูลจากเว็บไซต์ ณ วันที่ ๑๑ พฤศจิกายน ๒๕๖๔

Unmatched performance & affordability in an expandable mini-tower.

PRECISION 3630 TOWER

SPACE-SAVING DESIGN
New industrial design is 23% smaller than its predecessor with greater expandability to grow with your business needs without sacrificing power. A range of easy-to-reach ports keep you connected to everything you need while the optional Smart Card reader seamlessly keeps your IP secure.

PROFESSIONAL PERFORMANCE
Power through intensive tasks easily with 8th Generation Intel® Core™ and Xeon® processors and get real-time results with up to 64GB of faster 2666Mhz UDIMM memory.

LATEST TECHNOLOGY
Create VR content without limits thanks to Radeon™ Pro or NVIDIA® Quadro® professional-grade graphics with up to 225W of graphics supports. Scalable storage with SATA or PCIe NVMe SSD options up to 16TB deliver plenty of room for every project.

PEACE OF MIND
Dell Precision Optimizer Premium is the only AI-based performance optimizer software in the industry to automatically tune your workstation to run popular ISV applications at the fastest speeds possible. Independent Software Vendor (ISV) certified to ensure the high-performance applications you rely on every day run smoothly.

Recommended Accessories

PRECISION 3630 TOWER

DELL PREMIER WIRELESS KEYBOARD AND MOUSE | KM717

Enhance productivity and enjoy its elegant design that will fit into virtually any workspace. For increased productivity you can simultaneously pair up to two compatible devices with Bluetooth LE.

DELL ULTRASHARP 27 4K MONITOR | U2718Q

With the the world's first 27" 4K monitor with InfinityEdge you get stunning colors and details on a virtually borderless display made for multi-tasking.

PRECISION MINI-TOWER DUST FILTER

Custom built for your Precision, the external dust filter is easy to install and rinse clean while keeping your internal components clean and running smoothly.

DELL CANVAS

Bring your ideas to life with the groundbreaking new workspace tool that uses an intuitive touch screen, pen and totem to enable natural digital creation.

DELL 24 MONITOR | P2418D

See vividly clear visuals and get up to 18% more done with dual monitors by taking advantage of the 3 sided ultrathin bezel which is perfect for dual monitor setup.

PRECISION MINI-TOWER CABLE COVERS

Reduce clutter and provide secure cable management for your Precision with custom built cable covers.

WIRED MOUSE WITH FINGERPRINT READER

Enjoy secure authentication by just touching this mouse, that operates seamlessly with Microsoft's biometric sign-in features.

JABRA EVOLVE 75

With the ambient noise cancellation feature of this wireless headset you can hear every word clearly on your next call. This easy to carry device is certified for Microsoft Skype for Business.

3DCONNEXION SPACEMOUSE COMPACT

With its iconic, pure design, the SpaceMouse Compact is small enough to fit on every desk while the brushed steel base ensures the device stability for precise 3D navigation.

Built for business

SECURE

Only Dell provides innovative data security solutions that meet security challenges and business concerns head-on to protect your most critical and at-risk asset, your data. With Dell Data Security solutions, end users can work where and how they want knowing that data is protected.
- Dell Data Guardian protects data where ever it goes.
- Dell Endpoint Security Suite, powered by Cylance, stops up to 99% of malware.

MANAGEABLE

Part of the world's most manageable line of commercial PCs featuring the free Dell Client Command Suite toolkit for flexible and automated BIOS and system configurations. Optional vPro extensions allow for out-of-band systems management.

RELIABLE

Dell Reliable Memory Technology (RMT) Pro protects your work from potential crashes. In addition Dell commercial PCs have the lowest reported failure rate.

Features & Technical Specifications

Feature	Precision 3630 Tower Technical Specifications
Processor Options[1]	8th generation Intel Core i7 (Including I7-8700K Processor) and i5 and i3; Intel® Xeon® E Processors Intel Turbo Boost Technology and Intel Integrated HD Graphics on select Processors; optional vPro™ Technology (coming soon)
Operating System Options[2]	Windows® 10 Professional (64 bit) Windows® 10 Pro for Workstations (64 bit) w/ Intel Xeon processors Windows® 10 Home (64 bit) Red Hat® Enterprise Linux® 7.5 (coming soon) Ubuntu Linux 16.04 NeoKylin 6.0 SP3 (China only)
Chipset	Intel® C246 Chipset
Memory Options[3]	4 Dimm Slots; 8 to 64GB 2666Mhz Non-ECC & ECC DDR4 Memory
Graphics Options[3]	One PCI Express® x16 Gen 3 Graphics card up to 225W (Total for Graphics) (Some cards available in Dual Config) **Mid-range 3D cards:** AMD Radeon Pro WX 7100 AMD Radeon Pro WX 5100 & Dual WX 5100 AMD Radeon Pro WX 4100 & Dual WX 4100 NVIDIA Quadro P4000 & Dual P4000 NVIDIA Quadro P5000 NVIDIA Quadro P2000 & Dual P2000 **Entry 3D cards:** AMD Radeon Pro WX 3100 & Dual WX 3100 AMD Radeon Pro WX 2100 & Dual WX 2100 NVIDIA Quadro P1000 & Dual P1000 NVIDIA Quadro P620 & Dual P620 NVIDIA Quadro P400 & Dual P400 **Professional 2D cards:** Intel HD Graphics 630 **Consumer Graphics:** AMD Radeon RX 580 NVIDIA GTX 1060 NVIDIA GTX 1080
Storage Options[4]	Support for up to (1) M.2 PCIe SSD on motherboard slot and Up to (3) 3.5" SATA or (4) 2.5" SATA. Support for Intel Ready Mode technology Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling **M.2 PCIe SSD (NVMe)** Up to (1) 2TB on M/B Up to (1) 2TB on Dell Precision Ultra-Speed drive **2.5" SATA SSD** Up to (4) 1TB **2.5" SATA 7200 RPM** Up to (4) 1TB 7200 RPM **3.5" SATA** Up to (3) 4TB 5400 RPM Up to (3) 2TB 7200 RPM **Self Encrypting Drives** 500GB 2.5" 7200 RPM 512GB M.2 NVMe SSD 512 GB 2.5" SSD
Storage Controller	**Integrated:** Intel Rapid Storage Controller 12.0 supporting SATA 6Gb/s and host based RAID 0/1/5/10
Communications	**Integrated:** Intel Ethernet Connection I219-LM 10/100/1000 **Optional:** Intel 10/100/1000 PCIe Gigabit Networking card Aquantia® AQtion™ AQN-108 5/2.5 GbE NIC Adapter **Optional:** Wireless / Bluetooth w / vPro support

Features & Technical Specifications

Feature	Precision 3630 Tower Technical Specifications
Audio Controller	Integrated Realtek ALC3861 High Definition Audio Codec (2 Channel)
Speakers	Internal Speaker; Optional Dell 2.0 stereo speaker systems available and Dell sound bar for select flat-panel displays
Add-in cards	Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling **Optional:** Thunderbolt 3 PCIe Card Serial and Parallel Port PCIe Card (Full Height) USB Type-C 3.1 Gen 2 PCIe Card (Full Height) Powered USB 3.1 PCIe Card Remote Access Host Card, Tera2 Smart Card Reader (CAC/PIV)
I/O Ports	**Front** 2 - USB 2.0 Type A 1 - USB 3.1 Type A (5Gb) 1 - USB 3.1 Type C (10Gb), data only 1 - Microphone 1 - Headphone **Internal** 1 – USB 3.0 4 – SATA 6Gb/s **Rear** 2 - USB 2.0 Type A (with SmartPower) 4 - USB 3.1 Type A (5Gb) 2 - PS2 2 - DisplayPort 1 - Optional Port (VGA, HDMI 2.0, DP++ 1.2, Type C w/DP-Alt mode) 1 - RJ45 Network Connector 1 - Serial 1 - Audio Line out
Chassis	**HxWxD:** 13.19" x 6.95" x 13.58" (33.5cm x 17.7cm x 34.5cm), Min weight: 9.358Kg **Bays:** (3) internal 3.5" bays - supports (3) 3.5" or (4) 2.5" drives **Slots:** (1) Full Height PCIe x16 Gen3; (2) Full Height PCIe x4 Gen3 (open ended); (1) Full Height PCI; (1) M.2 (22x80 mm) **Power Supply:** 460W 90% efficient PSU (80PLUS Gold Certified Certified) Energy Star compliant; 300W 85% efficient PSU (80PLUS Bronze Certified) Energy Star Compliant
Storage devices	Optional: 1 optical drive: DVD-ROM; DVD+/-RW, Blu Ray Writer (Note: optical drive not available with Smart Card Reader (CAC/PIV)) SD Card Reader
Security Options[5]	Trusted Platform Module TPM 2.0, Dell Data Guardian, Dell Endpoint Security Suite Enterprise, Dell HW Crypto Accelerator, Microsoft Windows Bitlocker, Local HDD data wipe via BIOS ("Secure Erase"), Encryption - SED HDD (Opal FIPS), Chassis lock slot support, Chassis Intrusion Switch, D-Pedigree (Secure Supply Chain Functionality), Setup/BIOS Password, Optional Smart Card keyboards, Intel® Trusted Execution Technology, Intel® Identity Protection Technology, Dell Secure Works, BIOS support optional Computrace, Intel Software Guard extensions
Systems Management[6]	Dell Client Command Suite; via vPro (coming soon)
Regulatory & Environmental	ENERGY STAR® configurations available including 80 PLUS® Bronze and Gold power supplies (Bronze not available in the Americas); EPEAT® registered (see epeat.net for specific registration rating/status by country); China CECP; GS Mark. For a complete listing of declarations & certifications, see Dell's regulatory & compliance homepage at dell.com/regulatory_compliance
Warranty & Support Services[7]	3-Year Limited Hardware Warranty and 3-year NBD On-Site Service after Remote Diagnosis Optional: Dell ProSupport is designed to rapidly respond to your business's needs, help protect your investment and sensitive data and provide enhanced proactive support services to help reduce risk and complexity within your IT environment

Unmatched performance & affordability in an expandable mini-tower.

PRECISION 3630 TOWER

DELL

Transform how you work.

DELL 22 MONITOR | P2219H

OPTIMIZE YOUR WORKSPACE

Free up valuable desk space with this 21.5" FHD monitor featuring a small footprint and thin panel profile. Easily hide away cable clutter with the improved cable management design.

MAXIMIZE PRODUCTIVITY

The 3-sided ultrathin bezel delivers a seamless view across multiple monitors, while Easy Arrange in Dell Display Manager software helps you stay organized when multitasking.

WORK COMFORTABLY

Pivot, tilt, swivel and adjust the height of your monitor to your exact preference. Stay focused longer with a flicker-free screen and ComfortView that optimize eye comfort.

TRUSTED RELIABILITY

Dell monitors — World's number 1 monitor brand[1] Enjoy peace of mind with Dell Premium Panel Exchange, 3 year Advanced Exchange Service[2] and optional ProSupport.[3]

Maximize productivity
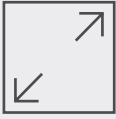
OPTIMIZED WORKSPACE

More room to work: Free up valuable desk space with a thin monitor profile and a small monitor base that's approximately 22% smaller than its predecessor.[4]

Clutter-free: Focus on your work while hiding away cable clutter with an improved cable management design.

Consistent and rich colors: A wide viewing angle enabled by In-Plane Switching technology lets you see vibrant colors—no matter where you sit.
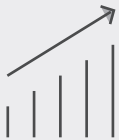
MAXIMIZE PRODUCTIVITY

Expand your efficiency: The three-sided ultrathin bezel design lets you enjoy an uninterrupted view of your content across multiple monitors. And, with dual monitors, you can increase your productivity by up to 18%.[5]

More ways to multitask: Work conveniently across multiple screens and select from predefined templates with the Easy Arrange feature on Dell Display Manager software. Quickly tile and arrange your applications and get back to work faster with Auto-restore, a feature that remembers where you left off.

WORK COMFORTABLY

Adjust to your comfort: Pivot, tilt, swivel and adjust the height of your monitor for a comfortable setup all day long. Or choose from a variety of mounts and stands, including VESA, for even more flexibility.

Easy on the eyes: This TÜV[6] Certified monitor has a flicker-free screen with ComfortView, a feature that reduces harmful blue light emissions. It's designed to optimize eye comfort even over extended viewing.

TRUSTED RELIABILITY

DELL MONITORS – WORLD'S NUMBER 1 MONITOR BRAND[1]

Peace of mind: Dell Premium Panel Exchange allows a free panel replacement during the Limited Hardware Warranty[7] period even if only one bright pixel is found.

Minimize downtime: Your monitor comes with a 3-year Advanced Exchange Service[2] so that if a replacement becomes necessary, it will be shipped to you the next business day during your 3-year Limited Hardware Warranty.[7]

Get a higher level of support: Upgrade to 24x7, in-region technical phone support from qualified engineers with Dell ProSupport option.[3]

Features & Technical Specifications

Monitor	Dell 22 Monitor - P2219H
Diagonal Viewing Size	54.61 cm (21.5 inches)
Active Display Area	
Height	476.06 mm (18.74")
Width	267.79 mm (10.54")
Maximum Preset Resolution	1920 x 1080 at 60 Hz
Aspect Ratio	16:9
Pixel Pitch	0.248 mm x 0.248 mm
Pixel Per Inch (PPI)	102
Brightness	250 cd/m² (typical)
Color Support	Color Gamut (typical): 72% (CIE1931)[8]
	Color Depth: 16.7 Million colors
Contrast Ratio	1000: 1 (typical)
Viewing Angle	178°/178°
Response Time	8 ms (Normal); 5 ms (Fast) - (gray to gray)
Panel Type	In-Plane Switching Technology
Backlight Technology	LED Edgelight System
ComfortView with Flicker-free screen	Yes
Dell Display Manager Compatibility	Yes
Remote Asset Management	Yes, via Dell Command | Monitor
Display Screen Coating	Antiglare with 3H hardness

Connectivity

Connectors	1 x DisplayPort version 1.2, 1 x HDMI port version 1.4, 1 x VGA port, 1 x USB 3.0 upstream port (bottom), 2 x USB 3.0 downstream ports (side), 2 x USB 2.0 downstream ports (bottom)
Built-in Devices	USB 3.0 super-speed hub (with 1 x USB 3.0 upstream port), 2 x USB 3.0 downstream ports, 2 x USB 2.0 downstream ports

Design Features

Adjustability	Height-adjustable stand (130 mm), Tilt (-5° to 21°)
	Swivel (-45° to 45°), Pivot (-90° to 90°)
Security	Security lock slot (cable lock sold separately)
Flat Panel Mount Interface	VESA (100 mm x 100 mm)

Power

AC input voltage/frequency/current	100 VAC to 240 VAC / 50 Hz or 60 Hz ± 3 Hz / 1.5 A (typical)
Power Consumption (Operational)	17W (typical) / 37W (maximum)[9]
Power Consumption Stand by / Sleep	Less than 0.3W

Dimensions (with stand)

Height (Compressed ~ Extended)	353.4 mm ~ 472.0 mm; 13.91" ~ 18.58"
Width	487.3 mm (19.19")
Depth	166.0 mm (6.54")

Weight

Weight (panel only - for VESA mount)	2.75 kg (6.06 lb)
Weight (with stand)	4.72 kg (10.41 lb)
Weight (with packaging)	6.26 kg (13.80 lb)

Standard Service Plan	Premium Panel Exchange, 3 Years Advanced Exchange Service[2] & Limited Hardware Warranty[7]
Optional Service Plan	Dell ProSupport[3]
Environmental Compliance	ENERGY STAR®, EPEAT® Gold[10], RoHS Compliant, TCO-Certified Display, BFR/PVC free monitor (excluding external cables), Arsenic-Free glass and Mercury-Free for the panel only

What's in the box?

Components
- Monitor with stand

Cables
- DisplayPort cable
- USB 3.0 upstream cable
- Power cable

Documentation
- Quick Setup Guide
- Safety and regulatory information

Adjustability and connectivity

DELL 22 MONITOR | P2219H

Easily adjust the panel to your preferred viewing position.

Back view -
Cable management slot

21º / 5º
130 mm
Tilt and height adjustable

90º / 90º
Pivot

45º / 45º
Swivel

Connectivity
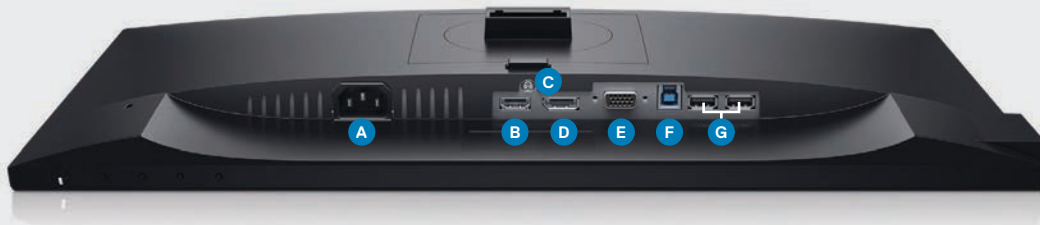
A	Power connector	E	VGA connector
B	HDMI port	F	USB upstream port
C	Stand lock feature	G	USB downstream ports (x2)
D	DisplayPort	H	USB downstream ports (x2)

RECOMMENDED ACCESSORIES

DELL DUAL MONITOR STAND | MDS19

Enjoy toolless monitor installation with Quick Release and the flexibility to pivot, tilt, swivel and adjust the height of each monitor independently. Features a small footprint and neat cable management.

DELL PRO STEREO SOUNDBAR | AE515M

Optimize conference calls and multimedia streaming with exceptional audio clarity. Minimize background noise with the dual mic array and echo-cancelling feature.

DELL WIRELESS KEYBOARD AND MOUSE | KM636

Elevated and spacious chiclet keys with muted typing sound. Pair up to 6 devices with Dell Universal Pairing.

Cisco Firepower 2100 Series

Enterprise Firewall

Next Generation Firewall

Next Generation IPS

Contents

Cisco Firepower 2100 Series appliances

The Cisco Firepower 2100 Series is a family of four threat-focused NGFW security platforms that deliver business resiliency through superior threat defense. It offers exceptional sustained performance when advanced threat functions are enabled. These platforms uniquely incorporate an innovative dual multicore CPU architecture that optimizes firewall, cryptographic, and threat inspection functions simultaneously. The series' firewall throughput range addresses use cases from the Internet edge to the data center. Network Equipment Building Standards (NEBS)- compliance is supported by the Cisco Firepower 2100 Series platform. The 2100 Series platforms can run either the Cisco ASA Firewall or Cisco Firepower Threat Defense (FTD).

Model overview

Cisco Firepower 2110/2120 Model

Cisco Firepower 2130/2140 Model

Cisco Firepower 2100 series summary:

Model	Firewall	NGFW	NGIPS	Interfaces	Optional interfaces
FPR-2110	3G	2.3G	2.3G	12 x RJ45, 4 x SFP	N/A
FPR-2120	6G	3G	3G	12 x RJ45, 4 x SFP	N/A
FPR-2130	10G	5G	5G	12 x RJ45, 4 x SFP+	10G SFP+, 1/10G FTW
FPR-2140	20G	9G	9G	12 x RJ45, 4 x SFP+	10G SFP+, 1/10G FTW

Detailed performance specifications and feature highlights

Table 1.   Performance specifications and feature highlights for firepower 2100 with the Cisco Firepower Threat defense image

Features	2110	2120	2130	2140
Throughput: FW + AVC (1024B)	2.3 Gbps	3 Gbps	5 Gbps	9 Gbps
Throughput: FW + AVC + IPS (1024B)	2.3 Gbps	3 Gbps	5 Gbps	9 Gbps
Maximum concurrent sessions, with AVC	1 million	1.5 million	2 million	3 million
Maximum new connections per	14K	17K	27K	57K

Features	2110	2120	2130	2140
second, with AVC				
TLS	365 Mbps	475 Mbps	735 Mbps	1.4 Gbps
Throughput: NGIPS (1024B)	2.3 Gbps	3 Gbps	5 Gbps	9 Gbps
IPSec VPN Throughput (1024B TCP w/Fastpath)	800 Mbps	1 Gbps	1.6 Gbps	3.2 Gbps
Maximum VPN Peers	1500	3500	7500	10,000
Cisco Firepower Device Manager (local management)	Yes	Yes	Yes	Yes
Centralized management	Centralized configuration, logging, monitoring, and reporting are performed by the Management Center or alternatively in the cloud with Cisco Defense Orchestrator			
Application Visibility and Control (AVC)	Standard, supporting more than 4000 applications, as well as geolocations, users, and websites			
AVC: OpenAppID support for custom, open source, application detectors	Standard			
Cisco Security Intelligence	Standard, with IP, URL, and DNS threat intelligence			
Cisco Firepower NGIPS	Available; can passively detect endpoints and infrastructure for threat correlation and Indicators of Compromise (IoC) intelligence			
Cisco AMP for Networks	Available; enables detection, blocking, tracking, analysis, and containment of targeted and persistent malware, addressing the attack continuum both during and after attacks. Integrated threat correlation with Cisco AMP for Endpoints is also optionally available			
Cisco AMP Threat Grid sandboxing	Available			
URL Filtering: number of categories	More than 80			
URL Filtering: number of URLs categorized	More than 280 million			
Automated threat feed and IPS signature updates	Yes: class-leading Collective Security Intelligence (CSI) from the Cisco Talos Group (https://www.cisco.com/c/en/us/products/security/talos.html)			
Third-party and open-source ecosystem	Open API for integrations with third-party products; Snort® and OpenAppID community resources for new and specific threats			
High availability and clustering	Active/standby			
Cisco Trust Anchor Technologies	Firepower 2100 Series platforms include Trust Anchor Technologies for supply chain and software image assurance. Please see the section below for additional details			

NOTE: Performance will vary depending on features activated, and network traffic protocol mix, and packet size characteristics. Performance is subject to change with new software releases. Consult your Cisco representative for detailed sizing guidance.

Table 2.　ASA Performance and capabilities on Firepower 2100 appliances

Features	2110	2120	2130	2140
Stateful inspection firewall throughput[1]	3 Gbps	6 Gbps	10 Gbps	20 Gbps
Stateful inspection firewall throughput (multiprotocol)[2]	1.5 Gbps	3 Gbps	5 Gbps	10 Gbps
Concurrent firewall connections	1 million	1.5 million	2 million	3 million
Firewall latency (UDP 64B microseconds)	-	-	-	-
New connections per second	18000	28000	40000	75000
IPsec VPN throughput (450B UDP L2L test)	500 Mbps	700 Mbps	1 Gbps	2 Gbps
Maximum VPN Peers	1500	3500	7500	10,000
Security contexts (included; maximum)	2; 25	2; 25	2; 30	2; 40
High availability	Active/active and active/standby	Active/active and active/standby	Active/active and active/standby	Active/active and active/standby
Clustering	-			
Scalability	VPN Load Balancing			
Centralized management	Centralized configuration, logging, monitoring, and reporting are performed by Cisco Security Manager or alternatively in the cloud with Cisco Defense Orchestrator			
Adaptive Security Device Manager	Web-based, local management for small-scale deployments			

[1] Throughput measured with 1500B User Datagram Protocol (UDP) traffic measured under ideal test conditions.

[2] "Multiprotocol" refers to a traffic profile consisting primarily of TCP-based protocols and applications like HTTP, SMTP, FTP, IMAPv4, BitTorrent, and DNS.

[3] In unclustered configuration.

Performance testing methodologies LINK

Hardware specifications

Table 3.　Cisco Firepower 2100 Series hardware specifications

Features	Cisco Firepower Model			
	2110	2120	2130	2140
Dimensions (H x W x D)	1.73 x 16.90 x 19.76 in. (4.4 x 42.9 x 50.2 cm)	1.73 x 16.90 x 19.76 in. (4.4 x 42.9 x 50.2 cm)	1.73 x 16.90 x 19.76 in. (4.4 x 42.9 x 50.2 cm)	1.73 x 16.90 x 19.76 in. (4.4 x 42.9 x 50.2 cm)
Form factor (rack units)	1RU	1RU	1RU	1RU

Features	Cisco Firepower Model			
Integrated I/O	12 x 10M/100M/1GBASE-T Ethernet interfaces (RJ-45), 4 x 1 Gigabit (SFP) Ethernet interfaces	12 x 10M/100M/1GBASE-T Ethernet interfaces (RJ-45), 4 x 1 Gigabit (SFP) Ethernet interfaces	12 x 10M/100M/1GBASE-T Ethernet interfaces (RJ-45), 4 x 10 Gigabit (SFP+) Ethernet interfaces	12 x 10M/100M/1GBASE-T Ethernet interfaces (RJ-45), 4 x 10 Gigabit (SFP+) Ethernet interfaces
Network modules	None	None	10G SFP+, 1/10G FTW Options	10G SFP+, 1/10G FTW Options
Note: The 2100 Series appliances may also be deployed as dedicated threat sensors with fail-to-wire network modules. Please contact your Cisco representative for details.				
Maximum number of interfaces	Up to 16 total Ethernet ports, (12x1G RJ-45, 4x1G SFP)	Up to 16 total Ethernet ports, (12x1G RJ-45, 4x1G SFP)	Up to 24 total Ethernet ports (12x1G RJ-45, 4x10G SFP+, and network module	Up to 24 total Ethernet ports (12x1G RJ-45, 4x10G SFP+, and network module
Integrated network management ports	1 x 10M/100M/1GBASE-T Ethernet port (RJ-45)	1 x 10M/100M/1GBASE-T Ethernet port (RJ-45)	1 x 10M/100M/1GBASE-T Ethernet port (RJ-45)	1 x 10M/100M/1GBASE-T Ethernet port (RJ-45)
Serial port	1 x RJ-45 console	1 x RJ-45 console	1 x RJ-45 console	1 x RJ-45 console
USB	1 x USB 2.0 Type-A (500mA)	1 x USB 2.0 Type-A (500mA)	1 x USB 2.0 Type-A (500mA)	1 x USB 2.0 Type-A (500mA)
Storage	1x 100 GB, 1x spare slot (for MSP)	1x 100 GB, 1x spare slot (for MSP)	1x 200 GB, 1x spare slot (for MSP)	1x 200 GB, 1x spare slot (for MSP)
Power supply configuration	Single integrated 250W AC power supply.	Single integrated 250W AC power supply.	Single 400W AC, Dual 400W AC optional. Single/Dual 350W DC optional[1]	Dual 400W AC. Single/dual 350W DC optional[1]
AC input voltage	100 to 240V AC	100 to 240V AC	100 to 240V AC	100 to 240V AC
AC maximum input current	< 2.7A at 100V	< 2.7A at 100V	< 6A at 100V	< 6A at 100V
AC maximum output power	250W	250W	400W	400W
AC frequency	50 to 60 Hz	50 to 60 Hz	50 to 60 Hz	50 to 60 Hz
AC efficiency	>88% at 50% load	>88% at 50% load	>89% at 50% load	>89% at 50% load
DC input voltage	-	-	-48V to -60VDC	-48V to -60VDC
DC maximum input current	-	-	< 12.5A at -48V	< 12.5A at -48V
DC maximum output power	-	-	350W	350W
DC efficiency	-	-	>88% at 50% load	>88% at 50% load
Redundancy	None	None	1+1 AC or DC with dual supplies	1+1 AC or DC with dual supplies
Fans	4 integrated (2 internal, 2	4 integrated (2 internal, 2	1 hot-swappable fan	1 hot-swappable fan

Features	Cisco Firepower Model			
	exhaust) fans[2]	exhaust) fans[2]	module (with 4 fans)[2]	module (with 4 fans)[2]
Noise	56 dBA @ 25C	56 dBA @ 25C	56 dBA @ 25C	56 dBA @ 25C
	74 dBA at highest system performance.	74 dBA at highest system performance.	77 dBA at highest system performance.	77 dBA at highest system performance.
Rack mountable	Yes. Fixed mount brackets included. (2-post). Mount rails optional (4-post EIA-310-D rack)	Yes. Fixed mount brackets included. (2-post). Mount rails optional (4-post EIA-310-D rack)	Yes. Mount rails included (4-post EIA-310-D rack)	Yes. Mount rails included (4-post EIA-310-D rack)
Weight	16.1 lb (7.3 kg): with 2x SSDs	16.1 lb (7.3 kg): with 2x SSDs	19.4 lb (8.8 kg) 1 x power supplies, 1 x NM, 1 x fan module, 2x SSDs	21 lb (9.53 kg) 2 x power supplies, 1 x NM, 1 x fan module, 2x SSDs
Temperature: operating	32 to 104°F (0 to 40°C)	32 to 104°F (0 to 40°C)	32 to 104°F (0 to 40°C) or NEBS operation (see below)[3]	32 to 104°F (0 to 40°C)
Temperature: nonoperating	-4 to 149°F (-20 to 65°C)	-4 to 149°F (-20 to 65°C)	-4 to 149°F (-20 to 65°C)	-4 to 149°F (-20 to 65°C)
Humidity: operating	10 to 85% noncondensing	10 to 85% noncondensing	10 to 85% noncondensing	10 to 85% noncondensing
Humidity: nonoperating	5 to 95% noncondensing	5 to 95% noncondensing	5 to 95% noncondensing	5 to 95% noncondensing
Altitude: operating	10,000 ft (max)	10,000 ft (max)	10,000 ft (max) or NEBS operation (see below)[3]	10,000 ft (max)
Altitude: nonoperating	40,000 ft (max)	40,000 ft (max)	40,000 ft (max)	40,000 ft (max)
NEBS operation (FPR-2130 Only)[3]			Operating altitude: 0 to 13,000 ft (3962 m)	
			Operating temperature:	
			Long term: 0 to 45°C, up to 6,000 ft (1829 m)	
			Long term: 0 to 35°C, 6,000 to 13,000 ft (1829 to 3964 m)	
			Short term: -5 to 55°C, up to 6,000 ft (1829 m)	

[1] Dual power supplies are hot-swappable.

[2] Fans operate in a 3+1 redundant configuration where the system will continue to function with only 3 operational fans. The 3 remaining fans will run at full speed.

[3] FPR-2130 platform is designed to be NEBS ready. The availability of NEBS certification is pending.

Table 4.   Table 4: Cisco Firepower 2100 Series NEBS, Regulatory, Safety, and EMC Compliance

Specification	Description
Regulatory compliance	Products comply with CE markings per directives 2004/108/EC and 2006/108/EC

Specification	Description
Safety	• UL 60950-1 • CAN/CSA-C22.2 No.60950-1 • EN 60950-1 • IEC 60950-1 • AS/NZS 60950-1 • GB4943
EMC: emissions	• 47CFR Part 15 (CFR 47) Class A (FCC Class A) • AS/NZS CISPR22 Class A • CISPR22 CLASS A • EN55022 Class A • ICES003 Class A • VCCI Class A • EN61000-3-2 • EN61000-3-3 • KN22 Class A • CNS13438 Class A • EN300386 • TCVN7189
EMC: Immunity	• EN55024 • CISPR24 • EN300386 • KN24 • TVCN 7317 • EN-61000-4-2, EN-61000-4-3, EN-61000-4-4, EN-61000-4-5, EN-61000-4-6, EN-61000-4-8, EN61000-4-11

Cisco Capital

Flexible payment solutions to help you achieve your objectives

Cisco Capital makes it easier to get the right technology to achieve your objectives, enable business transformation and help you stay competitive. We can help you reduce the total cost of ownership, conserve capital, and accelerate growth. In more than 100 countries, our flexible payment solutions can help you acquire hardware, software, services and complementary third-party equipment in easy, predictable payments. Learn more.

Cisco 4000 Series Integrated Services Routers

Cisco® 4000 Series Integrated Services Routers (ISRs) form an intelligent WAN platform that delivers the performance, security, and convergence capabilities that today's branch offices need.

Product Overview

The Cisco 4000 Series Integrated Services Routers (ISR) revolutionize WAN communications in the enterprise branch. With new levels of built-in intelligent network capabilities and convergence, the routers specifically address the growing need for application-aware networking in distributed enterprise sites. These locations tend to have lean IT resources. But they often also have a growing need for direct communication with both private data centers and public clouds across diverse links, including Multiprotocol Label Switching (MPLS) VPNs and the Internet.

The Cisco 4000 Series contains six platforms: the 4451, 4431, 4351, 4331, 4321 and 4221 ISRs (Figure 1).

Figure 1.　Cisco 4000 Series Integrated Services Routers

Features and Benefits

Cisco 4000 Series ISRs provide you with Cisco Intelligent WAN (IWAN) software features and a converged branch infrastructure. Along with superior throughput, these capabilities form the building blocks of next-generation branch-office WAN solutions.

Cisco Intelligent WAN (IWAN)

Cisco IWAN is a set of intelligent software services that allow you to reliably and securely connect users, devices, and branch office locations across a diverse set of WAN transport links. IWAN-enabled routers like the 4000 Series dynamically route traffic across the "best" link based on up-to-the-minute application and network conditions for great application experiences. You get tight control over application performance, bandwidth usage, data privacy, and availability of your WAN links—control that you need as your branches conduct greater volumes of mission-critical business.

Cisco Converged Branch Infrastructure

The Cisco 4000 Series ISRs consolidate many must-have IT functions, including network, compute, and storage resources. The high-performance, integrated routers run multiple concurrent IWAN services, including encryption, traffic management, and WAN optimization, without slowing your data throughput. And you can activate new services on demand through a simple licensing change.

Table 1 breaks out many of the features and benefits of the Cisco 4000 Series that create an intelligent WAN and a converged branch infrastructure.

Table 1.   Cisco 4000 Series ISR General Feature Highlights

Business Requirement(s)	Feature/Solution
Performance • Throughput • Service reliability	• Concurrent software services at speeds up to 2 Gbps. Backplane architecture supports high-bandwidth module-to-module communication at speeds up to 10 Gbps. • A distributed multicore architecture with the industry's first internal services plane. • Remote installation of application-aware services, which run identically to their counterparts in dedicated appliances.
Lower WAN expenditures	• Embedded IWAN solution for creating lower-cost, business-class Internet connections.
Pay-as-you-grow • Performance upgrade model • Investment protection • CapEx budget management	• Router capacity can be increased with a remote performance-on-demand license upgrade (no hardware upgrade) for exceptional savings.
Superior and secure user application experiences	• ISR-AX "Application Experience" software bundle with advanced routing and network monitoring services. • Dynamic Multipoint VPN (DMVPN), zone-based firewalls, intrusion prevention (Snort and Umbrella Branch) and content management using Cisco Cloud Web Security and OpenDNS protecting data, providing authentication credentials, and enabling transmissions that are not backhauled through the data center. • Secure boot feature performs hardware-based authentication of the bootloader software to prevent malicious or unintended software from booting on the system. • Code signing verifies digital signatures of executables prior to loading to prevent execution of altered or corrupted code. • Hardware authentication protects against hardware counterfeiting by using an on-board tamper-proof silicon, including field replaceable modules. If authentication fails, the module is not allowed to boot.
IT consolidation, space savings, and improved total cost of ownership (TCO)	• Single converged branch platform integrates routing, switching, virtual server, storage, security, unified communications, WAN optimization, and performance management tools.
Business continuity and increased resiliency	• 4400 Series models (4451 and 4431 ISRs) support dual integrated power supplies for backup. The entire 4000 Series supports optional power supply capable of delivering additional PoE power to endpoints. Defined models provide for a DC power supply. • Modular network interfaces with diverse connection options for load-balancing and network resiliency. • Modular interfaces with online removal and insertion (OIR) for module upgrades without network disruption. • Cisco Unified Survivable Remote Site Telephony (SRST), which serves as a resiliency complement to Cisco Hosted Collaboration Solution (HCS), a Cisco cloud-based UC service. • Support for multiple, diverse access links: T1/E1, T3/E3, Serial, xDSL, Gigabit and Ten-Gigabit Ethernet.
Lower telephony costs with VoIP and rich media experiences	• High-performance analog/digital gateway, allowing VoIP over less expensive Session Initiation Protocol (SIP) trunks. • Integrated IP PBX (Cisco Unified Communications Express) and Session Border Controller (Cisco Unified Border Element, or CUBE).
Easier manageability and support	• Single, universal software image for all features and performance-on-demand licensing flexibility. • No additional services and support needed for compute and storage. • Supported by Cisco and third-party management tools, with programmability and automation.

Platform Architecture

Table 2 lists the primary hardware architectural features and benefits of the Cisco 4000 Series. The routers run modular Cisco IOS® XE Software, widely deployed in the world's most demanding networks. The software's comprehensive portfolio of services spans multiple technology areas, including security, WAN optimization, app and network quality of service (QoS), and embedded management.

Table 2.   Architectural Highlights

Architectural Features	Benefits/Description
Multicore processors	• High-performance multicore processors support high-speed WAN connections. The data plane uses an emulated Flow Processor (FP) that delivers application-specific integrated circuit (ASIC)-like performance that does not degrade as services are added.
Embedded IP Security (IPsec) VPN hardware acceleration	• Increases scalability. When combined with an optional Cisco IOS XE Software Security license, enables WAN link security and VPN services.
Integrated Gigabit Ethernet ports	• The Cisco 4000 Series provides up to four built-in 10/100/1000 Ethernet ports for WAN or LAN. • Based on the platform, some of the 10/100/1000 Ethernet ports can support Small Form-Factor Pluggable (SFP)-based connectivity in addition to RJ-45 connections, enabling fiber or copper connectivity. • Optionally, depending on the platform, up to 30W PoE+ can be enabled on two of the built-in front panel Gigabit Ethernet interfaces to provide power to external devices such as fourth-generation (4G) LTE routers. • An additional dedicated Gigabit Ethernet port is provided for device management.[1]
USB-based console access	• A mini type B USB console port1 supports management connectivity when traditional serial ports are not available. • Traditional console and auxiliary ports are also available.[2]
Optional integrated power supply for distribution of PoE	• An optional upgrade to the internal power supply provides inline power (802.3af-compliant PoE or 802.3at-compliant PoE+) to optional integrated switch modules. • Redundant PoE conversion modules provide an additional layer of fault tolerance.
Optional integrated redundant power supply (RPS)	• For the 4400 Series, power redundancy is available by installing an optional integrated RPS for decreasing network downtime and protecting the network from power failures. • Optional PoE boost mode increases total PoE capacity to up to 1000W.
Cisco Enhanced Services Module (SM-X)	• Each service-module slot offers high data-throughput capability of up to 10 Gbps toward the system and up to 1 Gbps to other module slots. • Support for both single- and double-wide service modules provides flexibility in deployment options. • An SM-X slot can be converted into a Network Interface Module (NIM) slot using an optional carrier card. • Service modules support online insertion and removal (OIR), avoiding network disruption when installing new or replacement modules.1
Cisco Network Interface Modules (NIMs)[3]	• Up to three integrated NIM slots on the Cisco 4000 Series allow for flexible configurations. • Each NIM slot offers options of up to two 2-Gbps connections, one toward the route processor and one for direct module-to-module communication. The 4221 ISR has only one 1-Gbps connection to the route processor. • NIMs support OIR. • Special NIMs add support for solid-state drives (SSDs) and hard disk drives (HDDs).1
Cisco Integrated Services Card (ISC) slot on motherboard	• Integrated Services Card natively supports the new Cisco High-Density Packet Voice Digital Signal Processor Modules (PVDM4s), providing greater-density rich-media voice. • Each Integrated Services Card slot connects to the system architecture through an up to 2-Gbps link. • Future modules can be hosted on the Integrated Services Card slot, improving system functions.
Flash memory support	• A single flash memory slot is available to support high-speed storage densities, upgradable to up to 32 GB. The 4221 ISR ships with a fixed 8 GB flash. • Two USB type A 2.0 ports provide capabilities for convenient storage.1
DRAM	• For the 4400 Series ISRs, the default control-plane memory is 4 GB, upgradable to 16 GB to provide additional scalability for control-plane features. The default data-plane memory is 2 GB. • For the 4300 Series ISRs, the default memory is 4 GB, upgradable to 16 GB (only 8 GB for the 4321) to provide additional scalability. • The 4200 Series comes with 4 GB fixed DRAM.

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[1] Not supported on the 4221 model.

[2] The 4221 model supports shared console and auxiliary ports.

[3] Unified Communications (UC) License and Unified Communications NIM's are not supported on the ISR4221.

Managing Your Cisco 4000 Series ISRs

The Cisco network management applications listed at the top of Table 3 are standalone products that can be purchased or downloaded to manage your Cisco network devices. The applications are built specifically for the different operational phases; select those that best fit your needs. Those management capabilities listed under the "Cisco IOS Software XE Embedded Management" heading are directly integrated into the routers' software operating system.

Table 3.   Network Management Solutions

Operational Phase	Application	Description
Device staging and configuration	WebUI	• A GUI-based device-management tool for Cisco IOS and Cisco IOS XE Software-based access routers. This tool simplifies routing, firewall, VPN, unified communications, and WAN and LAN configuration through easy-to-use wizards.
Network-wide deployment, configuration, monitoring, and troubleshooting	Cisco Prime® Infrastructure	• Offers comprehensive lifecycle management of wired and wireless access, campus, and branch-office networks, rich visibility into end-user connectivity, and application performance assurance. • Provides wired lifecycle functions such as inventory, configuration, and image management; automated deployment; compliance reporting; integrated best practices; and reporting.
Staging, deployment, and changes to configuration and image files	Cisco Configuration Engine	• A secure network management product that provides zero-touch image and configuration distribution through centralized, template-based management.
Context-aware security configuration and monitoring	Cisco Prime Security Manager	• Management tool for configuring and managing context-aware security. The application supports both single- and multi-device manager form factors. • Provides the ability to write and enforce the granular context-aware security policies.
Cisco Wide Area Application Service (WAAS) management	Cisco WAAS Central Manager	• The management tool for the WAAS1.[4] (WAN optimization and application acceleration) integrated service. It provides a centralized mechanism for configuring WAAS features, reporting, and monitoring.
Cisco IOS XE Software Embedded Management Capabilities		
Feature	**Description**	
Cisco IOS Embedded Event Manager (EEM)	• A distributed and customized approach to event detection and recovery. • Offers the ability to monitor events and take informational, corrective, or any desired EEM action when the monitored events occur or when a threshold is reached.	
Cisco IOS XE IP Service-Level Agreements (IP SLAs)	• Helps assure the performance of new business-critical IP applications as well as IP services that use data and voice in an IP network.	
SNMP, Remote Monitoring (RMON), syslog, NetFlow, IP Flow Information Export (IPFix)	• Network monitoring and accounting tools.	

Product Specifications

Table 4 lists the general product specifications for the Cisco 4000 Series routers.

Table 4.   Specifications of Cisco 4000 Series Integrated Services Routers

Technical Specifications	Cisco 4451	Cisco 4431	Cisco 4351	Cisco 4331	Cisco 4321	Cisco 4221
Aggregate Throughput	1 Gbps to 2 Gbps	500 Mbps to 1 Gbps	200 Mbps to 400 Mbps	100 Mbps to 300 Mbps	50 Mbps to 100 Mbps	35 Mbps to 75 Mbps
Total onboard WAN or LAN 10/100/1000 ports	4	4	3	3	2	2

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[4] It is suggested to use AppNav with an external WAAS device for the 4221 model.

Technical Specifications	Cisco 4451	Cisco 4431	Cisco 4351	Cisco 4331	Cisco 4321	Cisco 4221
RJ-45-based ports	4	4	3	2	2	2
SFP-based ports	4	4	3	2	1	1
Enhanced service-module slots	2	0	2	1	0	0
Doublewide service-module slots	1 (assumes no singlewide SM-X modules installed)	0	1 (assumes no singlewide SM-X modules installed)	0	0	0
NIM slots	3	3	3	2	2	2
OIR (all I/O modules)	Yes	Yes	Yes	Yes	Yes	No
Onboard ISC slot	1	1	1	1	1	No
Default memory double-data-rate 3 (DDR3) error-correction-code (ECC) DRAM (Combined control/services/data planes)	NA	NA	4 GB	4 GB	4 GB	4 GB
Maximum memory DDR3 ECC DRAM (Combined control/services/data planes)	NA	NA	16 GB	16 GB	8 GB	4 GB
Default memory DDR3 ECC DRAM (data plane)	2 GB	2 GB	NA	NA	NA	NA
Maximum memory DDR3 ECC DRAM (data plane)	2 GB	2 GB	NA	NA	NA	NA
Default memory DDR3 ECC DRAM (control/services plane)	4 GB	4 GB	NA	NA	NA	NA
Maximum memory DDR3 ECC DRAM (control/services plane)	16 GB	16 GB	NA	NA	NA	NA
Default flash memory	8 GB	8 GB	4 GB	4 GB	4 GB	8 GB
Maximum flash memory	32 GB	32 GB	16 GB	16 GB	8 GB	8 GB
External USB 2.0 slots (type A)	2	2	2	1	1	1
USB console port - type B mini (up to 115.2 kbps)	1	1	1	1	1	0
Serial console port - RJ45 (up to 115.2 kbps)	1	1	1	1	1	1 (combo CON/AUX port)
Serial auxiliary port - RJ45 (up to 115.2 kbps)	1	1	1	1	1	1 (combo CON/AUX port)
Power-supply options	Internal: AC, DC (roadmap) and PoE	Internal: AC, DC, and PoE	Internal: AC, DC (roadmap) and PoE	Internal: AC and PoE	External: AC and PoE	External AC only
Redundant power supply	Internal: AC, DC (roadmap) and PoE	Internal: AC, DC, and PoE	N/A	N/A	N/A	NA

Technical Specifications	Cisco 4451	Cisco 4431	Cisco 4351	Cisco 4331	Cisco 4321	Cisco 4221
Power Specifications						
AC input voltage	100 to 240 VAC autoranging	100 to 240 VAC autoranging	100 to 240 VAC autoranging	100 to 240 VAC autoranging	100 to 240 VAC autoranging	100 to 240 VAC autoranging
AC input frequency	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz
AC input current range, AC power supply (maximum)	7.1 to 3.0A	3 to 1.3A	7.1 to 3.0A	3 to 1.3A	1.5 to 0.6A	1.5 to 0.6A
AC input surge current	<50 A	60 A peak and less than 5 Arms per half cycle	60 A peak and less than 12 Arms per half cycle	60 A peak and less than 5 Arms per half cycle	90 A peak and less than 3 Arms per half cycle	90 A peak and less than 3 Arms per half cycle
Typical power (no modules) (watts)	158	65	48	42	36	24
Maximum power with AC power supply (watts)	450 (no PoE)	250 (no PoE)	430	250	125	90
Maximum power with PoE power supply (platform only) (watts)	1000 with PoE redundant 1450 with PoE boost no redundancy	500 with PoE redundant 1000 with PoE boost no redundancy	990	530	260	NA (no PoE support)
Maximum endpoint PoE power available from PoE power supply (watts)	500 W with optional redundancy	250 W with optional redundancy	500	250	120	NA (no PoE support)
Maximum endpoint PoE power capacity with PoE boost (watts)	950 W no redundancy	500 W no redundancy	N/A	N/A	N/A	NA (no PoE support)
Sizes and Weights						
Dimensions (H x W x D)	3.5 x 17.25 x 18.5 in (88.9 x 438.15 x 469.9 mm)	1.73 x 17.25 x 19.97 in (43.9 x 438.15 x 507.2 mm)	3.5 x 17.25 x 18.5 in (88.9 x 438.15 x 469.9 mm)	1.75 x 17.25 x 17.25 in (44.45 x 438.15 x 438.15 mm)	1.75 x 14.55 x 11.60 in (44.55 x 369.57 x 294.64 mm)	1.72 x 12.7 x 10 in (43.7 x 322.6 x 254 mm)
External Power Supply Dimensions (H x W x D)	N/A	N/A	N/A	N/A	2.95 x 1.18 x 6.10 in (75 x 30 x 155 mm)	37 x 73 x 152 mm (Phihong mfg PN: AA90U-120A-R) 36.5 x 67 x 155 mm (Delta mfg PN: ADP90GR BA)
Shipping Box Dimensions (H x W x D)	9.75 x 22.25 x 26 in (24.76 x 56.51 x 66.04 mm)	7.88 x 22.25 x 28.75 in (200.2 x 565.1 x 730.25 mm)	9.75 x 22.25 x 26 in (24.76 x 56.51 x 66.04 mm)	7.125 x 22.75 x 22.5 in (180.98 x 577.85 x 571.5 mm)	7.0 x 21.5 x 16.125 in (177.8 x 546.1 x 409.6 mm)	4.13 x 18.25 x 12.94 in (104.9 x 463.6 x 328.7 mm)
Rack height	2 rack units (2RU)	1 rack units (1RU)	2 rack units (2RU)	1 rack unit (1RU)	1 rack unit (1RU)	1 rack unit (1RU)
Rack-mount 19in. (48.3 cm) EIA	Included	Included	Included	Included	Included	Optional
Rack-mount 23in. (58.4 cm) EIA	Optional	Optional	Optional	Optional	N/A	NA
Wall-mount	No	Yes	No	Yes	Mounting holes under chassis	Yes
Weight with 1, 450-WAC power supply (no modules)	28.8 lb (13.1 kg)	N/A	28.8 lb (13.1 kg)	N/A	N/A	NA
Weight with 1 1,000-WAC power supply+ 1 PoE power module (no other modules)	30.6 lb (13.9 kg)	N/A	29.0 lb (13.2 kg)	N/A	N/A	NA

Technical Specifications	Cisco 4451	Cisco 4431	Cisco 4351	Cisco 4331	Cisco 4321	Cisco 4221
Weight with AC PS (no modules)	N/A	18.5 lb (8.4 kg)	N/A	13.5 lb (6.2 kg)	7.7 lb (3.5 kg) + 1.2 lb (0.66 kg) external PS	7.1 lb (3.22 kg)
Weight with AC PS with POE (no modules)	N/A	18.6 lb (8.4 kg)	N/A	14.1 lb (6.4 kg)	N/A	NA
Typical weight (fully loaded with modules)	42.7 lb (19.4 kg)	22.4 lb (10.2 kg)	37.7 lb (17.1 kg)	16.1 lb (7.3 kg)	9.14 lb (4.2 kg) + 1.2 lb (0.66 kg) external PS	8.11 lb (3.68 kg)
Packaging Weight	6.4 lb (2.9 kg)	5.9 lb (2.7 kg)	6.4 lb (2.9 kg)	4.6 lb (2.1 kg)	2.2 lb (1 kg)	1.28 lb (0.58 kg)
Airflow	I/O side to bezel side	I/O side to bezel side	I/O side to bezel side	I/O side to bezel side	Right I/O side to Left I/O side	I/O side to bezel side
MTBF (Hours)	480770	512970	566310	587250	593270	593270
Environmental Specifications						
Operating Conditions						
Temperature	32º to 104ºF (0º to 40ºC)	32º to 104ºF (0º to 40ºC)	32º to 104ºF (0º to 40ºC)	32º to 104ºF (0º to 40ºC)	32º to 104ºF (0º to 40ºC)	32º to 104ºF (0º to 40ºC)
Altitude (China)	0 – 6,560 ft. (0 – 2,000 m)	0 – 6,560 ft. (0 – 2,000 m)	0 – 6,560 ft. (0 – 2,000 m)	0 – 6,560 ft. (0 – 2,000 m)	0 – 6,560 ft. (0 – 2,000 m)	0 – 6,560 ft. (0 – 2,000 m)
Altitude (Rest of the world)	0 – 10,000 ft. (0 – 3,050 m)	0 – 10,000 ft. (0 – 3,050 m)	0 – 10,000 ft. (0 – 3,050 m)	0 – 10,000 ft. (0 – 3,050 m)	0 – 10,000 ft. (0 – 3,050 m)	0 – 10,000 ft. (0 – 3,050 m)
Relative humidity	5% to 85%	5% to 85%	5% to 85%	5% to 85%	5% to 85%	5% to 85%
Short-term humidity	5% to 90%, not to exceed 0.024 kg water/kg of dry air	5% to 90%, not to exceed 0.024 kg water/kg of dry air	5% to 90%, not to exceed 0.024 kg water/kg of dry air	5% to 90%, not to exceed 0.024 kg water/kg of dry air	5% to 90%, not to exceed 0.024 kg water/kg of dry air	5% to 90%, not to exceed 0.024 kg water/kg of dry air
Acoustics: Sound pressure (Typical/maximum)	50.6/73.1 dBA	54.3/79.1 dBA	50.6/73.1 dBA	52.8/74.8 dBA	24.2/51.9 dBA	28.5/53 dBA
Acoustics: Sound power (Typical/maximum)	58.2/78.8 dBA	57.2/80.8 dBA	58.2/78.8 dBA	61.2/81.6 dBA	31.9/59.9 dBA	41/68 dBA
Nonoperating Conditions						
Temperature	-40º to 158ºF (-40º to 70ºC)	-40º to 158ºF (-40º to 70ºC)	-40º to 158ºF (-40º to 70ºC)	-40º to 158ºF (-40º to 70ºC)	-40º to 158ºF (-40º to 70ºC)	-40º to 158ºF (-40º to 70ºC)
Relative humidity	5% to 95%	5% to 95%	5% to 95%	5% to 95%	5% to 95%	5% to 95%
Altitude	15,584 ft (4750m)	15,584 ft (4750m)	15,584 ft (4750m)	15,584 ft (4750m)	15,584 ft (4750m)	15,584 ft (4750m)
Regulatory and Compliance						
Safety	UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1	UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 GB-4943	UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 GB-4943	UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 GB-4943	UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 GB-4943	UL 60950-1 CAN/CSA C22.2 No. 60950-1 EN 60950-1 AS/NZS 60950-1 IEC 60950-1 GB-4943

Technical Specifications	Cisco 4451	Cisco 4431	Cisco 4351	Cisco 4331	Cisco 4321	Cisco 4221
EMC	47 CFR, Part 15 ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 SD/EMI KN22, KN24	47 CFR, Part 15 ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 KN22, KN24	47 CFR, Part 15 ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 KN22, KN24	47 CFR, Part 15 ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 KN22, KN24	ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 KN22, KN24	ICES-003 Class A EN55022 Class A CISPR22 Class A AS/NZS 3548 Class A VCCI V-3 CNS 13438 EN 300-386 EN 61000 (Immunity) EN 55024, CISPR 24 EN50082-1 KN22, KN24
Telecom	T1 IC CS-03:2004 TIA-968-B:2009 HKTA 2028:2010 HKTA 2017:2010 HKTA 2015: 2006 G.703:2001 ID0002:2007 IS6100:2004 DSPR Gray Book:2000 DSPR Technical Condition: 2004 E1 AS/ACIF S016: 2001 AS/ACIF S038: 2001 G.703:2001 TBR 4:1995 TBR 12:1993 TBR 13:1996 RRA 2009-38 (RRL 2005-96) IDA TS DLCN:2011 IDA TS ISDN PRA:2005 IS6100: 2004 PTC 220:2008 Ethernet IEEE 802.3 ANSA X3.263	TIA-968-B CS-03 ANSI T1.101 ITU-T G.823, G.824 IEEE 802.3 RTTE Directive Homologation requirements vary by country and interface type. For specific country information, refer to the online approvals data base at: http://www.ciscofax.com.	TIA-968-B CS-03 ANSI T1.101 ITU-T G.823, G.824 IEEE 802.3 RTTE Directive Homologation requirements vary by country and interface type. For specific country information, refer to the online approvals data base at: http://www.ciscofax.com.	TIA-968-B CS-03 ANSI T1.101 ITU-T G.823, G.824 IEEE 802.3 RTTE Directive Homologation requirements vary by country and interface type. For specific country information, refer to the online approvals data base at: http://www.ciscofax.com.	TIA-968-B CS-03 ANSI T1.101 ITU-T G.823, G.824 IEEE 802.3 RTTE Directive Homologation requirements vary by country and interface type. For specific country information, refer to the online approvals data base at: http://www.ciscofax.com.	TIA-968-B CS-03 ANSI T1.101 ITU-T G.823, G.824 IEEE 802.3 RTTE Directive Homologation requirements vary by country and interface type. For specific country information, refer to the online approvals data base at: http://www.ciscofax.com.

Technical Specifications	Cisco 4451	Cisco 4431	Cisco 4351	Cisco 4331	Cisco 4321	Cisco 4221
Cisco IOS XE Software						
Protocols	IPv4, IPv6, static routes, Routing Information Protocol Versions 1 and 2 (RIP and RIPv2), Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), Border Gateway Protocol (BGP), BGP Router Reflector, Intermediate System-to-Intermediate System (IS-IS), Multicast Internet Group Management Protocol Version 3 (IGMPv3), Protocol Independent Multicast sparse mode (PIM SM), PIM Source-Specific Multicast (SSM), Resource Reservation Protocol (RSVP), Cisco Discovery Protocol, Encapsulated Remote Switched Port Analyzer (ERSPAN), Cisco IOS IP Service-Level Agreements (IPSLA), Call Home, Cisco IOS Embedded Event Manager (EEM), Internet Key Exchange (IKE), access control lists (ACL), Ethernet Virtual Connections (EVC), Dynamic Host Configuration Protocol (DHCP), Frame Relay (FR), DNS, Locator ID Separation Protocol (LISP), Overlay Transport Virtualization (OTV),[5] Hot Standby Router Protocol (HSRP), RADIUS, authentication, authorization, and accounting (AAA), Application Visibility and Control (AVC), Distance Vector Multicast Routing Protocol (DVMRP), IPv4-to-IPv6 Multicast, MPLS, Layer 2 and Layer 3 VPN, IPsec, Layer 2 Tunneling Protocol Version 3 (L2TPv3), Bidirectional Forwarding Detection (BFD), IEEE 802.1ag, and IEEE 802.3ah					
Encapsulations	Generic routing encapsulation (GRE), Ethernet, 802.1q VLAN, Point-to-Point Protocol (PPP), Multilink Point-to-Point Protocol (MLPPP), Frame Relay, Multilink Frame Relay (MLFR) (FR.15 and FR.16), High-Level Data Link Control (HDLC), Serial (RS-232, RS-449, X.21, V.35, and EIA-530), and PPP over Ethernet (PPPoE)					
Traffic management	QoS, Class-Based Weighted Fair Queuing (CBWFQ), Weighted Random Early Detection (WRED), Hierarchical QoS, Policy-Based Routing (PBR), Performance Routing (PfR), and Network-Based Application Recognition (NBAR)					
Cryptographic algorithms	Encryption: DES, 3DES, AES-128 or AES-256 (in CBC and GCM modes); Authentication: RSA (748/1024/2048 bit), ECDSA (256/384 bit); Integrity: MD5, SHA, SHA-256, SHA-384, SHA-512					

Services Plane: Enabling the Branch-in-a-Box

All Cisco 4000 Series ISRs contain processing cores built in as standard to allow full-featured services to run on board. This includes the full-featured Cisco WAAS engine that provides application acceleration and highly responsive virtual desktop experience. The technology is known as Cisco Service Containers, and it uses a standard hypervisor to allow x64-based applications to run.

The 4000 Series routers can be fitted with solid-state drives (SSD) and server cards for local storage and computing capability. The Cisco UCS® E-Series server cards are available with 8-core Intel® Xeon® processors with up to 48 GB of high-speed DDR3 memory and three drives built in, offering RAID 0, 1, and 5. This immense amount of compute power can eliminate the need for any dedicated servers at branch sites. Cisco UCS E-Series cards can be configured and managed using VMware vCenter and pooled with data center compute resources.

Product Performance and Scalability

The Cisco 4000 Series is built on a multicore CPU architecture. It runs modular Cisco IOS XE Software, which allows the platform to use to full advantage a distributed multicore architecture. The architecture of the Cisco 4000 Series separates control- and data-plane operations and integrates an industry-first services plane. This design delivers full-featured integrated services up to Layer 7 at high performance, with the ability to deliver application-aware network services while maintaining a stable platform and a high level of performance during periods of heavy network traffic.

The 4000 Series consists of three subseries of routers – the 4400 Series, the 4300 Series, and the 4200 Series – whose performance levels are represented in Figure 2.

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[5] Supported only on the 4451 for bandwidths less than100 Mbps.

Figure 2. Cisco 4000 Series ISRs Performance Comparison

Throughout the 4000 Series, all platforms come with fixed maximum performance levels. One fixed base performance level is delivered as the factory default, with an optional performance-on-demand license to increase the base forwarding throughput. This scenario enables deployment in high-speed WAN environments through performance-on-demand licensing to double or, for one of the platforms, triple the router capacity without any hardware upgrades.

All 4000 Series platforms have their fixed performance levels set well within actual capacity, with the result that performance does not necessarily degrade when a service is added to the configuration. This setup provides a deterministic performance, eliminating a network administrator's guesswork when planning for new services.

For a more detailed document on 4000 Series performance and platform scalability, refer to the white paper at http://www.cisco.com/c/en/us/products/collateral/routers/4000-series-integrated-services-routers-isr/white-paper-c11-734550.html.

Interfaces and Modules Support

The Cisco 4000 Series Integrated Services Routers (ISRs) are modular routers with LAN and WAN connectivity. The routers provide for network interface module (NIM) slots and enhanced service module (SM-X) slots, offering a rich set of modules, such as LAN, WAN and wireless interfaces, plus a range of compute engines for embedded services.

For the complete list of modules supported on the 4000 Series, refer to the Interfaces and Modules data sheet at http://www.cisco.com/c/en/us/products/routers/4000-series-integrated-services-routers-isr/relevant-interfaces-and-modules.html.

Support for Intelligent WAN

The 4000 Series is optimized for Cisco Intelligent WAN. For enterprises, this means that business-critical applications run faster, with more reliability and reduced operational expenditures (OpEx). The Intelligent WAN achieves this by giving all branches and data centers the ability to monitor, control, move, and report on streams of application data, such as specific web (HTTP) traffic. The 4000 Series has deep packet inspection capability and can accurately identify and control thousands of different applications, including custom in-house enterprise applications.

The 4000 Series with Intelligent WAN can pay for itself in WAN cost savings within months, and the ongoing deep application visibility and reporting will continue to provide valuable application, site, and user statistics to better manage the rollout of new sites or applications.

The benefits are immense:

1. Business-critical applications no longer have to contend with each other or with traffic that should be served on a best effort basis.
2. The enterprise network becomes more reliable because multiple paths can be used.
3. Costs are greatly reduced because dual MPLS links can be replaced with a mix of MPLS and Internet.
4. The time required to bring up new remote sites is dramatically reduced because the Intelligent WAN supports rapidly deployed DSL and 3G/4G LTE connections as easily as MPLS.
5. Security is assured across these connections using a zero-touch secure VPN technology used by governments and finance organizations worldwide.

From a platform perspective, the 4000 Series has the following:

1. Separate control and data planes for prevention of denial-of-service (DoS) attacks, with intrusion prevention system (IPS) and firewall capability built in.
2. Software-as-a-service (SaaS) applications can have content locally cached. The caching is automatic and peers directly with Akamai technology to obtain intelligence.
3. Application performance speed is greatly increased using built-in application acceleration technology that can locally cache at a byte level.

Support for Data Modeling

Enterprises and service providers wish to drive down the operational cost (OpEx) of their networks and increase the agility and speed with which they deliver new services, furthered by investments in software-defined networking (SDN) and network functions virtualization (NFV). Cisco routers provide support for Netconf and YANG data modeling, with increasing model coverage in successive releases.

Cisco IOS Software Licensing and Packaging

Universal Cisco IOS XE Image

A single Cisco IOS XE Universal image encompassing all functions is delivered with the platform. Advanced features can be enabled simply by activating a software license on the Universal image. Technology packages and feature licenses, enabled through right-to-use licenses, simplify software delivery and decrease the operational costs of deploying new features.

Four major technology licenses are available on the Cisco 4000 Series; these licenses can be activated through the Cisco software activation process identified at http://www.cisco.com/go/sa. The following licenses are available:

- IP Base: This technology package is available as the default.
- Application Experience (APPX): This license includes data and application performance features.
- Unified Communications (UC):[6] This license includes voice features.
- Security (SEC) or Security with No Payload Encryption (SEC-NPE): This license includes features for securing network infrastructure.

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[6] Unified Communications is not supported by ISR4221

The Cisco 4000 Series has a performance-on-demand license to increase the base forwarding throughput with no hardware changes. Also present is the High Security (HSEC) license, which removes the curtailment enforced by the U.S. government export restrictions on the encrypted tunnel count and encrypted throughput. The HSECK9 license is a separately required license for a feature to have full crypto functionality. Without the HSECK9 license, only 225 secure tunnels and 85 Mbps of crypto bandwidth would be available.

For additional information and details about Cisco IOS Software licensing and packaging on the Cisco 4000 Series, please visit http://www.cisco.com/c/en/us/td/docs/routers/access/4400/software/configuration/guide/isr4400swcfg.pdf.

Cisco 4000 Series Bundles

Cisco 4000 Series routers are available is several attractive bundles. The AX bundles integrate Cisco Wide Area Application Services (WAAS), Security (SEC), and Data (DATA) licenses into a single bundle that is simple to order, configure, and deploy. For customers who are also interested in voice along with all of these features, AXV presents an attractive option. See Table 5 for details.

Table 5.   Cisco 4000 Series Feature Bundles

Bundles	Features
Application Experience with Voice (AXV)	AX + Voice
Voice with Security (VSEC)	Voice + Security
Application Experience (AX)	IP Base + Security + advanced networking protocols: L2TPv3, BFD, MPLS, VRF, VXLAN[7] (bandwidth less than 100 Mbps) Application Experience: PfRv3, WAAS with AppNav, NBAR2, AVC, IPSLA Hybrid Cloud Connectivity: LISP, OTV5 (for bandwidth less than 100 Mbps), Virtual Private LAN Services (VPLS), Ethernet over MPLS Intelligent web caching: Akamai Connect
Voice (V)	IP Base + Unified Communications: Cisco Unified Communications Manager Express, Survivable Remote Site Telephony (SRST), CUBE
Security (SEC)	IP Base + Advanced Security: Zone-based firewall, IPsec VPN, EzVPN, Dynamic Multipoint VPN (DMVPN), FlexVPN

Note: The 4221/K9 does not support UC (voice). Hence, there are no V, VSEC, or AXV bundles for the 4221/K9 model.

More information on ISR AX bundles is available at http://www.cisco.com/go/ax.

A pay-as-you-grow licensing model lets you increase the performance level for the platforms from the base level to a higher level. So you can purchase at an attractive entry-level price point and increase the performance level as your business demand grows. Table 6 describes the performance licenses.

Table 6.   Cisco 4000 Series Performance Licenses

Platform	Performance-on-Demand License	Features
ISR4451	FL-44-PERF-K9	Increases the performance from base performance 1 Gbps to 2 Gbps
ISR4431	FL-44-PERF-K9	Increases the performance from base performance 500 Mbps to 1 Gbps
ISR4351	FL-4350-PERF-K9	Increases the performance from base performance 200 Mbps to 400 Mbps
ISR4331	FL-4330-PERF-K9	Increases the performance from base performance 100 Mbps to 300 Mbps
ISR4321	FL-4320-PERF-K9	Increases the performance from base performance 50 Mbps to 100 Mbps
ISR4221	FL-4220-PERF-K9	Increases the performance from base performance 35 Mbps to 75 Mbps

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[7] Supported only on the 4451 model

Ordering Information

The Cisco 4000 Series ISRs are orderable and shipping. To place an order, refer to Table 7 and visit the Cisco Ordering Home Page.

Table 7.   Cisco 4000 Series Ordering Information

Product Name	Product Description
ISR4451-X/K9	4451 ISR with 4 onboard GE, 3 NIM slots, 1 ISC slot, 2 SM slots, 8 GB flash memory default, 2 GB DRAM default (data plane), 4 GB DRAM default (control plane)
ISR4431/K9	4431 ISR with 4 onboard GE, 3 NIM slots, 1 ISC slot, 8 GB flash memory default, 2 GB DRAM default (data plane), 4 GB DRAM default (control plane)
ISR4351/K9	4351 ISR with 3 onboard GE, 3 NIM slots, 1 ISC slot, 2 SM slots, 4 GB flash memory default, 4 GB DRAM default
ISR4331/K9	4331 ISR with 3 onboard GE, 2 NIM slots, 1 ISC slot, 1 SM slot, 4 GB flash memory default, 4 GB DRAM default
ISR4321/K9	4321 ISR with 2 onboard GE, 2 NIM slots, 1 ISC slot, 4 GB flash memory default, 4 GB DRAM default
ISR4221/K9	4221 ISR with 2 onboard GE, 2 NIM slots, 1 ISC slot, 8 GB flash memory default, 4 GB DRAM default

For additional product numbers, including the Cisco 4000 Series bundle offerings, please contact your local Cisco account representative. To place an order, visit the Cisco Ordering Home Page. To download software, visit the Cisco Software Center.

Integrated Services Router Migration Options

The Cisco 4000 Series is included in the standard Cisco Technology Migration Program (TMP). Refer to http://www.cisco.com/go/tmp and contact your local Cisco account representative for program details.

Warranty Information

The Cisco 4000 Series Integrated Services Routers have a 90-day limited liability warranty.

Cisco and Partner Services for the Branch Office

Services from Cisco and our certified partners help you transform the branch-office experience and accelerate business innovation and growth. We have the expertise to create a clear, replicable, optimized branch-office footprint across technologies. Planning and design services align technology with your business goals and can increase deployment efficiency. Technical services help you improve operational efficiency, save money, and mitigate risk. Optimization services help you continuously improve performance and succeed with new technologies. For more information, please visit http://www.cisco.com/go/services.

Cisco Smart Net Total Care™ technical support for the Cisco 4000 Series is available on a one-time or annual contract basis. Support options range from help-desk assistance to proactive, onsite consultation. All support contracts include:

- Major Cisco IOS Software updates for protocol, security, bandwidth, and feature improvements

- Full access rights to Cisco.com technical libraries for technical assistance, electronic commerce, and product information

- Access 24 hours a day to the industry's largest dedicated technical support staff

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Cisco Capital® can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce CapEx. Accelerate your growth. Optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there's just one predictable payment. Cisco Capital is available in more than 100 countries. Learn more.

For More Information

For more information about the Cisco 4000 Series, visit http://www.cisco.com/go/ISR4K or contact your local Cisco account representative.

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HP 2530 Switch Series

Key features

- Cost-effective fully managed Layer 2 switches

- 24 or 48 Gigabit Ethernet ports and 4 SFP uplink ports

- PoE+ models for voice, video and wireless

- WDRR, ACLs, IPv4/IPv6 host support

- Includes lifetime warranty, all software releases, and technical phone support

Product overview

The HP 2530 Switch Series consists of four fully managed Layer 2 edge switches, delivering cost-effective, reliable, and secure connectivity for business networks. Designed for entry-level to midsize enterprise networks, these Gigabit Ethernet switches deliver full Layer 2 capabilities with enhanced access security, traffic prioritization, IPv6 host support, and optional PoE+, and include a product lifetime warranty.

Each 2530 switch has 24 or 48 RJ-45 10/100/1000 ports and four small form-factor pluggable (SFP) slots for fiber connectivity. For customers implementing Power over Ethernet for voice, video, or wireless deployments, the HP 2530-24G-PoE+ and the HP 2530-48G-PoE+ Switches are IEEE 802.3af and IEEE 802.3at compliant with up to 30 W per port.

The HP 2530 Switch Series is easy to use, deploy, and manage via SNMP, CLI, and Web GUI. The series offers flexible wall, table, and rack mounting; quiet operation; and improved power savings, with features such as IEEE 802.3 az (Energy Efficient Ethernet). These switches include a lifetime warranty and all software releases and technical phone support.

Features and benefits

Quality of Service (QoS)

- **Traffic prioritization (IEEE 802.1p)**
  allows real-time traffic classification with support for eight priority levels mapped to either two or four queues; uses weighted deficit round robin (WDRR) or strict priority (SP)

- **Simplified QoS configuration**

  - **Port-based**
    prioritize traffic by specifying a port and priority level

  - **VLAN-based**
    prioritize traffic by specifying a VLAN and priority level

- **Class of Service (CoS)**
  sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ

- **Rate limiting**
  sets per-port ingress enforced maximums for all ingressed traffic, or for broadcast, multicast, or unknown destination traffic

- **Layer 4 prioritization**
  enables prioritization based on TCP/UDP port numbers

- **Flow control**
  helps deliver reliable communication during full-duplex operation

Management

- **Choice of management interfaces**

  - **Web graphical user interface (GUI)**
    HTML-based easy-to-use graphical interface allows configuration of the switch from any Web browser

  - **Command-line (CLI)**
    robust command-line interface provides advanced configuration and diagnostics

  - **Simple Network Management Protocol (SNMPv1/v2c/v3)**
    allows a switch to be managed with a variety of third-party network management applications

- **Virtual stacking**
  single IP address management of up to 16 switches

- **sFlow (RFC 3176)**
  wire-speed traffic accounting and monitoring configured by SNMP and CLI with three terminal encrypted receivers

- **IEEE 802.1AB Link Layer Discovery Protocol (LLDP)**
  automates device discovery protocol for easy mapping by network management applications

- **Logging**
  provides local and remote logging of events via SNMP (v2c and v3) and syslog; provides log throttling and log filtering to reduce the number of log events generated

- **Port mirroring**
  allows traffic to be mirrored on any port or a network analyzer to assist with diagnostics or detecting network attacks

- **RMON (remote monitoring)**
  provides advanced monitoring and reporting capabilities for statistics, history, alarms, and events

- **Find-Fix-and-Inform**
  finds and fixes common network problems automatically, then informs the administrator

- **Friendly port names**
  allow assignment of descriptive names to ports

- **Dual flash images**
  provide independent primary and secondary operating system files for backup while upgrading

- **Multiple configuration files**
  allow multiple configuration files to be stored to a flash image

- **Front-panel LEDs**

  - **Locator LED**
    allows users to set the locator LED on a specific switch to either turn on, blink, or turn off; simplifies troubleshooting by making it easy to locate a particular switch within a rack of similar switches

  - **Per-port LEDs**
    provides an at-a-glance view of status, activity, speed, and full-duplex operation

  - **Power and fault LEDs**
    display any issues

Connectivity

- **IPv6**

  - **IPv6 host**
    allows the switch to be deployed and managed at the edge of an IPv6 network

  - **Dual stack (IPv4/IPv6)**
    supports connectivity for both protocols; provides a transition mechanism from IPv4 to IPv6

  - **MLD snooping**
    forwards IPv6 multicast traffic to the appropriate interface; prevents IPv6 multicast traffic from flooding the network

- **IEEE 802.3af Power over Ethernet (PoE)**
  provides up to 15.4 W per port to IEEE 802.3af-compliant PoE-powered devices such as IP phones, wireless access points, and security cameras

- **IEEE 802.3at Power over Ethernet Plus**
  provides up to 30 W per port to IEEE 802.3 for PoE/PoE+ powered devices such as video IP phones, IEEE 802.11n wireless access points, and advanced pan/tilt/zoom security cameras (see product specifications for total PoE power available)

- **Auto-MDIX**
  adjusts automatically for straight-through or crossover cables on all ports

- **Pre-standard PoE support**
  detects and provides power to pre-standard PoE devices; see list of supported devices in the product FAQ at **www.hp.com/networking/support**

- **Small form-factor pluggable (SFP) slots**
  provides fiber connectivity such as Gigabit-SX, -LX, -LH, and -BX with four SFP slots

- **Dual-personality (RJ-45 or USB micro-B) serial console port**
  gives easy access to switch CLI via front switch location of dual-personality RJ-45 or USB micro-B serial console port

Layer 2 switching

- **VLANs**
  provide support for 512 VLANs and 4,094 VLAN IDs

- **Jumbo packet support**
  supports up to 9220-byte frame size to improve the performance of large data transfers

- **16K MAC address table**
  provides access to many Layer 2 devices

- **GARP VLAN Registration Protocol**
  allows automatic learning and dynamic assignment of VLANs

Security

- **Access control lists (ACLs)**
  accommodates IPv4/IPv6 port and VLAN-based ACLs

- **Source-port filtering**
  allows only specified ports to communicate with each other

- **RADIUS/TACACS+**
  eases switch management security administration by using a password authentication server

- **Secure Sockets Layer (SSL)**
  encrypts all HTTP traffic, allowing secure access to the browser-based management GUI in the switch

- **Port security**
  allows access only to specified MAC addresses, which can be learned or specified by the administrator

- **MAC address lockout**
  prevents particular configured MAC addresses from connecting to the network

- **Multiple user authentication methods**

  - **IEEE 802.1X**
    is an industry-standard method of user authentication using an IEEE 802.1X supplicant on the client in conjunction with a RADIUS server

  - **Web-based authentication**
    is similar to IEEE 802.1X and provides a browser-based environment to authenticate clients that do not support the IEEE 802.1X supplicant

  - **MAC-based authentication**
    authenticates the client with the RADIUS server based on the client's MAC address

- **Secure shell (SSHv2; client and server)**
  encrypts all transmitted data for secure, remote CLI access over IP networks

- **Secure shell**
  encrypts all transmitted data for secure remote CLI access over IP networks

- **STP BPDU port protection**
  blocks Bridge Protocol Data Units (BPDUs) on ports that do not require BPDUs, preventing forged BPDU attacks

- **STP Root Guard**
  protects the root bridge from malicious attacks or configuration mistakes

- **Secure management access**
  securely encrypts all access methods (CLI, GUI, or MIB) through SSHv2 and SNMPv3

- **Custom banner**
  displays security policy when users log in to the switch

- **Secure FTP**
  allows secure file transfer to and from the switch; protects against unwanted file downloads or unauthorized copying of a switch configuration file

- **Protected ports CLI**
  offers intuitive CLI to configure the source-port filters feature by allowing specified ports to be isolated from all other ports on the switch; the protected port or ports can communicate only with the uplink or shared resources

- **Authentication flexibility**

  - **Multiple IEEE 802.1X users per port**
    provides authentication of up to eight IEEE 802.1X users per port; prevents user "piggybacking" on another user's IEEE 802.1X authentication

  - **Concurrent IEEE 802.1X and Web or MAC authentication schemes per port**
    switch port will accept any IEEE 802.1X and either Web or MAC authentications

- **Switch management logon security**
  helps secure switch CLI logon by optionally requiring either RADIUS or TACACS+ authentication

Convergence

- **LLDP-MED (Media Endpoint Discovery)**
  is a standard extension of LLDP that stores values for parameters such as QoS and VLAN to automatically configure network devices such as IP phones

- **IP multicast (data-driven IGMP)**
  automatically prevents flooding of IP multicast traffic

- **IEEE 802.1AB Link Layer Discovery Protocol (LLDP)**
  is an automated device discovery protocol that provides easy mapping of network management applications

- **PoE and PoE+ allocations**
  support multiple method (automatic, IEEE 802.3at dynamic, LLDP-MED fine grain, IEEE 802.3af device class, or user specified) to allocate and manage PoE/PoE+ power for more efficient energy saving

- **Voice VLAN**
  uses LLDP-MED to automatically configure a VLAN for IP phones

- **IP multicast (data-driven IGMPv3)**
  automatically prevents flooding of IP multicast traffic

Resiliency and high availability

- **Port trunking and link aggregation**

  - **Trunking**
    supports up to eight links per trunk to increase bandwidth and create redundant connections; supports L2, L3, and L4 trunk-load-balancing algorithm

  - **IEEE 802.3ad Link Aggregation Protocol (LACP)**
    eases configuration of trunks through automatic configuration

- **IEEE 802.1s Multiple Spanning Tree**
  provides high link availability in multiple VLAN environments by allowing multiple spanning trees; provides legacy support for IEEE 802.1d and IEEE 802.1w

Product architecture

- **Energy-efficient design**

  - **IEEE 802.3az**
    reduces power consumption during periods of low data activity

  - **Port low power mode**
    when no link is detected on a port, the port will automatically go into low-power mode to conserve energy

  - **Fans**
    variable-speed fans help reduce power consumption

  - **Port LEDs**
    port link and activity LEDs can be turned off to conserve energy

- **Switch on a chip**
  provides highly integrated, high-performance switch design with a nonblocking architecture

Flexibility

- **Flexible mounting**

  - **Rackable**
    is mountable in a standard 19-inch rack using included hardware

  - **Wall mountable**
    allows the switch to be mounted to a wall using included hardware

  - **Surface mountable**
    allows the switch to be mounted above or below a surface (such as a desk or table) with included hardware

- **Quiet operation**
  variable-speed fans adjust for the operating environment while lowering noise and energy consumption needs

Warranty and support

- **Lifetime warranty**
  for as long as you own the product with advance replacement and next-business-day delivery (available in most countries)†

- **Electronic and telephone support**
  limited electronic and telephone support is available from HP; to reach our support centers, refer to **www.hp.com/networking/contact-support**; for details on the duration of support provided with your product purchase, refer to **www.hp.com/networking/warrantysummary**

- **Software releases**
  to find software for your product, refer to **www.hp.com/networking/support**; for details on the software releases available with your product purchase, refer to **www.hp.com/networking/warrantysummary**

†HP warranty includes repair or replacement of hardware for as long as you own the product, with next business day advance replacement (available in most countries). The disk drive included with HP AllianceOne Advanced Services and Services zl Modules, HP Threat Management Services zl Module, HP AllianceOne Extended zl Module with Riverbed Steelhead, HP MSM765zl Mobility Controller and HP Survivable Branch Communication zl Module powered by Microsoft Lync has a five-year hardware warranty. For details, refer to the Software license and hardware warranty statements at **www.hp.com/networking/warranty**.

HP 2530 Switch Series

Specifications

	HP 2530-24G Switch (J9776A)	HP 2530-48G Switch (J9775A)
Ports	24 RJ-45 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only	48 RJ-45 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only
	4 fixed Gigabit Ethernet SFP ports	4 fixed Gigabit Ethernet SFP ports
	1 Dual-personality (RJ-45 or USB micro-B) serial console port	1 Dual-personality (RJ-45 or USB micro-B) serial console port
Physical characteristics		
	17.44(w) x 10.00(d) x 1.75(h) in (44.3 x 25.4 x 4.45 cm) (1U height)	17.44(w) x 10.00(d) x 1.75(h) in (44.3 x 25.4 x 4.45 cm) (1U height)
Weight	6.1 lb (2.77 kg)	6.8 lb (3.08 kg)
Memory and processor		
Processor	ARM9E @ 800 MHz, 256 MB flash, 128 MB DDR3 DIMM; packet buffer size: 1.5 MB dynamically allocated	ARM9E @ 800 MHz, 256 MB flash, 128 MB DDR3 DIMM; packet buffer size: 3 MB dynamically allocated
Mounting	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit available); horizontal surface mounting; wall mounting	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit available); horizontal surface mounting; wall mounting
Performance		
	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.3 µs (LIFO 64-byte packets)	< 2.3 µs (LIFO 64-byte packets)
Throughput	41.6 million pps	77.3 million pps
Switching capacity	56 Gbps	104 Gbps
MAC address table size	16000 entries	16000 entries
Environment		
Operating temperature	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)
Operating relative humidity	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 90% @ 149°F (65°C), noncondensing	15% to 90% @ 149°F (65°C), noncondensing
Altitude	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)
Acoustic	Pressure: 34.0 dB	Pressure: 34.5 dB
Electrical characteristics		
Maximum heat dissipation	164 BTU/hr (173.02 kJ/hr)	203 BTU/hr (214.17 kJ/hr)
Voltage	100-127/200-240 VAC	100-127/200-240 VAC
Current	.6/.4 A	1.2/0.7 A
Idle power	28.8 W	29.5 W
Maximum power rating	48.0 W	59.5 W
Frequency	50/60 Hz	50/60 Hz
Notes	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated.	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated.
Safety	UL 60950-1; CAN/CSA 22.2 No. 60950-1; EN 60825; IEC 60950-1; EN 60950-1	UL 60950-1; CAN/CSA 22.2 No. 60950-1; EN 60825; IEC 60950-1; EN 60950-1
Emissions	FCC Class A; EN 55022/CISPR-22 Class A; VCCI Class A	FCC Class A; EN 55022/CISPR-22 Class A; VCCI Class A
Immunity		
Generic	EN 55024, CISPR 24	EN 55024, CISPR 24
EN	EN 55024, CISPR 24	EN 55024, CISPR 24
ESD	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3	IEC 61000-4-3
EFT/Burst	IEC 61000-4-4	IEC 61000-4-4
Surge	IEC 61000-4-5	IEC 61000-4-5
Conducted	IEC 61000-4-6	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8	IEC 61000-4-8
Voltage dips and interruptions	IEC 61000-4-11	IEC 61000-4-11
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Management	IMC - Intelligent Management Center; command-line interface; Web browser; configuration menu; Out-of-band management (serial RS-232C or MicroUSB); IEEE 802.3 Ethernet MIB; Repeater MIB; Ethernet Interface MIB	IMC - Intelligent Management Center; command-line interface; Web browser; configuration menu; Out-of-band management (serial RS-232C or MicroUSB); IEEE 802.3 Ethernet MIB; Repeater MIB; Ethernet Interface MIB

HP 2530 Switch Series

Specifications (continued)

	HP 2530-24G Switch (J9776A)	HP 2530-48G Switch (J9775A)
Notes	When using mini-GBICs with this product, mini-GBICs with revision "B" or later (product number ends with the letter "B" or later, e.g., J4858B, J4859C) are required.	When using mini-GBICs with this product, mini-GBICs with revision "B" or later (product number ends with the letter "B" or later, e.g., J4858B, J4859C) are required.
Services	3-year, 4-hour onsite, 13x5 coverage for hardware (U4683E)	3-year, 4-hour onsite, 13x5 coverage for hardware (U4683E)
	3-year, 4-hour onsite, 24x7 coverage for hardware (U4835E)	3-year, 4-hour onsite, 24x7 coverage for hardware (U4835E)
	3-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 SW phone support and SW updates (U6321E)	3-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 SW phone support and SW updates (U6321E)
	3-year, 24x7 SW phone support, software updates (UF792E)	3-year, 24x7 SW phone support, software updates (UF792E)
	4-year, 4-hour onsite, 13x5 coverage for hardware (UR948E)	4-year, 4-hour onsite, 13x5 coverage for hardware (UR948E)
	4-year, 4-hour onsite, 24x7 coverage for hardware (UR949E)	4-year, 4-hour onsite, 24x7 coverage for hardware (UR949E)
	4-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone (UR950E)	4-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone (UR950E)
	4-year, 24x7 SW phone support, software updates (UR951E)	4-year, 24x7 SW phone support, software updates (UR951E)
	5-year, 4-hour onsite, 13x5 coverage for hardware (UR952E)	5-year, 4-hour onsite, 13x5 coverage for hardware (UR952E)
	5-year, 4-hour onsite, 24x7 coverage for hardware (UR953E)	5-year, 4-hour onsite, 24x7 coverage for hardware (UR953E)
	5-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone (UR954E)	5-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone (UR954E)
	3 Yr 6 hr Call-to-Repair Onsite (UW368E)	3 Yr 6 hr Call-to-Repair Onsite (UW368E)
	4 Yr 6 hr Call-to-Repair Onsite (UW369E)	4 Yr 6 hr Call-to-Repair Onsite (UW369E)
	5 Yr 6 hr Call-to-Repair Onsite (UW370E)	5 Yr 6 hr Call-to-Repair Onsite (UW370E)
	1-year, 4-hour onsite, 13x5 coverage for hardware (HR849E)	1-year, 4-hour onsite, 13x5 coverage for hardware (HR849E)
	1-year, 4-hour onsite, 24x7 coverage for hardware (HR850E)	1-year, 4-hour onsite, 24x7 coverage for hardware (HR850E)
	1-year, 6 hour Call-To-Repair Onsite for hardware (HR853E)	1-year, 6 hour Call-To-Repair Onsite for hardware (HR853E)
	1-year, 24x7 software phone support, software updates (HR852E)	1-year, 24x7 software phone support, software updates (HR852E)
	1-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone support and software updates (HR851E)	1-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone support and software updates (HR851E)
	1-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS554E)	1-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS554E)
	1-year, 24x7 software phone support, software updates + 4 hour hardware exchange (HS555E)	1-year, 24x7 software phone support, software updates + 4 hour hardware exchange (HS555E)
	3-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS556E)	3-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS556E)
	3-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS557E)	3-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS557E)
	4-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS558E)	4-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS558E)
	4-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS559E)	4-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS559E)
	5-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS560E)	5-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS560E)
	5-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS561E)	5-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS561E)
	Refer to the HP website at **www.hp.com/networking/services** for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local HP sales office.	Refer to the HP website at **www.hp.com/networking/services** for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local HP sales office.

HP 2530 Switch Series

Specifications (continued)

	HP 2530-24G Switch (J9776A)	HP 2530-48G Switch (J9775A)

Standards and protocols
(applies to all products in series)

Device management
RFC 1591 DNS (client)
SSHv1/SSHv2 Secure Shell

General protocols
IEEE 802.1D MAC Bridges
IEEE 802.1p Priority
IEEE 802.1Q VLANs
IEEE 802.1s Multiple Spanning Trees
IEEE 802.1w Rapid Reconfiguration of Spanning Tree
IEEE 802.3 Type 10BASE-T
IEEE 802.3ab 1000BASE-T
IEEE 802.3ad Link Aggregation Control Protocol (LACP)
IEEE 802.3af Power over Ethernet
IEEE 802.3at Power over Ethernet Plus
IEEE 802.3az Energy Efficient Ethernet
IEEE 802.3x Flow Control
RFC 768 UDP
RFC 783 TFTP Protocol (revision 2)
RFC 792 ICMP
RFC 793 TCP
RFC 826 ARP
RFC 854 TELNET
RFC 868 Time Protocol
RFC 951 BOOTP
RFC 1350 TFTP Protocol (revision 2)
RFC 1542 BOOTP Extensions
RFC 2030 Simple Network Time Protocol (SNTP) v4
RFC 2131 DHCP

IP multicast
RFC 3376 IGMPv3 (host joins only)

IPv6
RFC 1981 IPv6 Path MTU Discovery
RFC 2460 IPv6 Specification
RFC 2925 Remote Operations MIB (Ping only)
RFC 3315 DHCPv6 (client only)
RFC 3513 IPv6 Addressing Architecture
RFC 3596 DNS Extension for IPv6
RFC 4022 MIB for TCP
RFC 4113 MIB for UDP
RFC 4251 SSHv6 Architecture
RFC 4252 SSHv6 Authentication
RFC 4252 SSHv6 Transport Layer
RFC 4254 SSHv6 Connection
RFC 4293 MIB for IP
RFC 4419 Key Exchange for SSH
RFC 4443 ICMPv6
RFC 4861 IPv6 Neighbor Discovery
RFC 4862 IPv6 Stateless Address Auto-configuration

MIBs
RFC 1213 MIB II
RFC 1493 Bridge MIB
RFC 2021 RMONv2 MIB
RFC 2613 SMON MIB
RFC 2618 RADIUS Client MIB
RFC 2620 RADIUS Accounting Client MIB
RFC 2665 Ethernet-Like-MIB
RFC 2674 802.1p and IEEE 802.1Q Bridge MIB
RFC 2688 MAU-MIB
RFC 2737 Entity MIB (Version 2)
RFC 2863 The Interfaces Group MIB

Network management
IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
RFC 1098 A Simple Network Management Protocol (SNMP)
RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm) and 9 (events)
ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED)
SNMPv1/v2c/v3

QoS/CoS
RFC 2474 DiffServ precedence, with 4 queues per port
RFC 2475 DiffServ Architecture
RFC 2597 DiffServ Assured Forwarding (AF)
RFC 2598 DiffServ Expedited Forwarding (EF)

Security
IEEE 802.1X Port Based Network Access Control
RFC 1492 TACACS+
RFC 2138 RADIUS Authentication
RFC 2866 RADIUS Accounting
Secure Sockets Layer (SSL)

HP 2530 Switch Series

Specifications (continued)

	HP 2530-24G-PoE+ Switch (J9773A)	HP 2530-48G-PoE+ Switch (J9772A)
Ports	24 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only	48 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only
	4 fixed Gigabit Ethernet SFP ports	4 fixed Gigabit Ethernet SFP ports
	1 Dual-personality (RJ-45 or USB micro-B) serial console port	1 Dual-personality (RJ-45 or USB micro-B) serial console port
Physical characteristics		
	17.44(w) x 13.00(d) x 1.75(h) in (44.3 x 33.02 x 4.45 cm) (1U height)	17.44(w) x 13.00(d) x 1.75(h) in (44.3 x 32.26 x 4.45 cm) (1U height)
Weight	8.7 lb (3.95 kg)	10.4 lb (4.72 kg)
Memory and processor		
Processor	ARM9E @ 800 MHz, 256 MB flash, 128 MB DDR3 DIMM; packet buffer size: 1.5 MB dynamically allocated	ARM9E @ 800 MHz, 256 MB flash, 128 MB DDR3 DIMM; packet buffer size: 3 MB dynamically allocated
Mounting	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit available); horizontal surface mounting; wall mounting	Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (rack-mounting kit available); horizontal surface mounting; wall mounting
Performance		
	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.3 µs (LIFO 64-byte packets)	< 2.3 µs (LIFO 64-byte packets)
Throughput	41.6 million pps	77.3 million pps
Switching capacity	56 Gbps	104 Gbps
MAC address table size	16000 entries	16000 entries
Environment		
Operating temperature	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)
Operating relative humidity	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 90% @ 149°F (65°C), noncondensing	15% to 90% @ 149°F (65°C), noncondensing
Altitude	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)
Acoustic	Pressure: 43.9 dB	Pressure: 43.9 dB
Electrical characteristics		
Maximum heat dissipation	135 BTU/hr (142.42 kJ/hr), (switch only: 135 BTU/hr; combined switch + max. PoE devices: 843 BTU/hr)	236 BTU/hr (248.98 kJ/hr), (switch only: 236 BTU/hr; combined switch + max. PoE devices: 1624 BTU/hr)
Voltage	100-127/200-240 VAC	100-127/200-240 VAC
Current	3.2/1.6 A	5.8/2.9 A
Idle power	25.2 W	40.1 W
Maximum power rating	247 W	476 W
PoE power	195 W	382 W
Frequency	50/60 Hz	50/60 Hz
Notes	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated. PoE power is the total power budget available to all PoE ports.	Idle power is the actual power consumption of the device with no ports connected. Maximum power rating and maximum heat dissipation are the worst-case theoretical maximum numbers provided for planning the infrastructure with fully loaded PoE (if equipped), 100% traffic, all ports plugged in, and all modules populated. PoE power is the total power budget available to all PoE ports.
Safety	UL 60950-1; CAN/CSA 22.2 No. 60950-1; EN 60825; IEC 60950-1; EN 60950-1	UL 60950-1; CAN/CSA 22.2 No. 60950-1; EN 60825; IEC 60950-1; EN 60950-1
Emissions	FCC Class A; EN 55022/CISPR-22 Class A; VCCI Class A	FCC Class A; EN 55022/CISPR-22 Class A; VCCI Class A
Immunity		
Generic	EN 55024, CISPR 24	EN 55024, CISPR 24
EN	EN 55024, CISPR 24	EN 55024, CISPR 24
ESD	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3	IEC 61000-4-3
EFT/Burst	IEC 61000-4-4	IEC 61000-4-4
Surge	IEC 61000-4-5	IEC 61000-4-5
Conducted	IEC 61000-4-6	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8	IEC 61000-4-8
Voltage dips and interruptions	IEC 61000-4-11	IEC 61000-4-11
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3

HP 2530 Switch Series

Specifications (continued)

	HP 2530-24G-PoE+ Switch (J9773A)	HP 2530-48G-PoE+ Switch (J9772A)
Management	IMC - Intelligent Management Center; command-line interface; Web browser; configuration menu; Out-of-band management (serial RS-232C or MicroUSB); IEEE 802.3 Ethernet MIB; Repeater MIB; Ethernet Interface MIB	IMC - Intelligent Management Center; command-line interface; Web browser; configuration menu; Out-of-band management (serial RS-232C or MicroUSB); IEEE 802.3 Ethernet MIB; Repeater MIB; Ethernet Interface MIB
Notes	When using mini-GBICs with this product, mini-GBICs with revision "B" or later (product number ends with the letter "B" or later, e.g., J4858B, J4859C) are required.	When using mini-GBICs with this product, mini-GBICs with revision "B" or later (product number ends with the letter "B" or later, e.g., J4858B, J4859C) are required.
Services	3-year, 4-hour onsite, 13x5 coverage for hardware (U4683E)	3-year, 4-hour onsite, 13x5 coverage for hardware (U4683E)
	3-year, 4-hour onsite, 24x7 coverage for hardware (U4835E)	3-year, 4-hour onsite, 24x7 coverage for hardware (U4835E)
	3-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 SW phone support and SW updates (U6321E)	3-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 SW phone support and SW updates (U6321E)
	3-year, 24x7 SW phone support, software updates (UF792E)	3-year, 24x7 SW phone support, software updates (UF792E)
	4-year, 4-hour onsite, 13x5 coverage for hardware (UR948E)	4-year, 4-hour onsite, 13x5 coverage for hardware (UR948E)
	4-year, 4-hour onsite, 24x7 coverage for hardware (UR949E)	4-year, 4-hour onsite, 24x7 coverage for hardware (UR949E)
	4-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone (UR950E)	4-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone (UR950E)
	4-year, 24x7 SW phone support, software updates (UR951E)	4-year, 24x7 SW phone support, software updates (UR951E)
	5-year, 4-hour onsite, 13x5 coverage for hardware (UR952E)	5-year, 4-hour onsite, 13x5 coverage for hardware (UR952E)
	5-year, 4-hour onsite, 24x7 coverage for hardware (UR953E)	5-year, 4-hour onsite, 24x7 coverage for hardware (UR953E)
	5-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone (UR954E)	5-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone (UR954E)
	3 Yr 6 hr Call-to-Repair Onsite (UW368E)	3 Yr 6 hr Call-to-Repair Onsite (UW368E)
	4 Yr 6 hr Call-to-Repair Onsite (UW369E)	4 Yr 6 hr Call-to-Repair Onsite (UW369E)
	5 Yr 6 hr Call-to-Repair Onsite (UW370E)	5 Yr 6 hr Call-to-Repair Onsite (UW370E)
	1-year, 4-hour onsite, 13x5 coverage for hardware (HR849E)	1-year, 4-hour onsite, 13x5 coverage for hardware (HR849E)
	1-year, 4-hour onsite, 24x7 coverage for hardware (HR850E)	1-year, 4-hour onsite, 24x7 coverage for hardware (HR850E)
	1-year, 6 hour Call-To-Repair Onsite for hardware (HR853E)	1-year, 6 hour Call-To-Repair Onsite for hardware (HR853E)
	1-year, 24x7 software phone support, software updates (HR852E)	1-year, 24x7 software phone support, software updates (HR852E)
	1-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone support and software updates (HR851E)	1-year, 4-hour onsite, 24x7 coverage for hardware, 24x7 software phone support and software updates (HR851E)
	1-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS554E)	1-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS554E)
	1-year, 24x7 software phone support, software updates + 4 hour hardware exchange (HS555E)	1-year, 24x7 software phone support, software updates + 4 hour hardware exchange (HS555E)
	3-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS556E)	3-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS556E)
	3-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS557E)	3-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS557E)
	4-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS558E)	4-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS558E)
	4-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS559E)	4-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS559E)
	5-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS560E)	5-year, 24x7 software phone support, software updates + Next Business Day Hardware Exchange (HS560E)
	5-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS561E)	5-year, 24x7 software phone support, software updates + 4 hour Hardware Exchange (HS561E)
	Refer to the HP website at **www.hp.com/networking/services** for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local HP sales office.	Refer to the HP website at **www.hp.com/networking/services** for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local HP sales office.

HP 2530 Switch Series

Specifications (continued)

	HP 2530-24G-PoE+ Switch (J9773A)	HP 2530-48G-PoE+ Switch (J9772A)	
Standards and protocols (applies to all products in series)	**Device management** RFC 1591 DNS (client) SSHv1/SSHv2 Secure Shell **General protocols** IEEE 802.1D MAC Bridges IEEE 802.1p Priority IEEE 802.1Q VLANs IEEE 802.1s Multiple Spanning Trees IEEE 802.1w Rapid Reconfiguration of Spanning Tree IEEE 802.3 Type 10BASE-T IEEE 802.3ab 1000BASE-T IEEE 802.3ad Link Aggregation Control Protocol (LACP) IEEE 802.3af Power over Ethernet IEEE 802.3at Power over Ethernet Plus IEEE 802.3az Energy Efficient Ethernet IEEE 802.3x Flow Control RFC 768 UDP RFC 783 TFTP Protocol (revision 2) RFC 792 ICMP RFC 793 TCP RFC 826 ARP RFC 854 TELNET RFC 868 Time Protocol RFC 951 BOOTP RFC 1350 TFTP Protocol (revision 2) RFC 1542 BOOTP Extensions RFC 2030 Simple Network Time Protocol (SNTP) v4 RFC 2131 DHCP **IP multicast** RFC 3376 IGMPv3 (host joins only)	**IPv6** RFC 1981 IPv6 Path MTU Discovery RFC 2460 IPv6 Specification RFC 2925 Remote Operations MIB (Ping only) RFC 3315 DHCPv6 (client only) RFC 3513 IPv6 Addressing Architecture RFC 3596 DNS Extension for IPv6 RFC 4022 MIB for TCP RFC 4113 MIB for UDP RFC 4251 SSHv6 Architecture RFC 4252 SSHv6 Authentication RFC 4252 SSHv6 Transport Layer RFC 4254 SSHv6 Connection RFC 4293 MIB for IP RFC 4419 Key Exchange for SSH RFC 4443 ICMPv6 RFC 4861 IPv6 Neighbor Discovery RFC 4862 IPv6 Stateless Address Auto-configuration **MIBs** RFC 1213 MIB II RFC 1493 Bridge MIB RFC 2021 RMONv2 MIB RFC 2613 SMON MIB RFC 2618 RADIUS Client MIB RFC 2620 RADIUS Accounting Client MIB RFC 2665 Ethernet-Like-MIB RFC 2674 802.1p and IEEE 802.1Q Bridge MIB RFC 2688 MAU-MIB RFC 2737 Entity MIB (Version 2) RFC 2863 The Interfaces Group MIB	**Network management** IEEE 802.1AB Link Layer Discovery Protocol (LLDP) RFC 1098 A Simple Network Management Protocol (SNMP) RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm) and 9 (events) ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED) SNMPv1/v2c/v3 **QoS/CoS** RFC 2474 DiffServ precedence, with 4 queues per port RFC 2475 DiffServ Architecture RFC 2597 DiffServ Assured Forwarding (AF) RFC 2598 DiffServ Expedited Forwarding (EF) **Security** IEEE 802.1X Port Based Network Access Control RFC 1492 TACACS+ RFC 2138 RADIUS Authentication RFC 2866 RADIUS Accounting Secure Sockets Layer (SSL)	

HP 2530 Switch Series accessories

Transceivers

HP X121 1G SFP LC SX Transceiver (J4858C)

HP X121 1G SFP LC LX Transceiver (J4859C)

HP X121 1G SFP LC LH Transceiver (J4860C)

HP X111 100M SFP LC FX Transceiver (J9054C)

HP X112 100M SFP LC BX-D Transceiver (J9099B)

HP X112 100M SFP LC BX-U Transceiver (J9100B)

HP X122 1G SFP LC BX-D Transceiver (J9142B)

HP X122 1G SFP LC BX-U Transceiver (J9143B)

HP X121 1G SFP RJ45 T Transceiver (J8177C)

Cables

HP 0.5 m Multimode OM3 LC/LC Optical Cable (AJ833A)

HP 1 m Multimode OM3 LC/LC Optical Cable (AJ834A)

HP 2 m Multimode OM3 LC/LC Optical Cable (AJ835A)

HP 5 m Multimode OM3 LC/LC Optical Cable (AJ836A)

HP 15 m Multimode OM3 LC/LC Optical Cable (AJ837A)

HP 30 m Multimode OM3 LC/LC Optical Cable (AJ838A)

HP 50 m Multimode OM3 LC/LC Optical Cable (AJ839A)

Mounting Kit

HP X410 1U Universal 4-post Rack Mounting Kit (J9583A)

Products within this series are IPv6 Ready certified. See the Specifications section of this series for more information.

To learn more, visit hp.com/networking

HP Color LaserJet Pro MFP M477fdw

Unmatched print, scan, copy, and fax performance plus robust, comprehensive security for how you work. This color MFP finishes key tasks faster and guards against threats.[1] Original HP Toner cartridges with JetIntelligence produce more pages.[2]

Print Speed: Black & Color (letter): Up to 28 ppm
Print Resolution: Black & color (best): 600 x 600 dpi, Up to 38,400 x 600 enhanced dpi
Copy resolution: 600 x 600 dpi
Display: 4.3" intuitive touchscreen Color Graphic Display (CGD)
Standard connectivity: Hi-Speed USB 2.0 port; built-in Fast Ethernet 10/100/1000 Base-TX network port; Host USB
Paper Handling: 50-sheet multipurpose tray, 250-sheet input tray, 50-sheet Automatic Document Feeder (ADF), 150-sheet output bin

Speed through more tasks. Keep data protected.

- Scan digital files directly to email, USB, network folders, and the cloud with preloaded business apps.[3]
- Grab pages and go—without waiting around. This MFP wakes up and prints faster than the competition.[1]
- Breeze through multipage documents with two-sided printing that's faster than the competition.[1]
- Control access to print jobs and help keep printing safe with security features like LDAP authentication.[4]

Easy management. Efficient printing.

- Easily manage print jobs directly at the MFP—just tap and swipe the 4.3-inch (10.9 cm) touchscreen.[6]
- Easily print Microsoft® Word and PowerPoint® documents—now directly from your USB drive.[5]
- Easily manage devices and settings using HP Web Jetadmin with a suite of essential management features.[7]
- Print using less energy than competitors—enhanced by Original HP Toner cartridges with JetIntelligence.[8]

More. Pages, Performance, and Protection.

- Get the most prints for your money—with Original HP High Yield Color Toner cartridges with JetIntelligence.[2]
- Count on professional quality at high speeds with HP ColorSphere 3 toner.
- Help ensure you're getting the authentic HP quality you paid for with innovative anti-fraud technology.
- Print right away with preinstalled toner cartridges. Replace them with optional high-yield cartridges.

Stay connected with easy mobile printing options

- Easily print from a variety of smartphones and tablets—generally no setup or apps required.[9]
- Count on wireless direct printing in the office—from mobile devices—without accessing the company network.[11]
- Help workers print with just a touch of their NFC-enabled mobile device to the printer—no network needed.[12]
- Easily access, print, and share resources with Ethernet and wireless networking.[10]

[1] Based on HP internal testing of top three leading competitors' first page out from sleep mode and duplex print and copy speed completed 8/2015. Subject to device settings. Actual results may vary. For details se hp.com/go/Ljclaims [2] Based on cartridge yields for HP 305X compared with HP 410X Original HP LaserJet Toner Cartridges. For more information, see hp.com/go/learnaboutsupplies [3] Requires an Internet connection to the printer. Services may require registration. App availability varies by country, language, and agreements. For details, see hpconnected.com [4] HP JetAdvantage Private Print is available at no charge and requires that the printer be connected to the Internet with web services enabled. Not available in all countries. For more information, see hpjetadvantage.com [5] Microsoft and PowerPoint are U.S. registered trademarks of the Microsoft group of companies. Feature works with Microsoft Word and PowerPoint 2003 and later. Only Latin language fonts are supported. [6] Requires a wireless access point and an Internet connection to the printer. Services require registration. App availability varies by country, language, and agreements and requires a firmware upgrade. For details, visit hpconnected.com [7] HP Web Jetadmin is free and available for download at hp.com/go/webjetadmin [8] Based on HP testing using the ENERGY STAR® program's Typical Electricity Consumption (TEC) method or as reported in energystar.gov of top three leading competitors as of 8/2015. Actual results may vary. For details see hp.com/go/Ljclaims [9] Wireless operations are compatible with 2.4 GHz operations only. App or software and HP ePrint account registration may also be required. Some features require purchase of an optional accessory. Learn more at hp.com/go/mobileprinting [10] Feature is only supported by the HP Color LaserJet Pro MFP M477fdw and M477fnw. Wireless performance is dependent on physical environment and distance from access point, and may be limited during active VPN connections. [11] Feature is only supported by the HP Color LaserJet Pro MFP M477fdw and M477fnw. Mobile device needs to be connected directly to the Wi-Fi network of a wireless direct–capable MFP or printer prior to printing. Depending on mobile device, an app or driver may also be required. Learn more at hp.com/go/businessmobileprinting [12] Feature is supported by the HP Color LaserJet Pro MFP M477fdw. Requires a compatible NFC-printing-enabled mobile device. For a list of compatible NFC-printing-enabled mobile devices, see hp.com/go/nfcprinting

HP Color LaserJet Pro MFP M477fdw Specifications Table

Functions / Multitasking Supported	Print, copy, scan, fax, email / Yes
Print Speed	**Letter**: Up to 28 ppm black; Up to 28 ppm color[17] **First Page Out**: As fast as 8.9 sec black; As fast as 9.8 sec color[19]
Print Resolution	**Black (best)**: 600 x 600 dpi, Up to 38,400 x 600 enhanced dpi; **Color (best)**: 600 x 600 dpi, Up to 38,400 x 600 enhanced dpi
Print Technology	Laser
Print Resolution Technologies	HP ImageREt 3600, Pantone calibrated
Print Cartridges Number	4 (1 each black, cyan, magenta, yellow)
Standard Print languages	HP PCL 6, HP PCL 5c, HP postscript level 3 emulation, PCLm, PDF, URF, Native Office
Printer Smart Software Features	Auto-duplex printing, N-up printing, collation, HP ePrint, Apple AirPrint™, Mopria certified, Google Cloud Print, Wireless Direct Printing, HP Auto-On/Auto-Off Technology, Intuitive 4.3" touchscreen control panel, Print from Cloud using business apps on the control panel, HP JetAdvantage Private Print, Job Storage with PIN printing, Print from USB
Printer Management	Printer Administrator Resource Kit (Driver Configuration Utility, Driver Deployment Utility, Managed Printing Administrator); HP Web JetAdmin Software; HP Proxy Agent Software; HP Imaging and Printing Security Center; HP Utility (Mac); HP Device Toolbox (Win 7)
Scan Type / Technology	Flatbed, ADF / Contact Image Sensor (CIS)
Scan Resolution	**Hardware**: Up to 1200 x 1200 dpi; **Optical**: Up to 1200 x 1200 dpi
Scan Input Modes	Front-panel scan, copy, email, fax, or file buttons; HP Scan software; and user application via TWAIN or WIA
Scan Size	**ADF**: 8.5 x 14 in Maximum; 4 x 6 in Minimum; **Flatbed**: 8.5 x 11.7 in
Scan Speed	Up to 26 ppm/47 ipm (b&w), up to 21 ppm/30 ipm (color)[22]**Duplex**: Up to 47 ipm (b&w), up to 30 ipm (color)
Scanner Advanced Features	Scan-to-E-mail; Scan-to-cloud; Scan-to-USB; Scan-to-network folder; LDAP e-mail lookup; Single-pass 2-sided scanning ADF
Native Scan File Format	PDF, JPG[11]
Software Scan File Format	Windows HP Scan SW supports PDF, searchable PDF, JPG, RTF, TXT, BMP, PNG, TIFF. Mac HP Easy Scan SW supports PDF, searchable PDF, JPG, RTF, TXT, JPG-2000, PNG, TIF[11]
Bit depth / Grayscale levels	30-bit / 256
Digital Sending Standard Features	Scan to email; scan to folder; scan to USB drive
Copy Speed	**Black (letter)**: Up to 28 cpm; **Color (letter)**: Up to 28 cpm[20]
Copy Resolution	**Black (text and graphics)**: 600 x 600 dpi; 600 x 600 dpi; **Color (text and graphics)**: 600 x 600 dpi
Maximum Number Of Copies	Up to 99 copies
Copier Resize	25 to 400%
Copier Settings	Number of copies; Reduce/Enlarge; Lighter/Darker; Optimize; Paper; Multi-page copy; Collation; Tray Select; Two-Sided; Draft Mode; Image Adjustment; Set as New Defaults; Restore Defaults
Fax Speed	**Up to**: 33.6 kbps ; **Letter**: 3 sec per page[10]
Fax Resolution	**Black (best)**: Up to 300 x 300 dpi; **Black (standard)**: 203 x 96 dpi
Fax Smart Software Features	Permanent fax memory backup; Auto fax reduction; Auto redialing; Delayed sending; Fax forwarding; TAM interface; Polling; Junk barrier; Distinctive ring detection; Cover page wizard; Block fax; Billing codes; Save and load; Poll receive; Fax activity reports; Dial prefix setting; Print fax log
Fax Features	**Fax Memory**: Up to 400 pages; **Auto Fax Reduction Supported**: Yes; **Auto-Redialing**: Yes; **Fax Delayed Sending**: Yes; **Distinctive Ring Detection Supported**: Yes; **Fax Forwarding Supported**: Yes; **Fax Phone TAM Interface Supported**: Yes; **Fax Polling Supported**: Yes (receive only); **Fax Telephone Mode Supported**: Yes; **Junk Barrier Supported**: Yes, CSID matching only. (Caller ID not supported); **Maximum Speed Dialing Numbers**: Up to 120 numbers; **PC Interface Supported**: Yes (send only); **Remote Retrieval Capability Supported**: No; **Telephone Handset Supported**: No
Standard Connectivity	Hi-Speed USB 2.0 port; built-in Gigabit Ethernet 10/100/1000 Base-TX network port; Easy-access USB
Network Capabilities	Via built-in 10/100/1000Base-TX Ethernet, Gigabit; Auto-crossover Ethernet; authentication via 802.1X
Network Ready	Standard (built-in Gigabit Ethernet, Wi-Fi)
Wireless Capability	Built-in Wi-Fi; Authentication via WEP, WPA/WPA2, WPA Enterprise; Encryption via AES or TKIP; WPS; Wireless Direct Printing; NFC touch-to-Print
Mobile Printing Capability	HP ePrint, Apple AirPrint™, Wireless Direct Printing, NFC touch-to-print, Mopria-certified, Google Cloud Print, Mobile Apps
Memory	**Standard**: 256 MB NAND Flash, 256 MB DRAM; **Maximum**: 256 MB NAND Flash, 256 MB DRAM
Processor Speed	1200 MHz
Duty Cycle	**Monthly, letter**: Up to 50,000 pages[8]
Recommended Monthly Page Volume	750 to 4,000
Media Types Supported	Paper (bond, brochure, colored, glossy, letterhead, photo, plain, preprinted, prepunched, recycled, rough), postcards, labels, envelopes
Media Weight Supported	Tray 1: 16 to 47 lb (up to 52 lb with HP Color laser glossy photo papers); Tray 2: 16 to 43 lb (up to 47 lb with postcards, up to 52 lb with HP Color laser glossy photo papers); optional Tray 3: 16 to 43 lb (up to 47 lb with postcards, up to 40 lb with HP Color laser glossy photo papers); Automatic duplexer: 16 to 43 lb
Media Sizes Supported	Tray 1, Tray 2: Letter, legal, executive, Oficio (8.5 x 13 in), 3 x 5 in, 4 x 6 in, 5 x 8 in, envelopes (No 10, Monarch); Optional Tray 3: Letter, legal, executive,Oficio (8.5 x 13 in), 3 x 5 in, 4 x 6 in, 5 x 8 in; Automatic duplexer: Letter, legal, executive, Oficio (8.5 x 13 in)
Media Sizes Custom	Tray 1: 3 x 5 to 8.5 x 14 in; Tray 2, optional Tray 3: 3.94 x 5.83 to 8.5 x 14 in
Paper Handling	50-sheet multipurpose tray, 250-sheet input tray, 50-sheet Automatic Document Feeder (ADF); 150-sheet output bin; **Duplex Options**: Automatic (standard); **Auto Document Feeder Capacity**: Standard, 50 sheets uncurled; **Envelope Feeder**: No; **Standard Paper Trays**: 2; **Input Capacities**: Up to 300 sheets; **Output Capacities**: Up to 150 sheets; Up to 20 envelopes

What's in the box	**CF379A** Printer; 4 preinstalled starter HP LaserJet toner cartridges (Black: ~2300 pages, CYM: ~1200 pages); In-box documentation (Getting Started Guide, Install Poster); Software drivers and documentation on CD-ROM; Power cord; USB cable; Built-in duplexer; Built-in fax[21]
Replacement Cartridges	HP 410A Black LaserJet Toner Cartridge (~2300 pages) CF410A; HP 410X Black LaserJet Toner Cartridge (~6500 pages) CF410X; HP 410A Cyan LaserJet Toner Cartridge (~2300 pages) CF411A; HP 410X Cyan LaserJet Toner Cartridge (~5000 pages) CF411X; HP 410A Yellow LaserJet Toner Cartridge (~2300 pages) CF412A; HP 410X Yellow LaserJet Toner Cartridge (~5000 pages) CF412X; HP 410A Magenta LaserJet Toner Cartridge (~2300 pages) CF413A; HP 410X Magenta LaserJet Toner Cartridge (~5000 pages) CF413X[5]
Product Dimensions	**W x D x H**: 16.4 x 18.6 x 15.7 in[15]; **Maximum**: 16.8 x 25.7 x 16.3 in
Product Weight	51.2 lb[1]
Warranty Features	One-year limited hardware warranty
Energy Efficiency Compliance	ENERGY STAR® certified; Blue Angel; EPEAT® Silver
Control Panel	4.3-in intuitive color touchscreen (CGD)
Display Description	4.3" intuitive touchscreen Color Graphic Display (CGD)
Software Included	For Windows OS: HP Software Installer/Uninstaller, HP PCL 6 Printer Driver, HP Device Experience (DXP), HP Send Fax, HP Device Toolbox, HP Fax Print Driver, HP Fax Setup Wizard, HP Product Improvement Study, HP Scan App and Drivers, Scan to e-mail setup Wizard, Scan to Folder Setup Wizard, HP Update,Product Registration Assist,HP Web Services Assist (HP Connected),Online user manuals,(*software varies by OS: WinXP/Vista = driver only; Win 7 = full solution; Win 8+ and newer = drivers only with more apps available in MS App store) For Mac OS, Welcome Screen, (Directs users to HP.com or OS App Source for LaserJet Software)
Fonts and Typefaces	84 scalable TrueType fonts
Compatible Operating Systems	Windows OS compatible with In-Box Driver; Windows XP SP3 all 32-bit editions (XP Home, XP Pro, etc.); Windows Vista all 32-bit editions (Home Basic, Premium, Professional, etc.); Windows 7 all 32- & 64-bit editions; Windows 8/8.1 all 32- & 64-bit editions (excluding RT OS for Tablets); Windows 10 all 32- & 64-bit editions (excluding RT OS for Tablets); Windows OS compatible with Universal Print Driver (From http://www.hp.com); Windows XP SP3 32- & 64-bit editions (XP Home, XP Pro, etc.); Windows Vista all 32- & 64-bit editions (Home Basic, Premium, Professional, etc.); Windows 7 all 32- & 64-bit editions; Windows 8/8.1 all 32- & 64-bit editions (excluding RT OS for Tablets); Windows 10 all 32- & 64-bit editions (excluding RT OS for Tablets); Mac OS (HP Print Drivers available from HP.com and Apple Store); OS X 10.7 Lion; OS X 10.8 Mountain Lion; OS X 10.9 Mavericks; OS X 10.10 Yosemite; Mobile OS (In-OS drivers); iOS, Android, Windows 8/8.1/10 RT; Linux OS (In-OS HPLIP); SUSE Linux (12.2, 12.3, 13.1); Fedora (17, 18, 19, 20); Linux Mint (13, 14, 15, 16, 17); Boss (3.0, 5.0); Ubuntu (10.04, 11.10, 12.04, 12.10, 13.04, 13.10, 14.04, 14.10); Debian (6.0.x, 7.x); Other OS; UNIX[13]
Compatible Network Operating Systems	Windows OS compatible with In-Box Driver; Windows Server 2003/2003 R2 32-bit (SP1/SP2) Standard/Enterprise (+ Cluster & Terminal Services); Windows Server 2008 32-/64-bit (SP2) Standard/Enterprise (+ Cluster & Terminal Services); Windows Server 2008 R2 64-bit (SP1) Standard/Enterprise (+ Cluster & Terminal Services); Windows OS compatible with Universal Print Driver (UPD) or Product-Specific drivers from http://www.HP.com; Windows Server 2003/2003 R2 32-/64-bit (SP1/SP2) Standard/Enterprise/Datacenter (+ Cluster & Terminal Services); Windows Server 2008/2008 R2 32-/64-bit (SP1/SP2) Standard/Enterprise/Datacenter (+ Cluster & Terminal Services); Windows Server 2012/2012 R2 64-bit Standard/Foundation/Essentials/Datacenter (+ Cluster & Terminal Services); Citrix (on Windows Server 2003/2003R2); Citrix MetaFrame Presentation Server, 3.0; Citrix MetaFrame XP Presentation Server (Feature Release 1, 2, and 3); Citrix Presentation Server 4.0/4.5; Citrix XenApp 5.0 (Plus Feature Pack 2 & 3); Citrix (on Windows Server 2008/2008R2); Citrix XenApp 5.0 (Plus Feature Pack 2 & 3); Citrix XenApp 6.0/6.5/7.5; Citrix XenDesktop 5.6/7.0/7.5; Citrix (on Windows Server 2012/2012R2); Citrix XenApp 7.5; Citrix XenDesktop 7.0/7.5; Novell Servers (www.novell.com/iprint); Novell iPrint Appliance v1.0; Novell Open Enterprise Server 11/SP1; Novell Open Enterprise Server 2 for Linux; NetWare 6.5/SP8; Novell Clients (www.novell.com/iprint); Windows 8 (32-bit / 64-bit) recommend v5.86+, 8.1 recommend v5.94+; Windows 7 (32-bit / 64-bit) recommend v5.82+; Windows Vista (32-bit / 64-bit) recommend v5.82+ Windows XP / SP3 (32-bit only) recommend v5.82+
Minimum System Requirements	**PC**: Windows XP (SP2) (32-bit) or newer, 233 MHz processer or higher, 512 MB RAM, 400 MB HD space, CD-ROM or Internet, USB or Network connection; **MAC**: OSX 10.7 or newer; Internet; USB or Network connection; 1 GB HD space
Power	**Power Supply Type**: Internal (Built-in) power supply; **Power Requirements**: 110-volt input voltage: 110 to 127 VAC (+/- 10%), 60 Hz (+/- 3 Hz); **Power Consumption**: 570 watts (Active Printing), 18.6 watts (Ready), 2.5 watts (Sleep), 0.6 watts (Auto-On/Auto-Off, via USB connectivity), 0.05 watts (Shutdown or Off)[3]
Acoustics	**Acoustic Power Emissions**: 6.3 B(A); **Acoustic Pressure Emissions**: 49 dB(A)[7]
Operating Environment	**Operating Temperature Range**: 59 to 86°F; **Recommended Operating Temperature**: 59 to 80.6°F; **Storage Temperature Range**: -4 to 104°F; **Non-Operating Humidity Range**: 10 to 95% RH (non-condensing); **Operating Humidity Range**: 10 to 80% RH (non-condensing); **Recommended Humidity Operating Range**: 20 to 70% RH (non-condensing)
Security Management	Embedded Web Server: password-protection, secure browsing via SSL/TLS; Network: enable/disable network ports and features, SNMPv1 & SNMPv2 community password change; HP ePrint: HTTPS with certificate validation, HTTP Basic Access Authentication, SASL authentication; LDAP authentication and authorization; Firewall and ACL; SNMPv3, 802.1X, Secure Boot, authentication via WEP, WPA/WPA2 Personal, WPA2 Enterprise; encryption via AES or TKIP
Accessories	HP LaserJet 550-sheet Paper Feeder CF404A; HP v222w 16GB Mini USB Drive P0R81AA
HP Service and Support Options	U8TP0E - HP 3 year Next Business Day Color LaserJet M477 Multi Function Printer Hardware Support; U8TP1E - HP 4 year Next Business Day Color LaserJet M477 Multi Function Printer Hardware Support; U8TP2E - HP 5 year Next Business Day Color LaserJet M477 Multi Function Printer Hardware Support; U8TP5E - HP 3 year Next Business Day Exchange Color LaserJet M477 Multi Function Printer Service; U8TP3E - HP 3 year 4 hour 9x5 Color LaserJet M477 Multi Function Printer Hardware Support; H3110E - HP Network Install Inkjet/Personal LaserJet Service

Learn more at
hp.com

[1] With toner cartridges. [3] Power requirements are based on the country/region where the printer is sold. Do not convert operating voltages. This will damage the printer and void the product warranty. [5] Printer ships with preinstalled introductory cartridges Cyan, Magenta and Yellow (CMY) (~1200 pages) and Black A (KA) (~2300 pages) with Auto Toner Seal Removal for all cartridges. [7] Configuration tested: base model, simplex printing, A4 paper at an average of 43 ppm. [8] Duty cycle is defined as the maximum number of pages per month of imaged output. This value provides a comparison of product robustness in relation to other HP LaserJet or HP Color LaserJet devices, and enables appropriate deployment of printers and MFPs to satisfy the demands of connected individuals or groups. [10] Based on standard ITU-T test image #1 at standard resolution. More complicated pages or higher resolution will take longer and use more memory. [11] Windows and Mac support almost the same file types expect Mac supports JGP-2000 instead of BMP. [13] Not all "Compatible Operating Systems" are supported with INBOX software; Full solution software available only for Windows 7. Legacy Windows Operation Systems (XP, Vista, and equivalent servers) get print and scan drivers only; Windows 8 and 10 have apps available in MS App Store; Windows RT OS for Tablets (32- & 64-bit) uses a simplified HP print driver built into the RT OS; UNIX modelscripts are available on HP.com (Modelscripts are printer drivers for UNIX operating systems); Linux systems use in-OS HPLIP software. [15] Without optional 550-sheet tray. Dimensions with optional 550-sheet tray: 16.4 x 18.1 x 20.9 in (416 x 461 x 530 mm) [17] Measured using ISO/IEC 24734, excludes first set of test documents. For more information see hp.com/go/printerclaims. Exact speed varies depending on the system configuration, software application, driver, and document complexity. 19 Measured using ISO/IEC 17629. For more information see hp.com/go/printerclaims. Exact speed varies depending on the input voltage, system configuration, software application, driver, and document complexity. 20 First Copy Out and Copy Speed measured using ISO/IEC 29183, excludes first set of test documents. For more information see hp.com/go/printerclaims. Exact speed varies depending on the system configuration, software application, driver, and document complexity. 21 Declared cartridge yield value in accordance with ISO/IEC 19752. Actual yields vary considerably based on images printed and other factors. For more information, visit hp.com/go/learnaboutsupplies. HP Color LaserJet Pro MFP M477 in-box cartridge may have higher yield than stated for printer units manufactured before 2017. 22 Scan speeds measured from ADF. Actual processing speeds may vary depending on scan resolution, network conditions, computer performance, and application software.

SERVER RACK

G4 SERIES

Ventilation Slot

Mounting Pole w/screen UH

Front Door w/logo

Security Cam Locks

FEATURES

◈ **Designed and Manufactured** to comply with the standard of ANSI/EIA-310D-1992 (Rev.EIA-310C), IEC60297-1, IEC60297-2, BS5954 Part : 2, DIN 41494, 19" Standard.

◈ **Modular Knock Down** System in order to be delivered conveniently.VCD manual displaying every step of assembly is provided.

◈ **Produced** from Electro-Galvanized Sheet Steel with thickness of 1.5 mm. Mounting Pole, Frame Structure and Base made of 2.0 mm. Electro-galvanized Sheet Steel. Castor Base stand made of 3.0 mm. steel, 100% rust proof.

◈ **The structure** mounted as wedge lock for strength increasing.

◈ **Mounting Pole** were designed to be C-shape Angle in order to increase the strength. Punching of square mounting hole 10 x 10 mm. on both flange. They can be adjusted in/out freely to meet customer's needs. And provide the U-height screened on the mounting pole.

◈ **Front Door** is the steel frame with Acrylic 5.0 mm. thickness with film protection and the width of acrylic is 38 cm. (the height is being influenced by the size of the rack) which is perforated tetragon surounding the acrylic (same as honney comb). Door edge is bore with gray dust-proof rubber seal (3 fins). Security locks with 19" Germany Master Key.

◈ **Rear Door** is the steel door with perforated tetragon ventilation 50% of door's area (same as honney comb) to prevent the heat accumulation inside the cabinet to extend the life of all network equipments and servers. Door edge is bore with gray dust-proof rubber seal (3 fins). Security locks with 19" Germany Master Key which is the same set as the front door.

◈ **Hinge** is 19" Germany Export Rack products made from 3 pieces of high strength special PVC (ABS), rust-free and without any interfering noise. The reversibility of front and rear door opening from left of right by adjusting at one screw nut of hinge.

◈ **Side Panels** are steel with two handles of 19" Germany Slide Latch on the top part in order to easily removable. Inside the side panel has the vertical frame 70 mm. width mounted to prevent the panel for strenghten. Security lock with 19" Germany Master Key which is the same set as the front door.

◈ **Roof Cover** can be mounted with various type of single, dual and triple ventilating fans which can be maximum mounted 6 ventilating fans and can also be changed to vented raised roof cover in option.

◈ **Base** has the same width and depth of cabinet to fully supportive to all the weight. The bottom is three parts plinth with slide shutter for cable entry and gray sponge to protect any inner-passing by animals, any kind of ventilating fan can be equipped there as well.

◈ **Pedestal** was equipped with the castor base and is adjustable; by all of the 4 Pedestal's base made of black ABS and can be freely adjustable 180 degree to suit the slope and protect all effects from Electrostatic and earth leakage.

◈ **Castor** is 19" Germany Export Rack made of back nylon six with the diameter of 50 mm; equipped on the 360 degree swivel that allow to be moving conveniently with capacity the static load 150 kgs per castor.

◈ **New Shine Light Gray** Two-Tone color by Electrostatic Powder Coating paint for scratch resistance.

◈ **Grounding** with color stripe green and yellow copper wire 2.5 mm.; connecting between all removable part of Rack.

◈ **Screw Set** compose of Screws, Captive nuts, plastic Washer; by each were coated with nickel and M6 thread system.

◈ **Static load rating** 1200 kgs. certificated by KMUTT. The result shall be less than 3.0 mm. or 0.14 %.

◈ **Manufacturing and Distribution** by ISO 9001:2008 Company.

Grounding

Slide Latch w/logo

Pedestal

Castor w/logo

ORDERING INFORMATION

W=Width 600 mm. Standard

1U = 44.45 mm.	Overall Height (mm.)	Order No. of Different Depth (mm.)				
		D = 600	D = 800	D = 900	D = 1000	D = 1100
15U	850	G4-60615	G4-60815	G4-60915	G4-61015	G4-61115
27U	1390	G4-60627	G4-60827	G4-60927	G4-61027	G4-61127
36U	1790	G4-60636	G4-60836	G4-60936	G4-61036	G4-61136
39U	1850	G4-60639	G4-60839	G4-60939	G4-61039	G4-61139
42U	2050	G4-60642	G4-60842	G4-60942	G4-61042	G4-61142
45U	2185	G4-60645	G4-60845	G4-60945	G4-61045	G4-61145

W=Width 800 mm. Standard

1U = 44.45 mm.	Overall Height (mm.)	Order No. of Different Depth (mm.)			
		D = 800	D = 900	D = 1000	D = 11000
15U	850	G4-80815	G4-80915	G4-81015	G4-81115
27U	1390	G4-80827	G4-80927	G4-81027	G4-81127
36U	1790	G4-80836	G4-80936	G4-81036	G4-81136
39U	1850	G4-80839	G4-80939	G4-81039	G4-81139
42U	2050	G4-80842	G4-80942	G4-81042	G4-81142
45U	2185	G4-80845	G4-80945	G4-81045	G4-81145

* Order No. for Black Color   G4-XXXXXB

Sample : G4-60642B   Server Rack 42U, 60 x 60 cm., Black Color

Top Cover

Rear Door

Front Door

Side Panele

Options

Color	*Black or other
Width	21 inch or 23 inch
Thickness	1.6 mm or other
Door	Double door or Handle lock

Deliverly with

- 3 Master keys with trademark and number on the keys.
- Set of nut and screw according to the size of rack.

Drawing

Top View

Bottom View

Front View

Rear View

ACYLIC
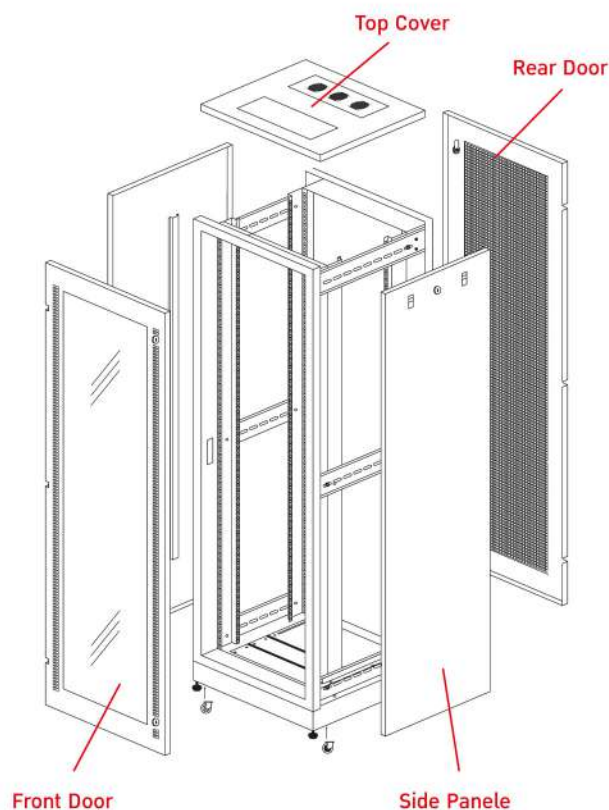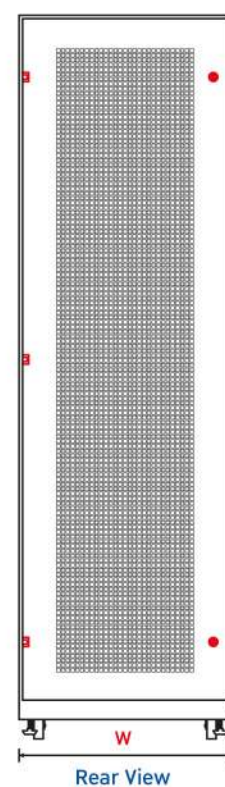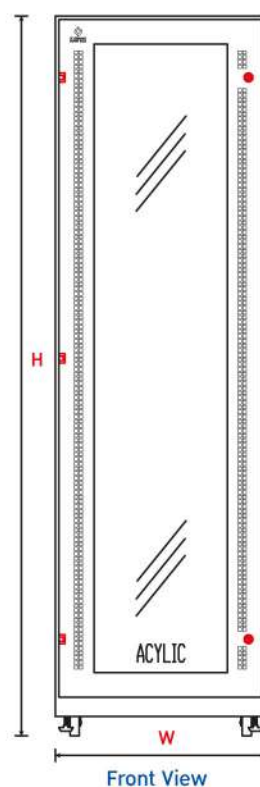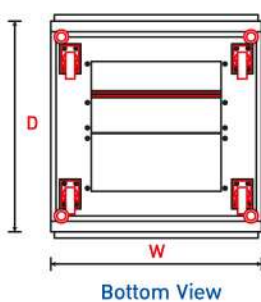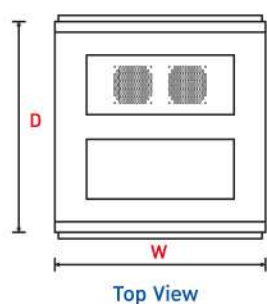
Engage customers in a new way. Introducing the Galaxy Tab S4.

Engage in more ways and in more places than ever.

The Galaxy Tab S4 delivers a more versatile mobile experience that gives you more freedom to work the way you want to. Connect, type, sign and share with ease; where, how and when it's best for you and your customers. And with security from the chip up and easy deployment and management, the Galaxy Tab S4 is truly enterprise-ready.

Key Features

Greater engagement.

Crisp. Clear. Captivating. A stunningly bright 10.5" state-of-the-art Super AMOLED display gives you room for dynamic, on-the-spot presentations.

DeX means more doing. When the Tab S4 is connected to a workstation via DeX, you can use Dual Mode to turn the Tab S4 into a second screen. Watch presentations on a monitor while taking notes or signing documents on the Tab S4.[1]

Cinematic surround sound. Bring presentations, videos and more to life like never before. Dolby Atmos® and quad speakers tuned by AKG surround you in extraordinary sound.

Productivity everywhere.

S Pen provided, productivity unleashed. Capture ideas quickly, run presentations, sign documents and more. And it never needs charging.

DeX gives you a powerful desktop-like experience. Samsung DeX makes any place a work space. Simply attach the optional keyboard cover, and DeX transforms the Tab S4 into a powerful desktop-like experience.[2]

Powerful, long-lasting battery. When your team has a long-lasting battery of up to 16 hours on a single charge, they're always ready.[3]

Cellular connectivity keeps you connected. No matter where your team is working, the Galaxy Tab S4 keeps them connected.

Enterprise-ready security and manageability.

Defense-grade security. The Galaxy Tab S4 is protected by Knox, a security platform built from the chip up for superior protection.[4]

Management made easy. Knox Manage is a cloud-based EMM solution with an affordable license fee that lets you restrict access to certain apps or websites, and remotely wipe and support devices.

Easy changes and updates. With Knox Configure, our cloud-based management solution, you can provision and customize a large number of devices, push security patches and deploy application updates, all remotely. And built-in Enterprise Firmware Over-The-Air (E-FOTA) enables remote device management, so you can test updates and control firmware and OS updates while allowing your devices to remain in the field.

Contact Us: samsung.com/b2btablets

Galaxy Tab S4

	Galaxy Tab® S4 Wi-FI		Galaxy Tab® S4 Verizon	Galaxy Tab® S4 AT&T	Galaxy Tab® S4 T-Mobile	Galaxy Tab® S4 Sprint
Part Numbers	64GB	Black SM-T830NZKAXAR Gray SM-T830NZAAXAR	Black SM-T837VZKAVZW	Black SM-T837AZKAATT	Black SM-T837TZKATMB	Black SM-T837PZKASPR
	256GB	Black SM-T830NZKLXAR Gray SM-T830NZALXAR				
Operating System	Android Oreo 8.1		Android Oreo 8.1	Android Oreo 8.1	Android Oreo 8.1	Android Oreo 8.1
CPU	MSM8998		MSM8998	MSM8998	MSM8998	MSM8998
Processor	Quad 2.35GHz + Quad 1.9GHz		Quad 2.35GHz + Quad 1.9GHz	Quad 2.35GHz + Quad 1.9GHz	Quad 2.35GHz + Quad 1.9GHz	Quad 2.35GHz + Quad 1.9GHz
S-Pen	Included		Included	Included	Included	Included
DeX	Samsung DeX for Tablet		Samsung DeX for Tablet	Samsung DeX for Tablet	Samsung DeX for Tablet	Samsung DeX for Tablet
Memory (RAM, Speed)⁵	4.0GB		4.0GB	4.0GB	4.0GB	4.0GB
Memory (Internal)⁶	64GB or 256GB		64GB	64GB	64GB	64GB
Memory (External / MicroSD Capacity)⁷	MicroSD (up to 400GB)		MicroSD (up to 400GB)	MicroSD (up to 400GB)	MicroSD (up to 400GB)	MicroSD (up to 400GB)
Display Screen Size	10.5"		10.5"	10.5"	10.5"	10.5"
Display Type	sAMOLED		sAMOLED	sAMOLED	sAMOLED	sAMOLED
Display Resolution	WQXGA (2560 x 1600, 287 ppi)		WQXGA (2560 x 1600)	WQXGA (2560 x 1600)	WQXGA (2560 x 1600)	WQXGA (2560 x 1600)
Touchscreen	Yes		Yes	Yes	Yes	Yes
Headphone Out	3.5mm		3.5mm	3.5mm	3.5mm	3.5mm
Microphone	Yes		Yes	Yes	Yes	Yes
Speakers	4		4	4	4	4
Camera Back / Front / Flash / Autofocus	13MP / 8MP / Yes / Yes		13MP / 8MP / Yes / Yes	13MP / 8MP / Yes / Yes	13MP / 8MP / Yes / Yes	13MP / 8MP / Yes / Yes
USB / USB Port	USB 3.1 / USB Type C		USB 3.1 / USB Type C	USB 3.1 / USB Type C	USB 3.1 / USB Type C	USB 3.1 / USB Type C
LTE (Carrier Support)	N/A		Verizon	AT&T	T-Mobile	Sprint
Connectivity / Wi-Fi	802.11 a / b / g / n / ac (2.4GHz + 5GHz)		802.11 a/b/g/n/ac (2.4GHz + 5GHz)	802.11 a/b/g/n/ac (2.4GHz + 5GHz)	802.11 a/b/g/n/ac (2.4GHz + 5GHz)	802.11 a/b/g/n/ac (2.4GHz + 5GHz)
Wi-Fi Direct	Yes		Yes	Yes	Yes	Yes
Bluetooth	BT 5.0		BT 5.0	BT 5.0	BT 5.0	BT 5.0
GPS Navigation	Yes		Yes	Yes	Yes	Yes
Battery Capacity³	7,300 mAh, Fast-charging		7,300 mAh, Fast-charging	7,300 mAh, Fast-charging	7,300 mAh, Fast-charging	7,300 mAh, Fast-charging
Battery Type	Lithium Ion		Lithium Ion	Lithium Ion	Lithium Ion	Lithium Ion
Internet Use Time	Up to 16 hours (video playback)		Up to 16 hours (video playback)	Up to 16 hours (video playback)	Up to 16 hours (video playback)	Up to 16 hours (video playback)
Security	Knox 3.2		Knox 3.2	Knox 3.2	Knox 3.2	Knox 3.2
Enhanced Authentication	Iris Scan		Iris Scan	Iris Scan	Iris Scan	Iris Scan
Temp Range (Operating / Non-Operating)	0 to 35°C (32 to 95°F)		0 to 35°C (32 to 95°F)	0 to 35°C (32 to 95°F)	0 to 35°C (32 to 95°F)	0 to 35°C (32 to 95°F)
Recycled / Recyclable Packaging	Yes		Yes	Yes	Yes	Yes
Standard Warranty	1-Year		1-Year	1-Year	1-Year	1-Year
Dimensions (H x W x D)	9.81" x 6.47" x 0.28"		9.81" x 6.47" x 0.28"	9.81" x 6.47" x 0.28"	9.81" x 6.47" x 0.28"	9.81" x 6.47" x 0.28"
Weight	1.06 lbs		1.06 lbs	1.06 lbs	1.06 lbs	1.06 lbs

Device Layout

1. Iris LED
2. Light / Proximity Sensor
3. Front Camera
4. Iris Camera
5. Mic
6. Power Button
7. Volume Button
8. Mic
9. Bixby Button
10. SIM / microSD
11. Pogo
12. Speaker
13. Main Camera
14. Flash
15. Earphone Jack
16. Type C USB 3.1
17. S Pen

Galaxy Tab® S4 (S Pen included in the box)

FRONT BACK

SAMSUNG

¹DeX can be activated via Samsung Galaxy Tab S4 keyboard cover (SKU: EJ-FT830UBEGUJ) sold separately. Accessories and monitor sold separately. Samsung DeX using an HDMI adapter, multi-port adapter or cable is available on Galaxy Tab S4. Using a genuine Samsung HDMI adapter or cable qualified for Samsung DeX is recommended. Cable is sold separately and some functions may differ from DeX Pad. Certain apps may not run or may require license (for purchase) on Samsung DeX. ²Portion of memory occupied by existing content. ³MicroSD card sold separately. ⁴Based on average battery life under typical usage conditions. Average expected performance based on typical use. Actual battery life depends on factors such as network, features selected, frequency of calls, and voice, data, and other application-usage patterns. Results may vary. ⁵For the full list of Knox certifications, please visit samsungknox.com.⁶Portion of memory occupied by existing content. ⁷Actual storage space availability may vary depending on pre-installed software.

IBIS TRAX HD3D
BULLETTRAX

BULLETTRAX
BULLET ACQUISITION STATION

The BULLETTRAX acquisition station is specialized for the entry of bullet information onto an IBIS network.

BULLETTRAX captures high-resolution 2D images and 3D topographic information of a bullet's lands and grooves. It produces an image strip representing a bullet's 360-degree circumference, or a combination of regions from a bullet's fragments.
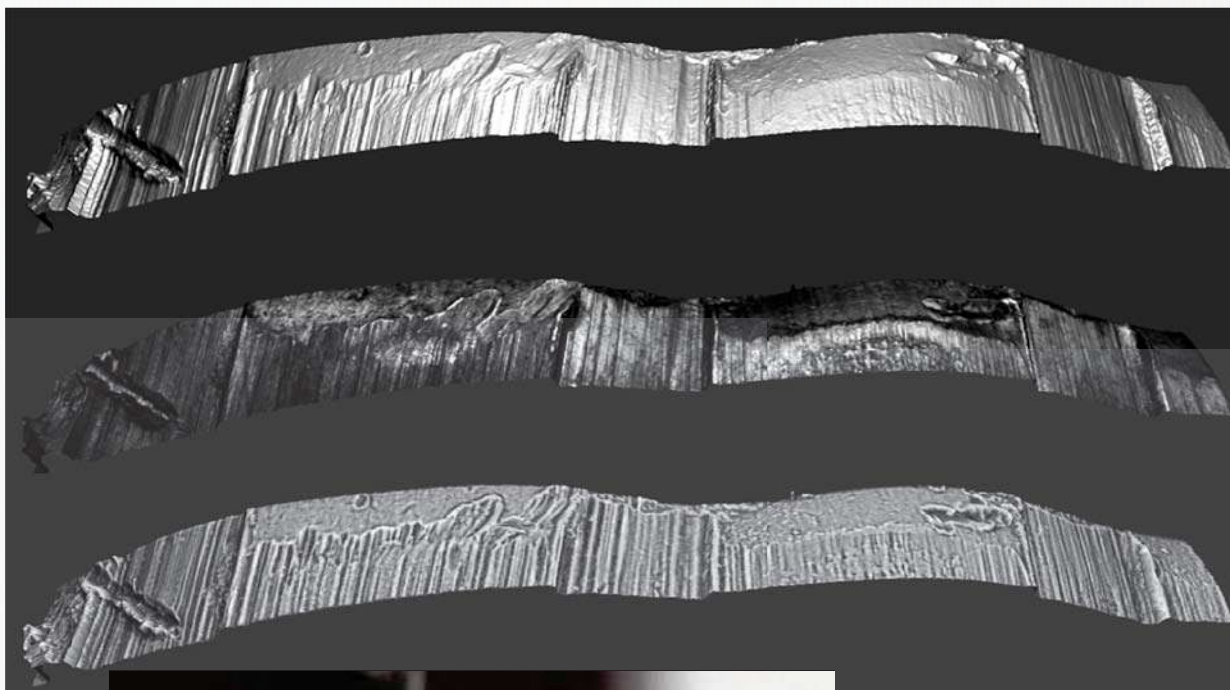
UNIVERSAL BULLET HOLDER

The acquisition process is fully automated after the initial setup by the user. This reduces the operator's required training level, and produces consistent image quality. Complex algorithms track the bullet's surface by rotating and moving the bullet, and they precisely capture its markings and its shape at optimal focus and lighting settings.

360° WRAPAROUND

DAMAGED BULLETS AND FRAGMENTS

BULLETTRAX
OTHER FEATURES:

- Automated surface deformation tracking

- Automated shoulder delimiter placement

- Hands-off operation allows multitasking

- Cut or button rifling, polygonal rifling, and smoothbore

- Full range of calibers: .17 to .50

IBIS TRAX HD3D
BRASSTRAX

BRASSTRAX
CARTRIDGE CASE ACQUISITION STATION

The BRASSTRAX acquisition station is specialized for the entry of cartridge case information onto an IBIS network.

BRASSTRAX captures high-resolution 2D images and precise 3D topographic information of significant regions of interest. For centerfire cartridge cases, this includes the breech face and firing pin impressions on the primer, and the ejector mark. For rimfire cartridge cases, this includes the firing pin impression. A detailed image of the complete head is also captured for reference.

The majority of the acquisition process is fully automated, so that minimal user input reduces operator variability. The automation of image focus, image lighting, and region of interest outlining ensures consistent image quality for visualization and uniformity for optimal comparison performance.
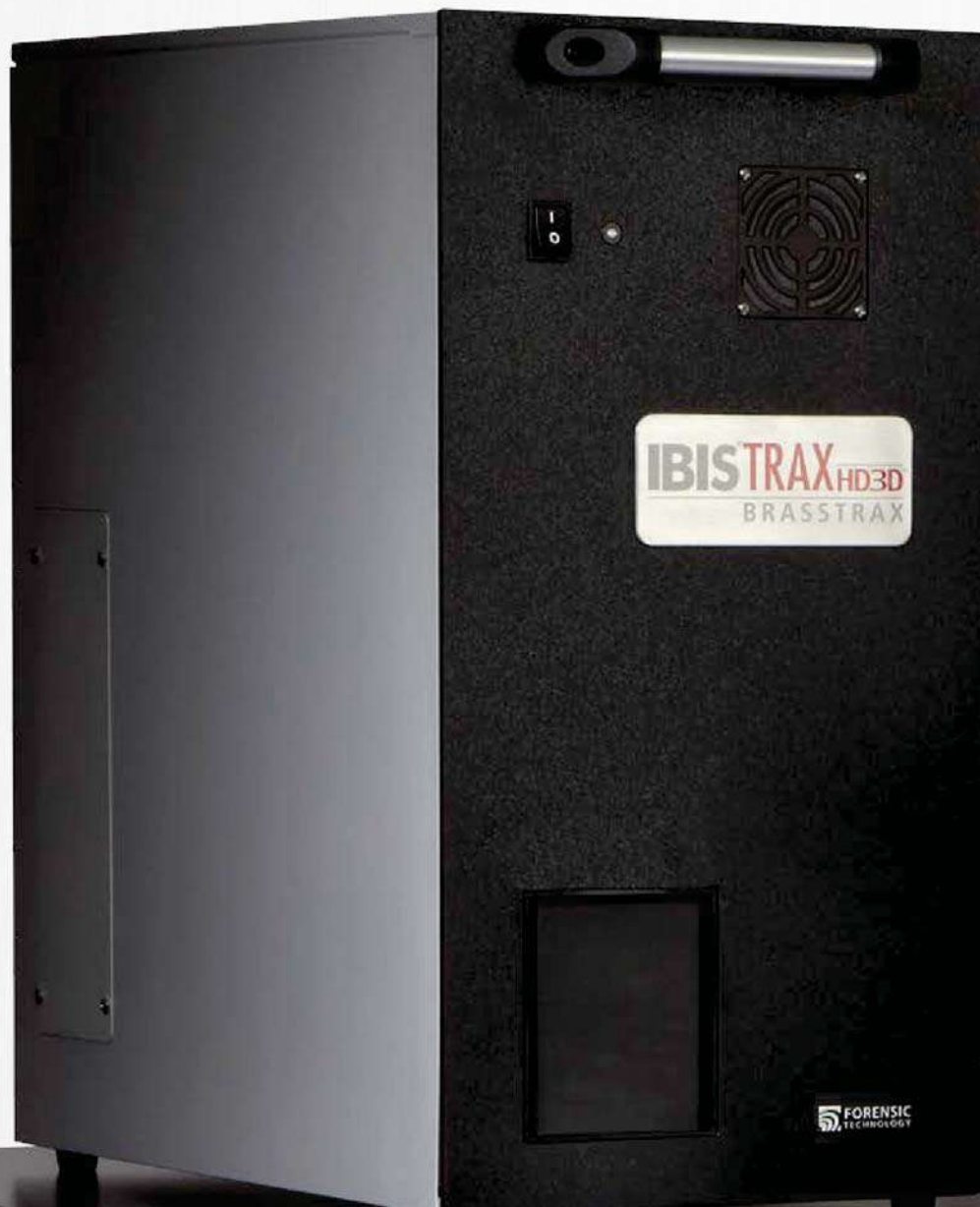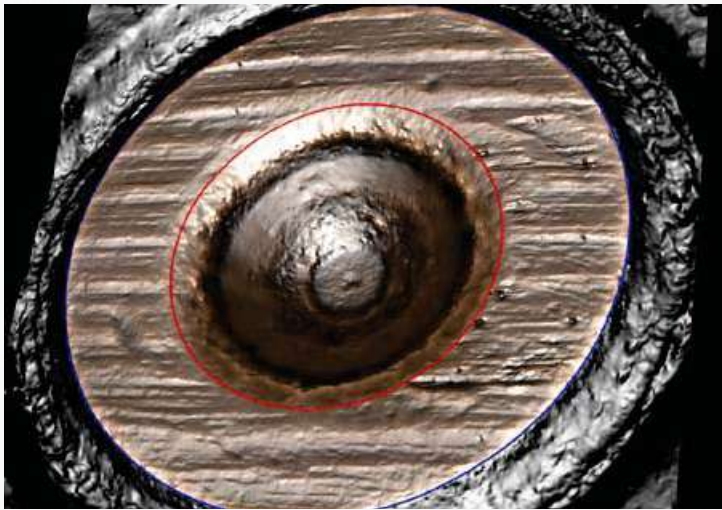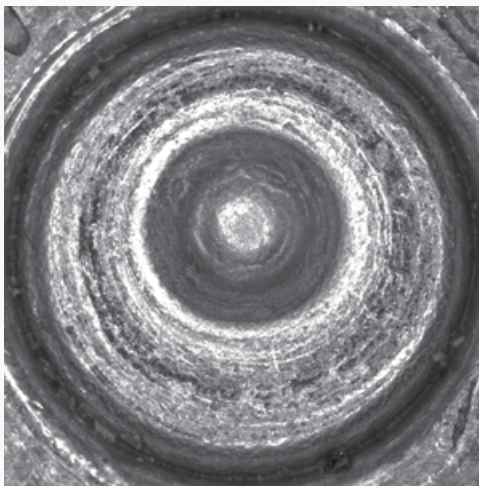
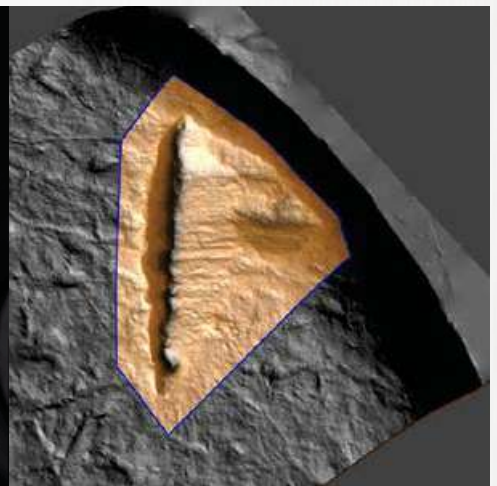ACCURATE 3D DATA AT THE MICROMETER LEVEL

UNIVERSAL
CARTRIDGE CASE
HOLDER

HIGH-RESOLUTION 2D IMAGES

FULL HEADSTAMP IMAGE

REGION OF INTEREST OUTLINES

BRASSTRAX
OTHER FEATURES:

- Automated flowback and washout detection

- Automated self-test and adjustment

- Hands-off operation allows multitasking

- Multiple magnification levels

- Full range of calibers: .17 to .50 and from .410 bore to 10-gauge for shot shells

- Detailed online help and user guides

- Multiple light sources, including a patented ring light

IBIS TRAX HD3D

MATCHPOINT

MATCHPOINT
ANALYSIS STATION

MATCHPOINT is the firearm expert's analysis station for reviewing the potential matches obtained from IBIS correlation algorithms.

Access to high-resolution 2D images and precise 3D topography offers remarkable viewing capabilities and useful alternatives when analyzing cartridge case and bullet markings.

An extensive array of viewers and functions assist with the identification of similar candidates. High level analysis of correlation results and visual comparisons allow for the rapid elimination of non-matches. Powerful in-depth visualization tools provide capabilities far beyond those of the conventional comparison microscope, and make it easier to recognize high-confidence matches. The work done using MATCHPOINT significantly increases the identification success rate, and decreases the effort required for ultimate confirmation on a conventional comparison microscope.

Bullets acquired using BULLETTRAX are viewed as a continuous wraparound image that is always in focus. The flattened image strip can be viewed in 2D, 3D, or a mix of both. This overall view provides a useful perspective for performing high-level phase alignment before comparing the finer markings, and it also simplifies the comparison of damaged bullets. Additionally, the combination of the enhanced surface markings and the realistic shape simultaneously makes it easier to locate and emphasize significant markings, such as those on the bearing surface of polygonal and unrifled bullets.

Cartridge cases acquired using BRASSTRAX are viewed based on multiple regions of interest in 2D, 3D, or a mix of both. One or more of these regions can hold the key to finding a match. The high-definition 3D topography provides outstanding clarity of the cartridge case surface, facilitating visual comparisons of the breech face and firing pin impressions, and of the ejector marks. With advanced 3D modeling, the expert has full control over the image, thus helping to reveal the important surface markings. This leads to the accurate interpretation of the markings and to finding the areas of agreement more easily.

With today's growing computing power, countless innovative viewing techniques are on the horizon. New comparison and viewing capabilities continue to be added, leading to increased product effectiveness and contributing to scientific progress.
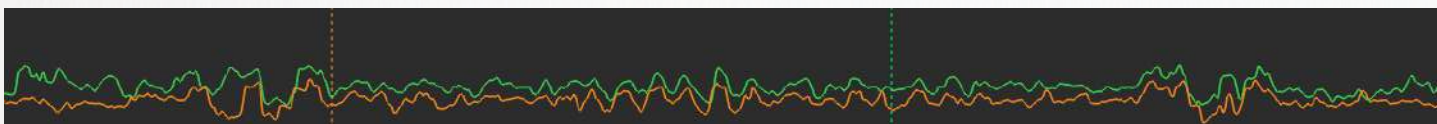

*CROSS-SECTION PROFILES*

*SCORE ANALYSIS*

MATCHPOINT
OTHER FEATURES:

- "Reshaping" of a deformed bullet to more closely resemble a pristine reference bullet
- Printouts of information screens, viewer screens, and images
- Reports with generic and custom templates
- Variety of output formats
- Generate manual correlation requests
- Search and view case and exhibit information
- User viewing preferences
- Dynamic 3D viewing
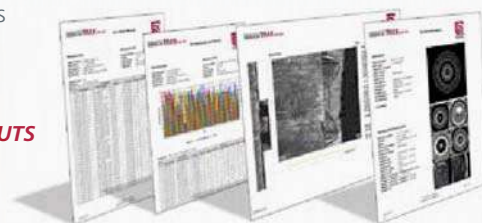
REPORTS AND PRINTOUTS
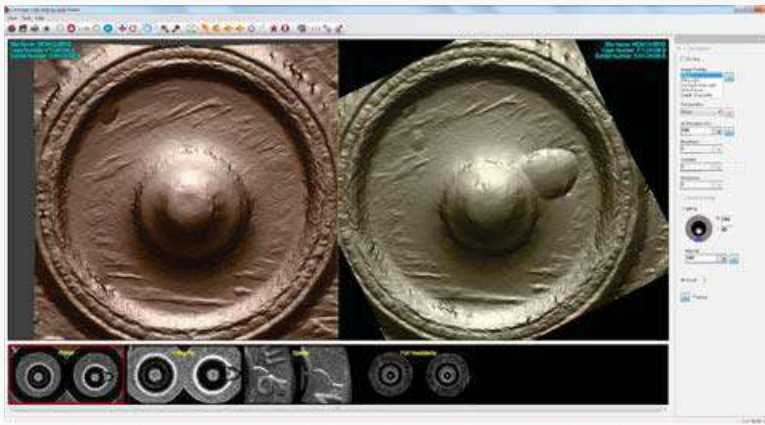
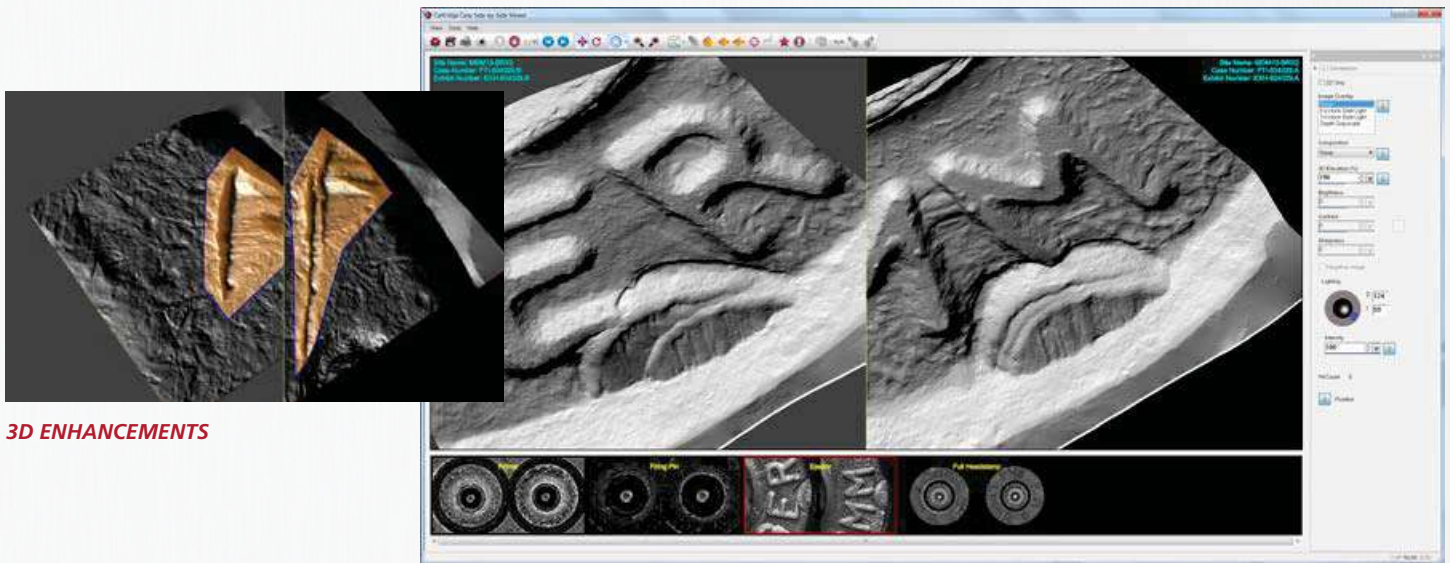*CARTRIDGE CASE SIDE-BY-SIDE VIEWER*
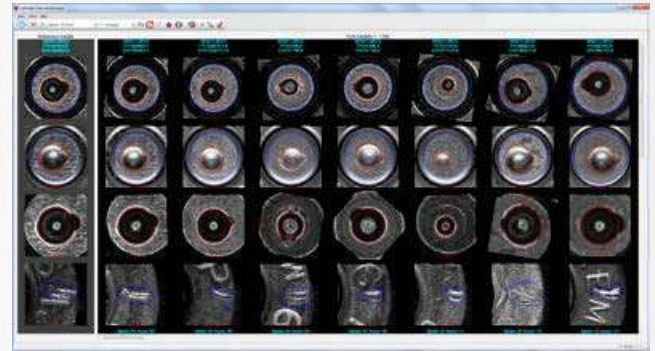
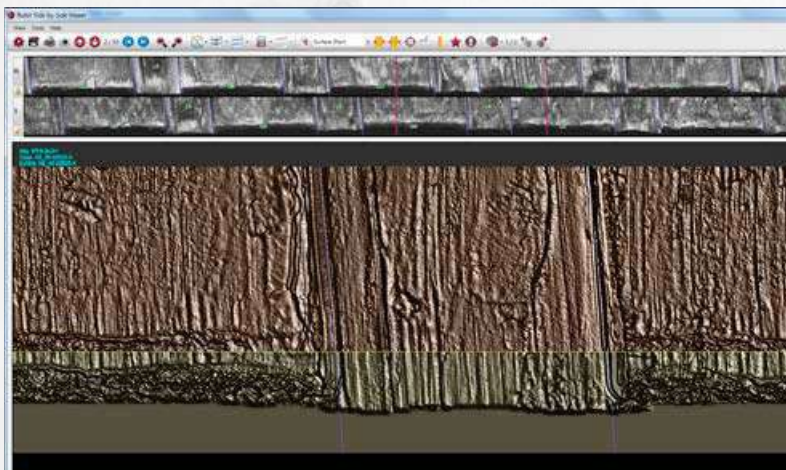*CARTRIDGE CASE MULTIVIEWER*

INDEPENDENT REGIONS OF INTEREST
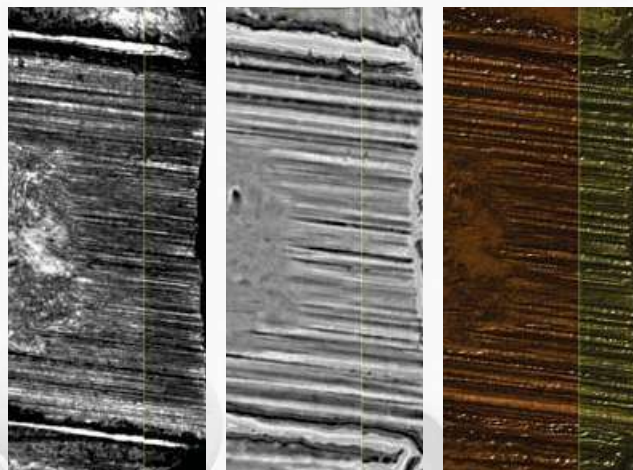

3D ENHANCEMENTS

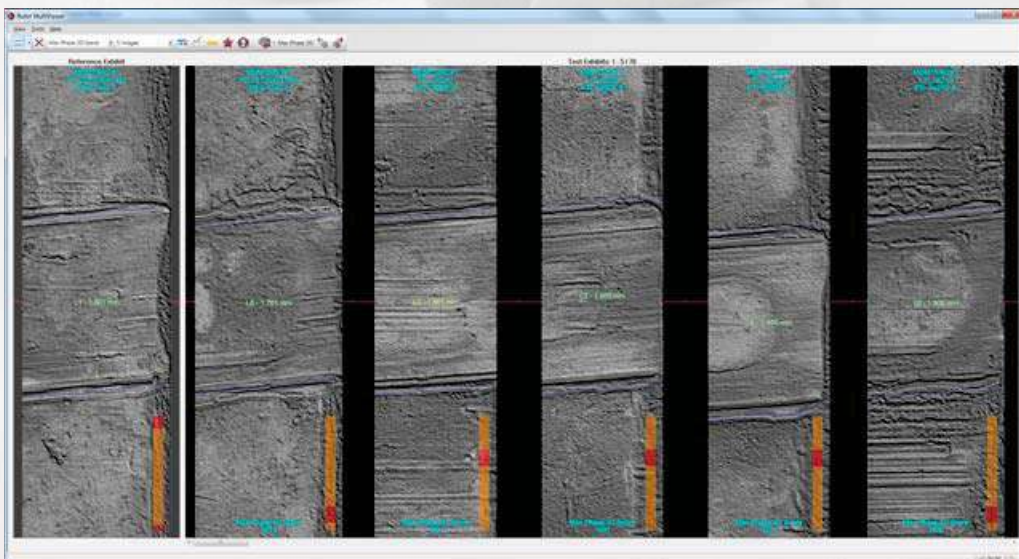# IBIS TRAX HD3D
MATCHPOINT

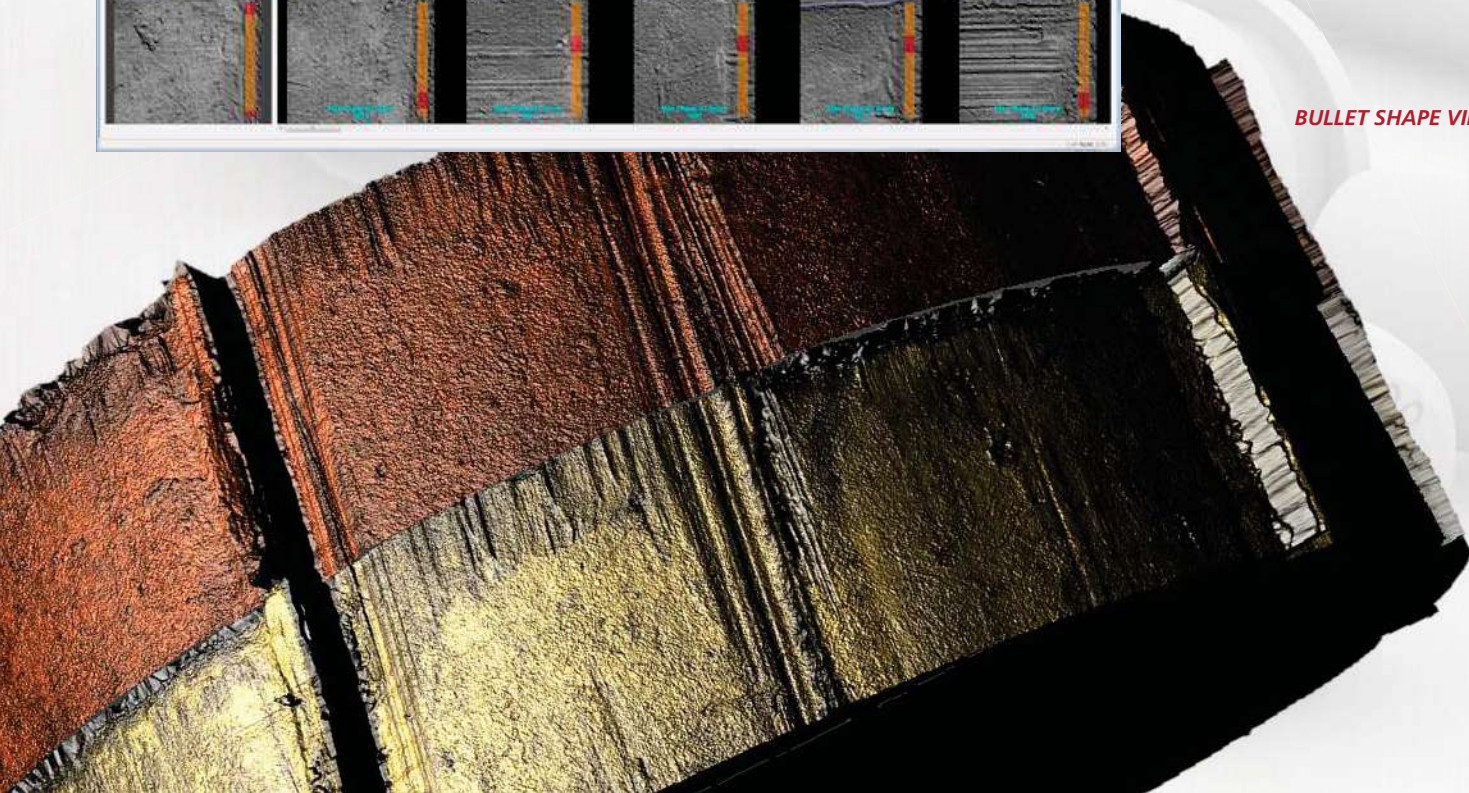
BULLET SIDE-BY-SIDE VIEWER

2D AND 3D ENHANCEMENTS

BULLET MULTIVIEWER

BULLET SHAPE VIEWING

DATA CONCENTRATOR
STORAGE AND MANAGEMENT

The Data Concentrator provides scalable storage and backup services for the exhibits acquired using BRASSTRAX and BULLETTRAX acquisition stations. It can store from thousands to millions of exhibits. There is great value in this data, and the Data Concentrator implements rigorous mechanisms to guarantee its preservation and validity over time.

Typically, the Data Concentrator automatically generates a correlation request for each exhibit received from its acquisition stations, for comparison against previously captured exhibits. The scope of correlations can be configured to encompass specific acquisition sites on an IBIS network, in order to optimize searches based on crime patterns and geography. The correlation requests are processed by the Correlation Server and the correlation results are returned to the Data Concentrator.

According to the size of an IBIS network, one or more Data Concentrators can be centralized or distributed, and can accommodate local and remote connectivity for acquisition stations and analysis stations.

Data Concentrator

Capture

Analysis

Correlation

LEONICS®

UTT-series   Three Phase True Online UPS

Smart Protection
- Static bypass
- Manual maintenance bypass
- Zero time transfer
- EMI protection
- Surge, over charge, over discharge, overload, and short circuit protection

Power Display and Management
- LED indicator and LCD display with control panel (10kVA- 30kVA model)
- LED indicator and large touchscreen LCD (40kVA - 120kVA model)
- Intelligent battery management
- Hot swappable battery
- Extended backup time (option)

Communication
- RS-232, RS-485 port and dry contacts
- SNMP/HTTP monitor capability (option)

Saving
- High efficiency > 98% in Eco mode
- Front opening door for easy access and maintenance

Safety
- Emergency Power Off function (EPO)

Reliable Power Quailty
- Input voltage 380 Vac (L-L) with -40% to 25%
- Input frequency 50 Hz/60 Hz
- Output voltage 380 Vac (L-L) ± 1%
- Output frequency 50 Hz/60 Hz ± 3 Hz adjustable

High Reliability
- True on-line double conversion technology
- Modular design with high MTBF and low MTTR
- Horizontal modularity parallel redundant configuration up to 6 units
- Full digital control with three DSPs including IGBT rectifier, inverter and charger
- Digital circulating current control technology
- Intelligent self-diagnose function

Applications
- Internet service provider
- Computer data center
- Industrial automation
- Bank or security system
- Telecommunication system
- Transportation system
- Mission-critical equipments

Three Phase Input / Output True On-line Double Conversion Sine Wave UPS

LEONICS®

UTT-series Three Phase True On-Line Double Conversion Sine Wave UPS

SPECIFICATIONS

MODEL			UTT-103	UTT-153	UTT-203	UTT-303	UTT-403	UTT-603	UTT-803	UTT-104	UTT-124
CAPACITY	VA		10 kVA	15 kVA	20 kVA	30 kVA	40 kVA	60 kVA	80 kVA	100 kVA	120 kVA
	Watt		8 kW	12 kW	16 kW	24 kW	32 kW	48 kW	64 kW	80 kW	96 kW
MAIN INPUT	Voltage		380 Vac (L-L) -40% to 25%								
	Frequency		50 / 60 Hz								
	Frequency range		40 - 70 Hz								
	Terminal connection		3 phase + N + PE								
	Power factor		more than 0.99								
BYPASS INPUT	Voltage		380 Vac (L-L) -20% to 15%								
	Frequency		50 / 60 Hz ± 5 Hz								
OUTPUT	Voltage		380 Vac (L-L) ± 1% (balance load), 1.5% (unbalance load)								
	Voltage transient		5% (0 - 100% load step)								
	Power factor		0.8								
	Frequency		50 Hz ± 3 Hz (adjustable)								
	Frequency precision		± 0.02% (free running)								
	Phase tolerance		120˚± 0.5˚ (balance and unbalance load)								
	Voltage unbalance degree		± 1%								
	Frequency tracking speed		0.5 Hz/s to 5 Hz/s (adjustable)								
	Harmonic distortion		< 1.5% of THD at linear load, < 5% of THD at non-linear load								
	Overload capability		102% long time operation 110% transfer to bypass after 1 hour 125% transfer to bypass after 10 minutes 150% transfer to bypass after 1 minute > 150% transfer to bypass after 200 ms								
	Bypass overload capability		125% long time operation 125% < load < 130%, last for more than 1 hour 130% < load < 150% last for more than 6 minutes >1000% last for more than 100 ms								
	Crest factor ratio		3 : 1								
EFFICIENCY	AC to AC		95%								
	Economy mode		98%								
	Battery mode		95%								
BATTERY	Type		sealed lead acid (maintenance free) rechargeable								
	Capacity		40x12V 9Ah (built-in)		80 x 12V 9Ah (built-in)		40 x 12 V (external battery)				
	Backup time		15 - 30 min (depending on connected load)								
	Extended backup time		option								
	Recharge time		80% capacity after 8 hours charging								
STANDARD	EMI attenuation		IEC 62040-2								
	EMS		IEC 61000-4-2 (ESD), IEC 61000-4-3 (RS), IEC 61000-4-4 (EFT), IEC 61000-4-5 (Surge)								
	Surge protection		Comply with IEC 60664-1 Class IV, endure surge of 1.2/50µs +8/20µs higher than 6kV/3kA								
	Enclosure protection		IP20								
INDICATOR	Front panel LED		UPS Status, Bypass, Rectifier, Inverter, Output, Battery								
	Front panel LCD's		Input (V, A, Hz, power factor), Bypass input (V, A, Hz, power factor), AC output (V, A, Hz, power factor), Load (kVA, kW, kVAR, %), Battery data (V, A, %,˚C, environmental temperature), History, UPS status				Input (V, A, Hz, power factor), Bypass input (V, A, Hz, power factor), AC output (V, A, Hz, power factor), Load (kVA, kW, kVAR, %), Battery data (V, A, %,˚C, environmental temperature, remaining backup time, equalize charging, float charging, disconnected), Current and History alarm and UPS system information				
AUDIBLE ALARM	Buzzer		yes								
CONNECTION			top or bottom cable connection								
COMMUNICATION INTERFACE	Standard interface		RS-232 port, RS-485 port and dry contacts								
	SNMP/HTTP capability		option								
SOFTWARE			UPS monitoring and management software								
ACOUSTIC NOISE			< 55 dBA at 1 metre								
ENVIRONMENT	Temperature		0 - 40˚C								
	Humidity		0 - 90% (non-condensing)								
DIMENSIONS	W x H x D (approx. in cm.)		54 x 110 x 69				60 x 135 x 85.5		60 x 160 x 85.5		
WEIGHT	Approximate in kg.		97	97.5	97.5	99.5	164		176		

Continuous product development is our commitment. In that manner, the above specifications may be changed without prior notice.

Authorized Distributor:

SG Series UPS

10 - 600 kVA three phase 400 Vac

with ultra-high efficiency eBoost™ technology


imagination at work

From protecting assets such as generators, transmission lines and motors, to ensuring secure wireless data transmission & **providing uninterruptible power,** GE delivers industry-leading technologies to solve the unique challenges of each customer.

GE SG Series Uninterruptible Power Supplies 10-600 kVA

The GE SG Series is one of the best performing and most reliable three-phase UPS systems providing critical power protection for a wide range of applications. The SG Series operates in VFI mode (Voltage Frequency Independent) and has been developed to satisfy the growing request of clean input performances through an innovative control algorithm on the IGBT rectifier power components instead of using standard filters. The SG Series is developed using GE's Design for Six Sigma methodology to ensure that the product fully meets customer requirements and expectations.

The SG Series UPS provides top class reliability and performance. With backfeed protection and compliance to EMC and safety standards the SG Series complies to current standards. Reliability can be further increased by paralleling more units utilising GE's unique RPA™ technology (Redundant Parallel Architecture). Through their complete life cycle, all GE UPS systems are fully supported by service teams which provide world-class, 24x7 preventive and corrective services, training and application expertise.

Ensuring uptime for critical processes
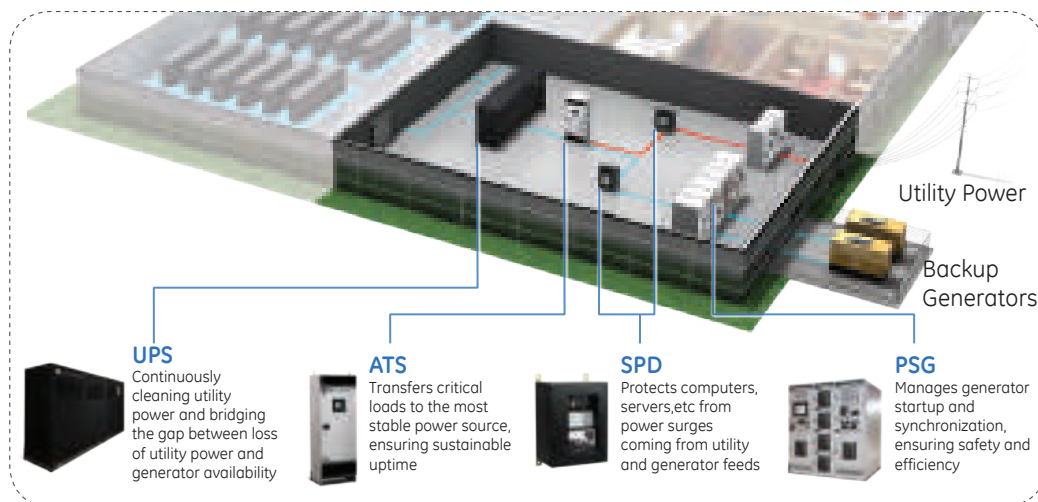
For mission critical processes, customers rely on our industry-leading power quality solutions to increase critical system reliability. GE's Critical Power business has technology that delivers superior performance and industry-leading energy efficiency for facility backup power management. In addition to our UPS Solutions, we provide the Standby Generator Paralleling Switchgear, Automatic Transfer Switches and Surge Suppression Devices that deliver power efficiently and reliably.

Utility Power

Backup Generators

UPS
Continuously cleaning utility power and bridging the gap between loss of utility power and generator availability

ATS
Transfers critical loads to the most stable power source, ensuring sustainable uptime

SPD
Protects computers, servers,etc from power surges coming from utility and generator feeds

PSG
Manages generator startup and synchronization, ensuring safety and efficiency

SG Series 10 - 600 kVA UPS

Delivering Best-in-Class Efficiency with eBoost Technology

GE's SG Series is one of the most efficient and reliable Three Phase UPS Systems, providing best-in- class output performance and critical power protection for your data center needs. The SG Series UPS solutions are designed and optimized to provide high efficiency at part load conditions.

The SG Series UPS assures low input current harmonic distortion and best-in-class output voltage regulation and dynamic response. This helps customers save operational costs while implementing environmentally-friendly solutions.

Low total cost of ownership

- High efficiency in double conversion up to 94% and eBoost mode operation up to 99%.
- eBoost* operation minimizes efficiency losses providing annual power & cooling savings up to $300k for 5MW data center
- PurePulse IGBT rectifier keeps your supply network clean and provides advantages by reducing size of circuit breaker, cables and generator.

Easier Installation and Configuration Flexibility

- True front access for operation and maintenance, reduces mean time to repair (MTTR)
- Smaller size reduced installation and operational foot print
- Redundant Parallel Architecture for reliability, redundancy & scalability
- Parallel up to 6 UPS Modules

High Performance and Availability

- Enhanced output performance to protect and supply modern IT load with lagging-leading power factor (0.9) without derating
- Excellent dynamic performance and low output voltage distortion
- Inverter zig-zag isolation transformer provides better short circuit capability and load galvanic separation

Key Features

PurePulse – IGBT rectifier clean input <2% THDi

eBoost technology for high efficiency up to 99%

Output power factor: 1.0 (10-40 kVA), 0.9 (160-600 kVA)

True font access design

Smaller foot print

Inverter Zig-Zag isolation transformer

Extremely low output voltage distortion

Superior battery management

Intelligent Energy Management integrated (IEMi)

* eBoost option is available on 160-500 kVA UPS models.

3

Energy Efficiency is our focus

The GE SG Series is one of the most energy efficient double-conversion UPS with output transformer topology in the industry, and provides world-class energy efficiency across the operating load range.

GE's UPS performance is optimized at 50-75% load operation, as this is the most common operating range. The optimization of the SG Series includes selecting all major power chain components based on maximizing the component efficiency at part load conditions.

True efficiency

GE UPS efficiency data are real values confirmed by measurements, representing the state of the art of power electronic technology.

This avoids any surprise in cooling system design and in economical evaluation of energy consumption over the life cycle, ensuring peace of mind for your investment.

SG Series 200 kVA Efficiency
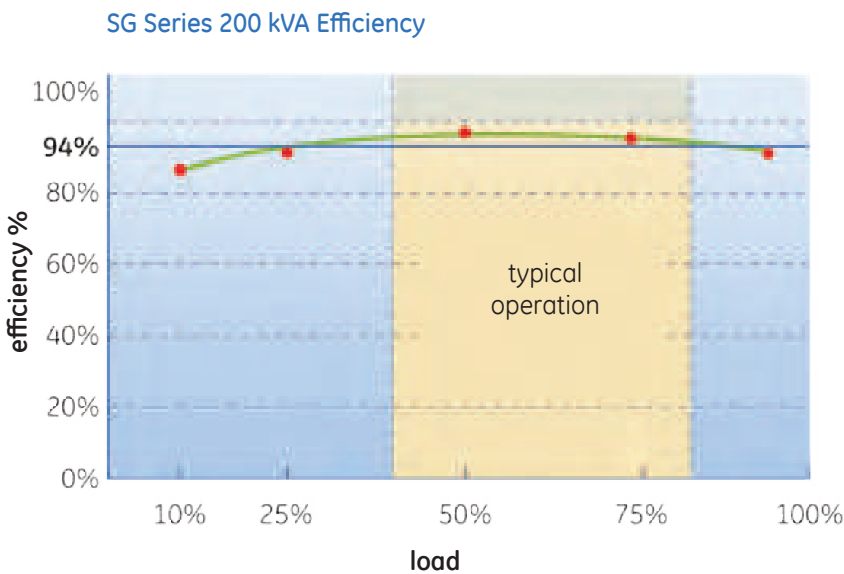
eBoost Savings

eBoost* operation provides considerable energy life cycle cost savings ranging from $0.5MM to $7MM**. Savings are dependent upon load, power costs and life cycle duration (years).

* eBoost option is available on 160-500 kVA UPS models.

** Assumptions:

- Power Cost = $0.10/kw-hr
- Operating Hrs/Year = 8.760
- Configuration = S+S operating at 50% of capacity

Data Center Life Cycle Cost (10 Years)


4
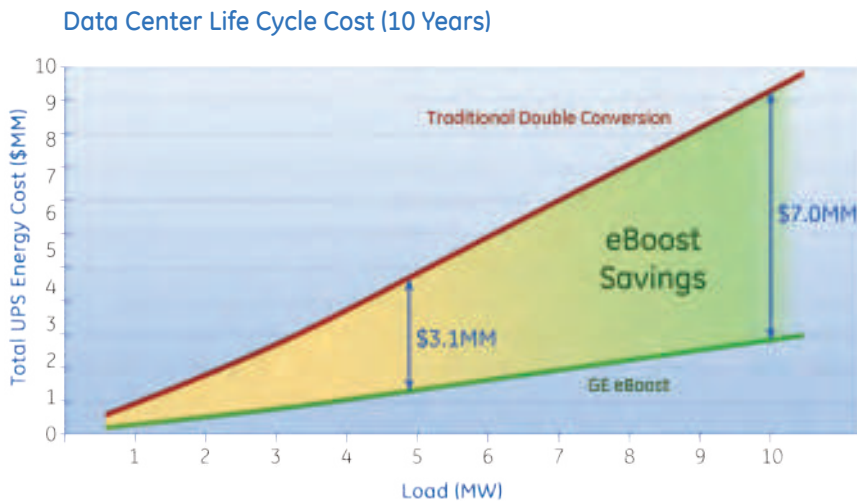
Ultra-High Efficiency Mode

eBoost™

Energy consumption is a critical issue for IT organizations as their datacenter energy demands continue to grow. Their goal is to reduce cost and keep the datacenter running. IT organizations can reduce energy consumption costs without sacrificing system reliability with GE's eBoost technology.

Technology Features

- Up to 99% UPS efficiency
- Compliant to ITI (CBEMA) curve during transient events
- Patented power electronics and magnetics ensures less than 2ms transfer time to inverter
- Patented power conditioning/filtering design via bypass inductor and output transformer/capacitor while in eBoost mode
- Battery trickle charge in eBoost operating mode
- Up to 3 MW UPS capacity using paralleled modules
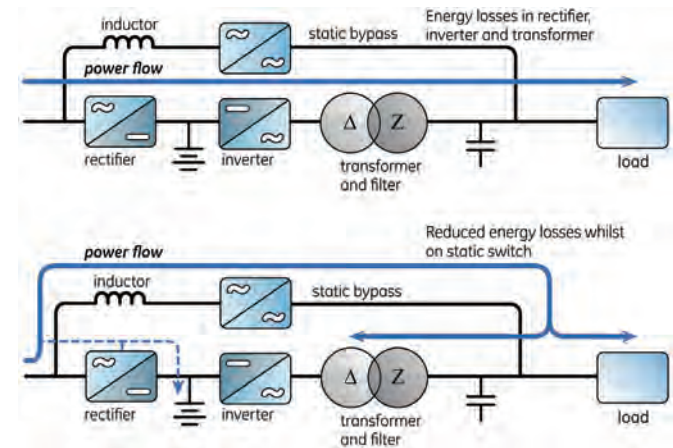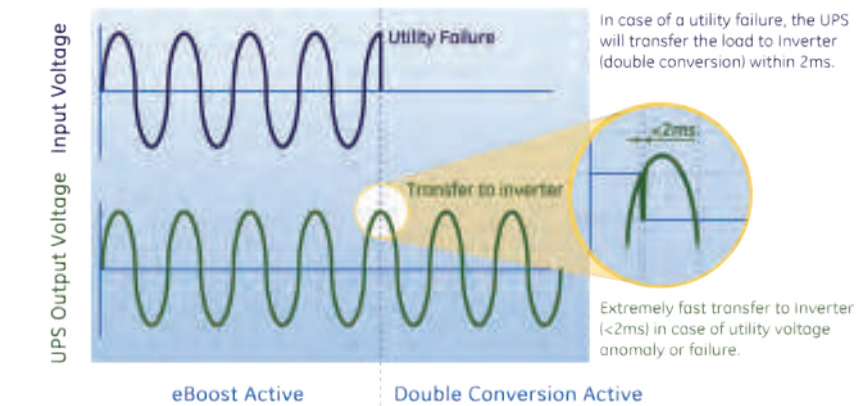
What is eBoost?

e = high efficiency up to 99%

Boost = fast transfer to inverter < 2ms

Customer Benefits

- 80% reduction in UPS losses
- System energy cost savings
- Reduced heat (BTU) generation
- Energy savings from reduced cooling
- Extend UPS component life
- User-programmable scheduling

eBoost Performance

Specifications

On SG Series UPS products, 160-500 kVA, single module and Redundant Parallel Architecture (RPA) operation:

Transfer time:	<2ms
Input voltage range:	+/- 10%
Input frequency range:	+/- 2%
Efficiency:	up to 99%

Innovative Product Technology

PurePulse™ - IGBT rectifier clean input

PurePulse is an innovative control algorithm applied on the IGBT rectifier (available from 10 to 500 kVA).

This current source rectifier assures an input Total Harmonic Distortion (THDi) of less than 2% and draws a pure sinusoidal waveform from the mains.

Advantages

- UPS input performances
  Total Current Harmonic Distortion THDi = 2% without additional harmonics filters
  UPS input power factor: 0.99
- Constant behavior at all loads
  Negligible harmonics contents at full and partial loads.

Superior Battery Management (SBM)

Every GE UPS incorporates a standard feature called Superior Battery Management (SBM) that can be configured to periodically test the battery system and calculate true battery runtime using measured values for temperature and load.

Advantages

- Works with all Battery Types: Flooded, VRLA, NiCD
- Online Battery Test: The risk of load loss is prevented by periodic rectifier/battery testing to insure proper operation
- Increases Battery Life: Monitors all key parameters of the battery plant to maximize reliability and warn of possible problems.

Digital Signal Processor (DSP)

DSP (Digital Signal Processor) performance enables the high sampling rates required to achieve the appropriate bandwidth for the current and voltage controls for an efficient double-conversion UPS.

- High speed sampling rate for precise RPA control
- Faster transient response time
- Redundant high speed communication
- All digital controls for increased reliability and stability
- All system control parameters are adjustable from the front panel

Zig Zag Output Transformer

The ZigZag transformer enables the UPS to run with heavily unbalanced loads while supplying full kVA output capacity at 100% non-linear load.

The secondary windings of the output transformer form a ZigZag pattern to cancel triplen (third order) load harmonics. This reduces neutral conductor loading and losses in all the conductors and the input transformer. Inverter output transformer inductance filters noise during eBoost operation.

- Provides Galvanic Isolation of the Load
- Protects Inverter from Non-Linear Loads
- Protects Inverter from High Inrush Loads
- No Magnetizing Inrush Current during eBoost Transfers

Space Vector Modulation (SVM)

Space Vector Modulation is the next generation of Pulse Width Modulation (PWM) inverter control technology.

SVM uses an advanced switching technique for PWM driving Insulated Gate Bipolar Transistors (IGBT). The objective of SVM is to generate the output voltage vector using simpler switching pattern combinations.

In traditional PWM, the triangle wave is compared to a reference sinewave. The result is a pulse width modulated rectangular waveform, which is used to provide gate signals to the IGBTs.

PWM signals have to be calculated in real time and normally require 3-dimensional calculations (one for each three phase leg) to determine the inverter state. By using SVM, the calculation is simplified to a 2-dimensional "space vector" in a polar coordinate plane, speeding up the response and improving system performance.

Advantages

- Higher efficiency at full and partial load
  Reduces IGBT switching losses
- Improved output performance
  Reduces Total Harmonic Distortion (THD) with non-linear loads and improves transient response to step loads
- Precise paralleled system performance
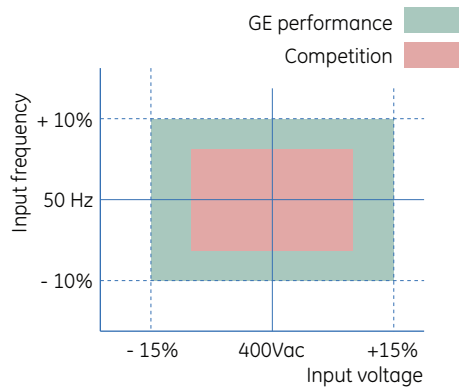 More accurate load sharing for RPA operation.
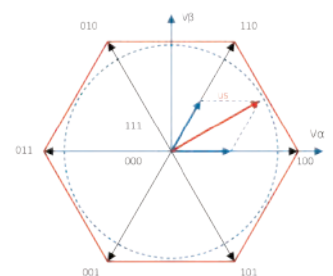
Input Performance

Input Performance

Robust Rectifier for Wide Input Range

The wide AC input voltage and frequency window avoids unnecessary battery discharge even when operating from an unstable AC source (i.e. diesel generator).

Programmable Soft Start

Allows the rectifier to ramp up in a programmable time period (0-15 seconds) eliminating in-rush current. This feature reduces the need of oversizing the input power system (gensets, feeder cables, and overcurrent devices).

Generator Compatibility

User-programmable features such as slew rate, phase angle rate-of-change and voltage rate-of-change allow the UPS to quickly sync to a genset during emergency back-up. GE's optional input filter also has user-programmable features ensuring quick and continuous synchronization to generator voltage.

PurePulse™ technology for clean input source

From thyristor to IGBT rectifier, a technology breakthrough innovation toward the future.

PurePulse is an innovative control algorithm applied on the IGBT rectifier. This current source rectifier assures an **input Total Harmonic Distortion (THDi) of less than 2% with input power factor PF = 0.99** and draws a pure sinusoidal waveform from the mains. The advantages of GE's PurePulse technology span from savings in the sizing of upfront equipment (such as emergency generator, cabling and circuit breakers) to a total elimination of cost for additional active or passive filters.

Benefits

• Saving in the sizing of upfront equipment e.g. emergency generators, cablings, circuit breakers, ...

• Saving cost due to no additional filters; Avoid the installation and the tuning of additional harmonics traps

• No disturbances to nearby equipment; Eliminate any cause of perturbation and outage on upfront electrical equipment, avoiding also any investigation and analysis cost due to malfunction.

PurePulse™ technology
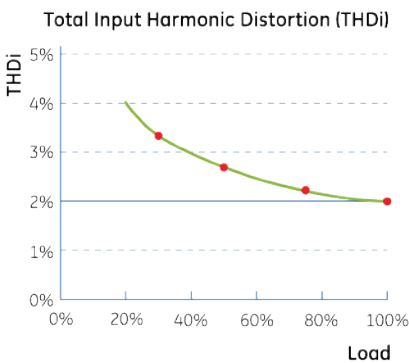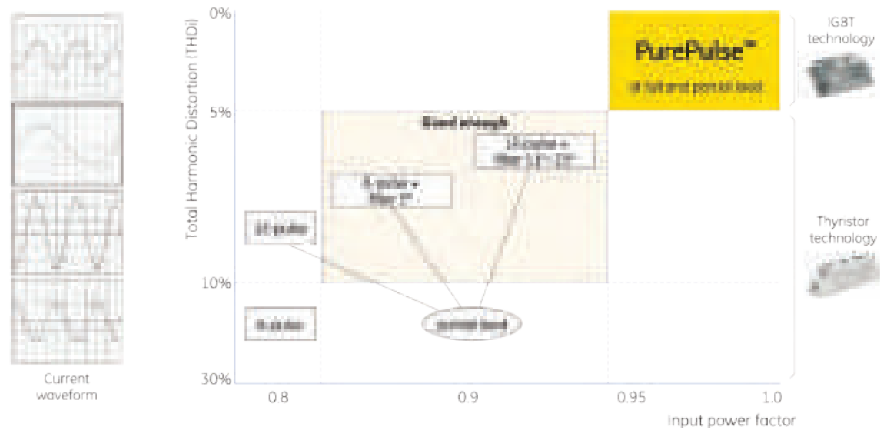
Output Performance

Total Harmonic Distortion (THD)

A distorted output voltage waveform affects the proper function of the load's equipment. The SG Series has very low output voltage THD, even with connected 100% unbalanced or 100% non-linear loads.

Transient Response

With the use of SVM and the ZigZag transformer, the GE UPS can react very quickly to zero-100% step loads (within 1/3 cycle). This reduces the need to oversize the UPS for severe pulse-load applications.

Overload Capabilities

The SG Series UPS has a robust inverter capable of delivering 150% overload for 1 minute and 125% for 10 minutes, ensuring power protection safety for applications requiring start-up overcurrent and for temporary peak load.

Voltage regulation

SVM and the Zig-Zag transformer enable the inverter to react very quickly under step load conditions. As a result, the GE UPS has very tight voltage regulation during step loads and 100% phase-to-neutral (Ph-N) load imbalances.

Short-circuit capability

The SG Series inverter supplies 2.7 and 4.0 times (for 200 ms) the nominal current respectively for ph-ph and ph-N/PE short-circuit, ensuring the proper selectivity of the protection devices (fuses and breakers).

Output power capability

Nowadays IT installation requirements is driving to power sources able to supply loads with leading power (capacitive loads) without affecting the power capability. Whereas most of the UPS available in the market are designed to supply loads up to power factor 0.8 lagging, the SG Series UPS are able to supply full power without any derating for all loads from 0.9 lagging to 0.9 leading. This unique characteristic avoids any UPS oversizing in case of unity or leading power factor as for computer loads. The table below shows the additional power (kW) available compared to UPS designed according to traditional technology.

UPS rating	500 kVA			
Load power factor	0.8 lagging	0.9 lagging	1	0.9 leading
GE-SG Series	400 kW	450 kW	450 kW	450 kW
Traditional technology for PF=0.8	400 kW	387 kW	362 kW	300 kW
SG Series additional power available	0%	+16%	+24%	+50%

SG Series power capability (60-600 kVA)
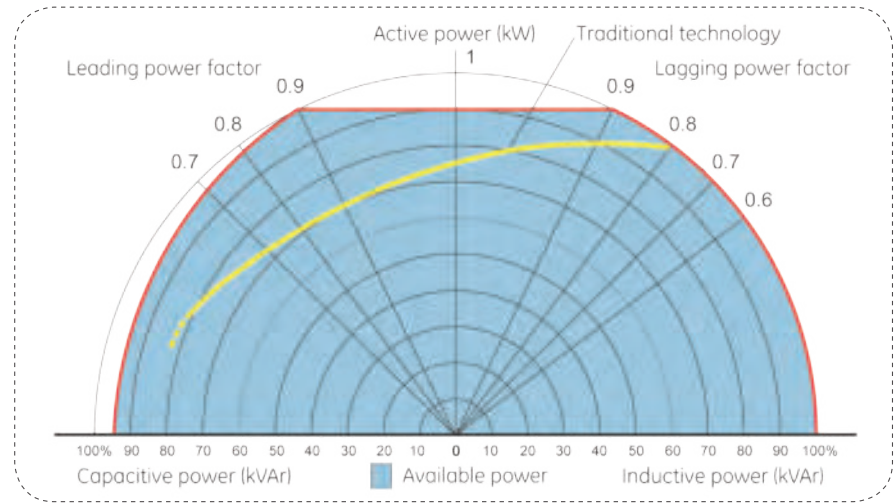
- Designed to supply real power for any type of application
  - inductive loads
  - resistive loads
  - capacitive loads

- No de-rating required to supply resistive and capacitive loads (0.9)

- Suitable for modern power supply application with unity or capacitive power factor, crest factor up to 3:1

Redundant Parallel Architecture™ (RPA) System Configuration

GE provides RPA, a unique technology that can parallel UPS modules with true redundancy by eliminating any single point of failure. RPA provides a scalable paralleling technique that reduces operating footprint and increases system reliability by eliminating the need for external paralleling equipment and cabinets (centralized bypass and master control).

One of the UPS modules in the system intelligently takes the leadership role, while the other UPS modules have access to all control parameters. If one UPS fails to operate, the load is automatically redistributed among the others. If the lead UPS fails to operate, then another UPS automatically takes on the leadership role. GE's RPA technology is implemented by distributing the control electronics within each UPS module in the system.

RPA™ System Advantages

No Single Points of Failure

The RPA system provides complete redundancy of all critical components, allows paralleling of up to 6 units for increased load capacity or redundancy.

Bypass Inductor Design

Ensures excellent output voltage regulation between paralleled modules and assists bypass line conditioning (eBoost only). Bypass inductor design & RPA cable saver available only for eBoost unit 160-500 kVA.

Scalable and Modular

The system can be easily expanded for higher capacity and redundancy without any interruption to the critical load or transfer to bypass.

Distributed Control Logic

Each module in an RPA system has its own operational controller. Each one continuously communicates with all others in order to manage the entire system like a team.

Redundant Communication

Redundant high speed bus and control electronics provide higher system reliability.

Online Maintenance

N+1 configurations allow maintenance on any single module in the system while other modules provide online protection with battery backup.

Sequential Soft Start

Provides sequential soft start of each module to reduce instantaneous load on input feeders during mains recovery. This helps avoid over-rating of generator and overheating of cable and fuses.

RPA Cable Saver

UPS Module input and output cable length variation up to 10% between modules. With eBoost technology this cable length flexibility is increased up to 25% between modules.

Smaller Footprint

RPA eliminates centralized control and external static bypass cabinet.

GE's RPA™ System

Standard RPA™ Configuration:
True Redundancy with Distributed Control & Bypass
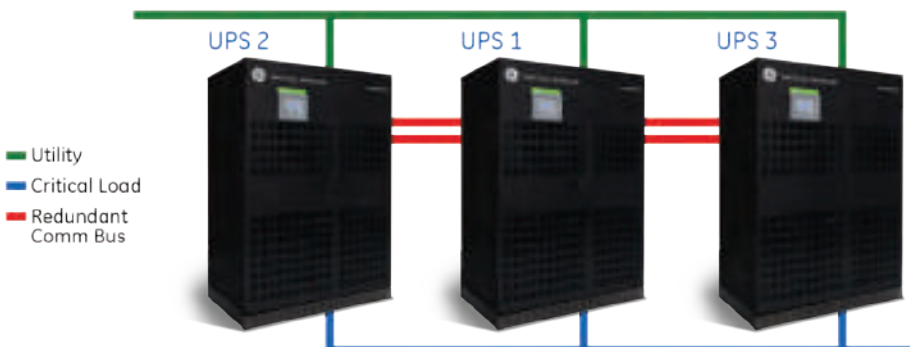
Configurable up to 6 units in parallel

- Future expansion
- Safe and reliable power supply
- Redundant Communication Bus

Easy to install and maintain

- Easy system upgrade/downgrade
- Maintenance operation without load interruption

Software & Connectivity Solutions

Protection Software

GE Data Protection software can communicate with the UPS over RS-232, USB or SNMP to receive status information and measurement values of the UPS. In case of a critical condition (time on battery, remaining battery autonomy time or low battery) for the load, the software starts a controlled shutdown.
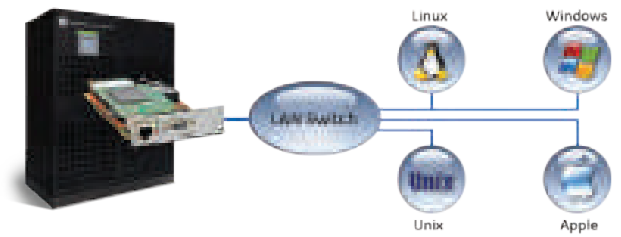
An enhanced alarm management system provides the possibility to start applications, send messages, and send e-mails for every upcoming or disappearing alarm.

Remote Monitoring and Diagnostic Solution

GE remote monitoring solution is an anytime, anywhere concept in UPS status monitoring and alarm notification supporting all GE UPS product lines.

Accessing the latest site information via Web and being alerted by Email or SMS , it enables the user to make timely decisions in case of changing critical conditions. With comprehensive data collection and analysis it improves diagnostics capability and enhances response time.

- 24/7 remote access to your UPS data using standard web browser
- Automatic alerting in case of event direct and immediately to you cell phone or by email
- Regularly operational reports with proactive information on critical data
- Preventative information using PMAD (Preventative Maintenance & Advanced Diagnostics) feature
- Possibility to reduce intervention and onsite work
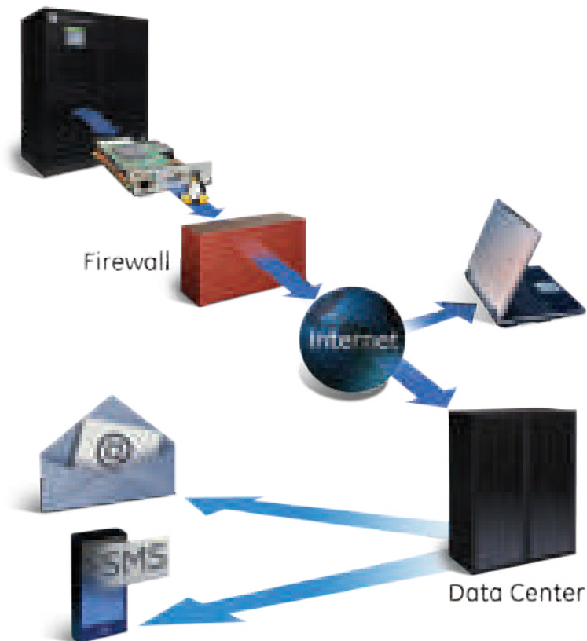
Remote Connectivity to Building Management Systems

This optional Standard Network Management Protocol (SNMP) Plug–In Card allows the UPS to communicate over a LAN or interface through all major building management systems (BMS).

Integrates a modern web server for UPS monitoring Via LAN, drives remote server shutdown in case of critical UPS alarms and works as Modbus TCP Converter "as well as Modbus RTU 485".
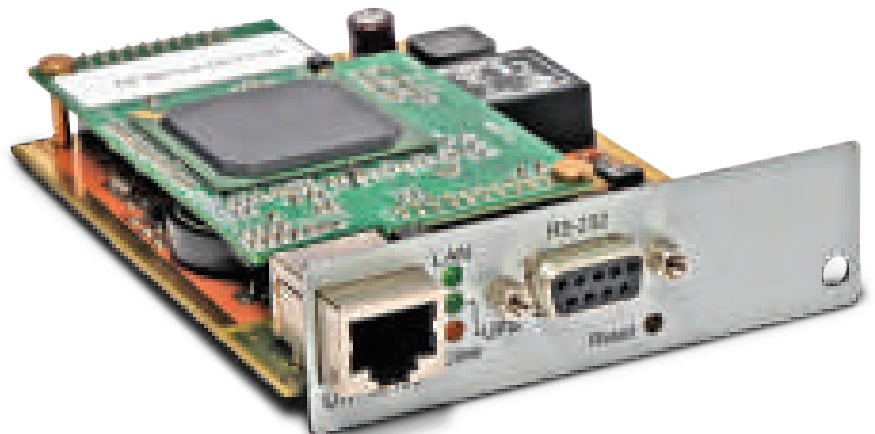
Intelligent Energy Management Integrated (IEMi)

GE's Intelligent Energy Management integrated (IEMi) operating mode offers the capability to optimize and increase system efficiency while maintaining the system reliability for UPS's in a redundant parallel architecture (RPA™).

UPS system sizing accounts for normal load requirement, over-load and capacity for future expansion. In addition, redundancy level of N+1 or N+2 is considered to enhance system reliability.

Most UPS systems typically operate at low load levels <50%. At load level of less than 30-40%, efficiency of UPS decreases in comparison to normal operating load range of 40%-75%. In redundant parallel architecture (RPA™) system of 4 UPS modules its more efficient to have 2 UPS operating at 40% load range than 4 units operating at 20% load range.

For parallel UPS installations, IEMi operating mode saves energy by dynamically utilizing the UPS modules as needed to meet the required output power without compromising power quality to the critical load.

Features & Benefits

- User programmable scheduling
- Front graphic panel accessible set-points
- Reduction in UPS losses and cooling
- Double conversion operation - no compromise on power quality
- System energy cost savings
- Redundant operation - no compromise on system reliability
- Cyclic operation ensures even UPS run-time
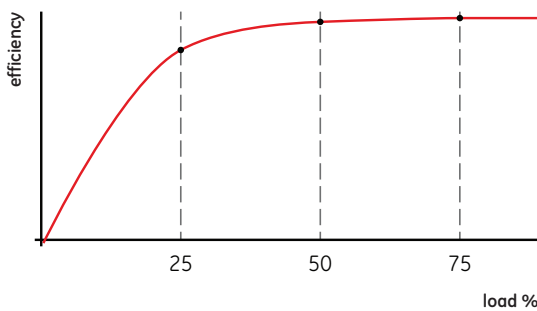
Power Quality Service

Performance Through People

Whether you are a large corporation with multiple sites or a small business owner with a single location, GE will enable you to have a constant supply of clean and reliable power to keep your business up and running.

GE has local offices in a number of countries around the globe and also a network of selected business partners, whose salespeople and service engineers combine expertise in our solutions with an in-depth knowledge of local market conditions.

GE's service & authorized service providers business partners, located in more than 100 countries around the world, use all that expertise and knowledge to adapt GE's products and services precisely to their customers' needs.

- On site & emergency services
- Service agreements
- Spare parts and repairs
- Support and remote services
- Online support

Technical Specifications

Power Rating	Output Power rating (kVA)	10	15	20	30	40	60	80	100	120	160	200	250	300	400	500	600
	Output Power Rating (kW)	10	15	20	30	40*	54	72	90	108	144	180	225	270	360	450	540
	Output Power Factor	| 0.9 lead. - 0.6 lag |				| 0.9 lead. - 0.9 lag. |											
Energy Usage	Efficiency (eBoost mode, option)					| up to 99% (available for 160-500 kVA only) |											
	Efficiency	| up to 92.3% |				| up to 94% |											
Technology	Rectifier Technology	| IGBT PurePulse™ |															Thyr.
	RPA	| up to 6 units |															
Physicals	Dimensions (w), mm	| 680 |				| 650 |	835	| 900 |		| 1300 |			| 1800 |		1950	
	Dimensions (d), mm	| 800 |				| 850 |							| 950 |			
	Dimensions (h), mm	| 1450 |				| 1900 |										
	Weight (kg)	285	335	335	400	400	550	630	860	1050[1]	1220[2]	1470[2]	1560[2]	2190[3]	2470[3]	2950	
Input	Voltage Range	| 340 - 460 Vac |															
	Frequency Range	| 45 - 66 Hz |				| 45 - 65 Hz |											
	Current THD	| 2% |														| 5% |	
Output	Voltage	| 3x380/400/415Vac, user selectable |															
	Frequency	| 50/60 Hz +/- 0.1% |															
	Voltage THD at Linear Load	| < 2% |				| < 1.5% |											
	Voltage THD at Non-linear Load	| < 3% |				| < 3% |											
	Voltage Regulation Static	| < +/- 1% |															
	Voltage Regulation Dynamic (100% step load)	| +/- 3% |				| < +/- 2% (recovery time < 5 ms) |											
	Overload Capability/Inverter	| 125% 10 min., 150% 1 min |															
	Topology	| VFI (Voltage Frequency Independent) according to IEC 62040-3 |															
General	Audible Noise, db(A)	| < 65 |				| < 69 |							72	| < 75 |		
	Protection Degree	| IP 20 |															
	Ambient Operating Temperature	| 0-40° C |															
	Operating Modes	| Double conversion, automatic bypass, Super ECO mode (60-120kVA), eBoost mode (160-500kVA, option), frequency converter, RPA |															
	Standard	| CE Mark, IEC 62040-1, IEC 62040-2, IEC 62040-3, IEC 60950 |															
	Safety Standards	| EN/IEC 62040-1 |															
	EMC Standards	| EN/IEC 62040-2 |															
	Color	| 160-500 kVA: RAL 9005, black; other models RAL 9003, white |															

* at 30° C operating temperature

1 - add 20kgs if with eBoost option
2 - add 30kgs if with eBoost option
3 - add 75kgs if with eBoost option

Specifications subject to change without prior notice

your distributor:
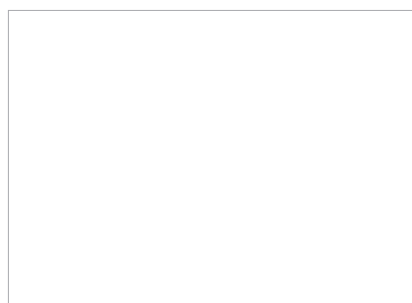
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GE imagination at work

English
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1016768 / 130906

Eaton 9155/9355 UPS

Scalable.
Flexible.
Compact.

E·T·N

Powering Business Worldwide

Introduction and overview

The Eaton® 9155/9355 uninterruptible power systems (UPS) are mid-size double-conversion UPSs that resolve all utility power problems and supply clean, continuous, uninterruptible power for the ever-expanding loads in today´s space-constrained server rooms. The 9155/9355 also offers an industry-leading combination of flexibility, scalability and power density – all in one high-efficiency package. The product family consists of single- and three-phase UPS models with a power range of 8-40 kVA.

Key applications

- Server and computer rooms, small data centres
- Financial services
- Healthcare
- Building management
- Industrial automation equipment
- Security systems

Benefits

Premium power performance

- Double conversion topology provides the highest level of protection
- With a transformer-free design and sophisticated sensing and control circuitry, the 9155/9355 delivers up to 93 percent efficiency
- Active power factor correction (PFC) provides unbeatable 0,99 input power factor and less than 4.5 percent input ITHD, thus enhancing compatibility with generators and eliminating interference with other critical equipment in the same network
- The UPS enables optimal power protection for modern 0.9 p.f. rated IT equipment

True reliability

- Hot Sync® technology allows two or more UPSs to be paralleled to increase availability or add capacity
- ABM® technology charges batteries only when necessary, preventing corrosion and prolonging battery service life by up to 50 percent
- Internal batteries in all standard configurations support up to 20 min runtime

Extensive configurability

- Configurable and multilingual LCD control panel with back light and graphical mimic screen makes it easy to monitor UPS status
- A wide range of connectivity options guarantees smooth integration with the requirements of various application systems
- Bundled with Eaton Software Suite, the UPS provides an orderly network shutdown in the event of an extended power outage If required, the 9155/9355 can also be integrated with network management, industrial automation and building management systems

Cost savings and sustainability

- The UPS features high efficiency, thus reducing utility costs, extending battery runtimes and producing cooler operating conditions
- The compact tower design offers a smaller footprint, thus enabling easy space planning and preserving valuable floor space
- Internal batteries often eliminate the need for costly and space-consuming external battery cabinets

- The single technical platform used in Eaton´s three-phase products guarantees easy upgrades and consistent in service, thus lowering total cost of ownership
- Eaton uses sustainable materials and highly efficient manufacturing technology, thus generating savings in carbon footprint

Customised solutions

- Eaton solutions can be customised to meet the requirements of even the most demanding applications
- A range of service agreement options can be easily customised to meet customers' needs and budget

Premium power performance

Double-conversion design for highest power protection
Unlike some other commercially available UPS technologies, the double-conversion design used in the 9155/9355 completely isolates output power from input power anomalies and delivers 100-percent conditioned, perfect sine wave output, regulating both voltage and frequency. Even when presented with the most severe power disturbances, power output remains stable.

The 9155/9355 continually monitors incoming electrical power and removes all power irregularities that are inherent in commercial utility power. During power outages and other interruptions, internal batteries provide emergency power to safeguard operation.

With the 9155/9355 UPS, data centre and facility managers can rest assured that their systems and equipment are fully protected from the effects of mains disturbances.

Self-diagnosis
The 9155/9355 constantly monitors its own operation – including voltage, temperature and function of internal components – and sends an alarm or takes action if it detects a potential problem.

Self-correction
If it senses a problem, the 9155/9355 instantly transfers the power path to a bypass source with zero interruption in power. When the alarm condition passes, the 9155/9355 automatically reverts from bypass to normal power.
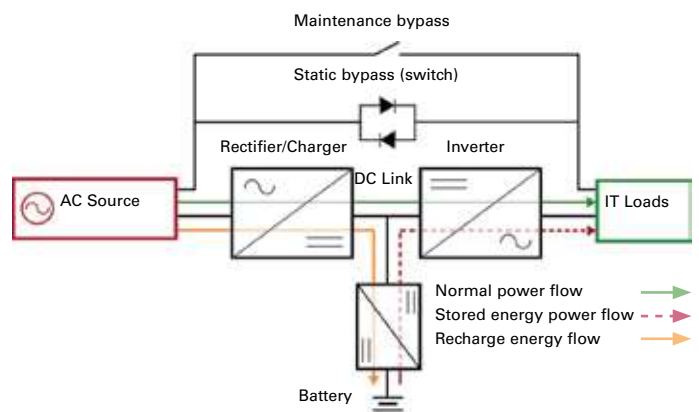
Efficiency and cost savings

The 9155/9355 delivers a robust combination of low input current distortion and high power factor for maximum efficiency. Operating at greater than 90 percent efficiency across all load ranges, the 9155/9355 helps to reduce utility costs, extend battery runtimes and produce cooler operating conditions.

In addition, Eaton´s use of sustainable materials and highly efficient manufacturing technology results in savings in carbon foot print compared to competitive UPS products.

The 9155/9355 UPS provides industry-leading power density and a 10-40 percent footprint reduction versus comparable UPS solutions. All standard 9155/9355 configurations incorporate internal batteries to provide significantly more runtime and offer 13 percent more capacity at equivalent VA ratings. Extended runtime allows

the 9155/9355 to power this extra capacity for nearly four times longer without requiring additional hardware, eliminating the need for costly and space-consuming external battery cabinets.

Standard 10 kVA and 20 kVA capacity models can also be upgraded to 15 kVA and 30 kVA respectively, providing 50 percent more power with no additional hardware and no increase in footprint. The small footprint of the 9155/9355 enables easy space planning for data centres and saves valuable floorspace.

The 9155/9355 UPS provides a 10-40 percent footprint reduction versus comparable UPS solutions

8-15 kVA UPS

20-40 kVA UPS
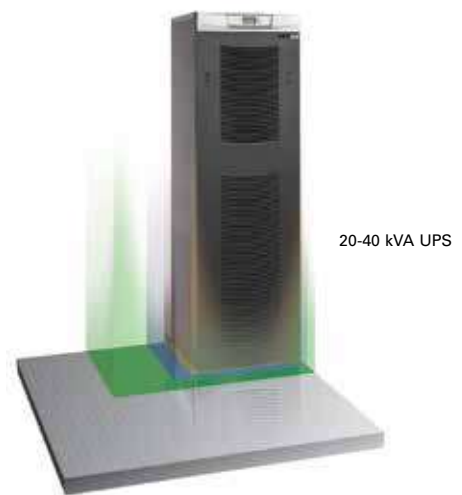
True reliability

Powerware Hot Sync technology boosts power reliabilityEaton's Hot Sync technology is designed for parallel redundant N+1 systems to satisfy 24/7 applications. It can also be used in parallel capacity systems to enable customers with ever-increasing load demands to take advantages of the scalability benefits it offers. Thanks to Hot Sync, up to four equivalent 9155/9355 modules can be paralleled for additional capacity or redundancy. Accurate, equal load share is the number-one characteristic determining the integral quality and reliability of a parallel UPS system. With Hot Sync technology this is achieved without the need for communication between the UPSs, thus no single point of failure is added when introducing parallel modules to a system. From an operational and economical viewpoint, the achieved "close to perfect" reliability brings clear savings in the long run, as every downtime incident is costly and might lead to unpredictable consequences.

Hot Sync

no common logic
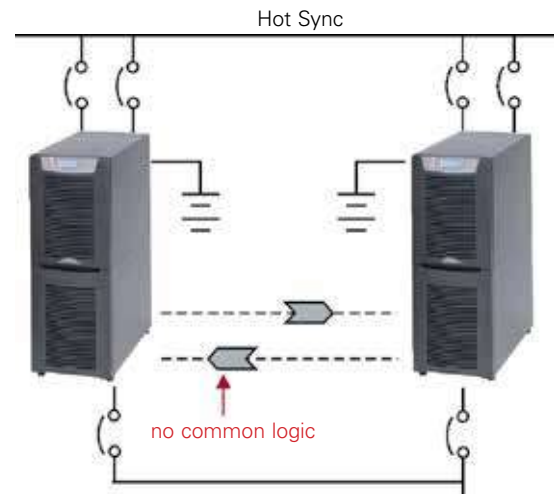
The benefits of Hot Sync:

- Erases single point of failure
- Systems are capable of paralleling for both redundancy and capacity
- Ensures that each module is operating independently
- No added circuitry or components are required for standard UPS to be switched in to operate in parallel
- A proven technology – thousands of systems are operating successfully around the world

ABM optimises battery performance and service life

The ABM technology used in the 9155/9355 UPS maximises the health and service life of batteries:

- ABM technology uses a unique three-stage charging technique that significantly extends battery service life and optimises recharge time compared to traditional trickle charging
- Temperature-compensated charging monitors battery temperature and adjusts the charge rate accordingly, which properly charges the battery and greatly extends battery life
- An integrated battery management system tests and monitors battery health and remaining lifetime, providing user notifications to guide preventive maintenance

Extensive configurability

Connectivity Options

Web/SNMP cards are complete UPS monitoring, control and shutdown solutions in a networked IT environment. In case of alert the Web/SNMP card can notify users and administrators through e-mail and SNMP traps. In case of a prolonged power failure the protected computer systems can be shut down in a graceful manner with Intelligent Power Protector software. The unique three-port switching hub on the X-Slot model provides additional network connections.

ConnectUPS-X
P/N 116750221-001 for Eaton 9155, 9355, 9390, 9395, BladeUPS.
ConnectUPS-E
P/N 116750223-001 is an external model that is connected to a serial port on a UPS. It supports Eaton 9130, 9155, 9355, 9390 and 9395 UPS (requires cable 1023247).
Network Card-MS Web/SNMP adapter
Catalog number: Network-MS
The Eaton Network Card-MS supports SNMP v1 and v3; IPv4 and v6; http, https and SMTP
Works with: 5130, 5PX, 9130, 9135, Evolution, Evolution S, EX, MX, MX Frame, EX RT

Environmental Monitoring Probe (EMP) adds temperature, humidity and two contact closure monitoring capability to ConnectUPS Web/SNMP cards. It is well suited for monitoring rack temperature and door status, as well as battery temperature. Operating system shutdown can be triggered if user defined thresholds are exceeded or contact closure status changes. P/N 116750224-001 works with Network-MS, Network and Modbus – MS, ConnectUPS and PXGX cards as well as network enabled ePDUs.

Relay/AS400 cards are an easy connection to IBM AS/400 series computers as well as industrial and building management systems.
P/N 1018460 for Eaton 9155, 9355, 9390, 9395, BladeUPS.
P/N 1014018 for Eaton 9130.
C/N RELAY-MS for 5130, 5PX, 9135, Evolution, Evolution S, EX, MX, MX Frame, EX RT

X-Slot ModBus card connects the UPS to industrial and building management systems using ModBus/JBUS RTU protocol.
P/N 103005425-5591 for Eaton 9155, 9355, 9395, BladeUPS.

Network and MODBUS Card-MS (MODBUS-MS) offers ModBus RTU in addition to Web and SNMP for 5130, 5PX, 9130, 9135, Evolution, Evolution S, EX, MX, MX Frame, EX RT

PXGX UPS card P/N 103007974-5591 offers ModBus TCP as well as Web and SNMP interfaces for 9155, 9355, 9390, 9395 and BladeUPS.

ViewUPS-X remote display is an LCD panel that lets users view the status of the UPS from as far as 100 m. ViewUPS-X has also four status LEDs and an alarm sound. The display is bundled with a dedicated X-Slot card that also powers the display through the communication cable. In addition to the remote display connection the card has also a SELV isolated relay port for connection to monitoring systems and AS/400 computers.
P/N 1027020 for 9155, 9355, 9390, 9395 and BladeUPS.

ConnectUPS - X

Network Card-MS

Environmental Monitoring Probe

BD relay card (for Eaton 9130 UPS)

Relay MS

X-Slot relay card

PXGX UPS

X-Slot Modbus card

ViewUPS-X

Modbus MS card

UPS options

- 9155/9355 is available with an optional integrated or external MBS that provides wrap-around bypass for UPS maintenance or service without shutting down the load
- An integrated output isolation transformer
- Tie cabinets for parallel systems
- Wall-mountable UPS centre for single UPS input, output and bypass distribution
- External battery cabinets line up and match perfectly with 9155/9355 UPS cabinets, and provide extended runtimes

External maintenance bypass switch (MBS)

Customised solutions

Eaton has vast experience in delivering solutions for the most demanding applications. As an example, marine UPSs have special dependability requirements due to the harsh operational conditions they have to withstand and the critical nature of the equipment they protect. Eaton has supplied marine UPSs to hundreds of vessels over the years.

The 9155/9355 has been also tested and certified for use in medical imaging system applications by all major suppliers of X-ray, MRI and CT machines.

Eaton offers 9155/9355 based customised systems for different markets, including:

- Marine/offshore
- Healthcare/medical
- Oil & Gas
- Rail & Track/underground/traffic/tunnel/mines
- Aviation
- Industrial applications
- Defence/military
- Emergency lighting

Expertise and reliability through Eaton service
Eaton provides an extensive technical support network to cover the power protection needs of our customers. We offer a number of distinct service packages to match different types of maintenance needs and budgets. Whichever package you choose, you can rest assured that it will deliver power security and reliability to keep your core business running. For more information, please contact your local Eaton service organisation or authorised service partner.

TECHNICAL SPECIFICATIONS

UPS output power rating (0.9 p.f.)

kVA	8	10	12	15
kW	7.2	9	10.8	13.5

General

Efficiency in double-conversion mode (full load)	92%
Efficiency in double-conversion mode (half load)	90%
Efficiency in high efficiency mode	up to 98%
Distributed parallelling with Hot Sync technology	4
Field upgradeable	yes
Inverter/rectifier topology	transformer-free IGBT with PWM
Audible noise	<50 dB
Altitude (max)	1000 m without derating (max 2000 m)

Input

Input wiring	1 ph or 3 ph + N + PE
Nominal voltage rating (configurable)	220/380, 230/400, 240/415 V 50/60 Hz
Input voltage range	Low -20% at 100% load/-50% at 50% load without battery discharge; High +10%/max +20%
Input frequency range	45-65 Hz
Input power factor	0.99
Input ITHD	less than 4.5%
Soft start capability	Yes
Internal backfeed protection	Yes

Output

Output wiring	1 ph or 3 ph + N + PE
Nominal voltage rating (configurable)	220/380, 230/400, 240/415 V 50/60 Hz
Output UTHD	<3% (100% linear load); <5% (reference non- linear load)
Output power factor	0,9 (e.g. 9 kW at 10 kVA)
Permitted load power factor	0.7 lagging - 0.8 leading
Overload on inverter	10 min 100-110%; 1 min 110-125%; 5 sec 125-150%; 300 ms >150%
Overload when bypass available	60 min 100-110%, 10 min 110-125%; 1 min >125-150%

Battery

Type	Maintenance-free VRLA batteries, NiCd
Charging method	ABM technology or Float
Temperature compensation	Optional
Battery nominal voltage (lead-acid)	384 V (32x12 V, 192 cells)
Charging current / Model	Default 3 A *Max 30 A

*May be limited by maximum UPS input current rating

Accessories

Isolation transformer, long-life batteries, external battery cabinets, UPS Center (input, bypass, distribution), X-Slot connectivity (Web/SNMP, ModBus/Jbus, Relay, Hot Sync, ViewUPS-X remote display), Hot Sync parallel tie cabinet, integrated manual bypass, external maintenance bypass switch

Communications

X-Slot	2 communication bays
Serial ports	1 available
Relay inputs/outputs	2/1 programmable

Compliance with standards

Safety (CB certified)	IEC 62040-1, IEC 60950-1
EMC	IEC 62040-2
Performance	IEC 62040-3

Stand-alone UPS with 1-phase input

Part number	Description	Rating	Back-up (p.f. 0.7)	Dimensions (HxWxD)	Weight
1022532	9155-8-S-10-32x7Ah	8 kVA / 7.2 kW	10 min	817x305x702 mm	155 kg
1022533	9155-8-S-15-32x9Ah	8 kVA / 7.2 kW	15 min	817x305x702 mm	160 kg
1022534	9155-8-S-28-64x7Ah	8 kVA / 7.2 kW	28 min	1214x305x702 mm	250 kg
1022535	9155-8-S-33-64x9Ah	8 kVA / 7.2 kW	33 min	1214x305x702 mm	275 kg
1022536	9155-10-S-10-32x9Ah	10 kVA / 9 kW	10 min	817x305x702 mm	160 kg
1022537	9155-10-S-20-64x7Ah	10 kVA / 9 kW	20 min	1214x305x702 mm	250 kg
1022538	9155-10-S-25-64x9Ah	10 kVA / 9 kW	25 min	1214x305x702 mm	275 kg

Stand-alone UPS with 3-phase input

Part number 9155/9355	Description	Rating	Back-up (p.f. 0.7)	Dimensions (HxWxD)	Weight
1022480	9155-8-N-10-32x7Ah	8 kVA / 7.2 kW	10 min	817x305x702 mm	155 kg
1022481/1023411	9155/9355-8-N-15-32x9Ah	8 kVA / 7.2 kW	15 min	817x305x702 mm	160 kg
1022482	9155-8-N-28-64x7Ah	8 kVA / 7.2 kW	28 min	1214x305x702 mm	250 kg
1022483/1023412	9155/9355-8-N-33-64x9Ah	8 kVA / 7.2 kW	33 min	1214x305x702 mm	275 kg
1022484/1023413	9155/9355-10-N-10-32x9Ah	10 kVA / 9 kW	10 min	817x305x702 mm	160 kg
1022485	9155-10-N-20-64x7Ah	10 kVA / 9 kW	20 min	1214x305x702 mm	250 kg
1022486/1023414	9155/9355-10-N-25-64x9Ah	10 kVA / 9 kW	25 min	1214x305x702 mm	275 kg
1022487/1023415	9155/9355-12-N-8-32x9Ah	12 kVA / 10.8 kW	8 min	817x305x702 mm	160 kg
1022488	9155-12-N-15-64x7Ah	12 kVA / 10.8 kW	15 min	1214x305x702 mm	250 kg
1022489/1023416	9155/9355-12-N-20-64x9Ah	12 kVA / 10.8 kW	20 min	1214x305x702 mm	275 kg
1022490/1023417	9155/9355-15-N-5-32x9Ah	15 kVA / 13.5 kW	5 min	817x305x702 mm	160 kg
1022491	9155-15-N-10-64x7Ah	15 kVA / 13.5 kW	10 min	1214x305x702 mm	250 kg
1022492/1023418	9155/9355-15-N-15-64x9Ah	15 kVA / 13.5 kW	15 min	1214x305x702 mm	275 kg

External battery cabinets

Part number	Description	Rating	Back-up (p.f. 0.7)	Dimensions (HxWxD)	Weight
1022561	9X55-BAT5-64x7Ah	2x32x7 Ah	Check technical specifications	817x305x699 mm	195 kg
1022562	9X55-BAT5-96x7Ah	3x32x7 Ah		1214x305x699 mm	310 kg

TECHNICAL SPECIFICATIONS

UPS output power rating (0.9 p.f.)

kVA	20	30	40
kW	18	27	36

General

Efficiency in double-conversion mode (full load)	93%
Efficiency in double conversion mode (half load)	91%
Distributed paralleling with Hot Sync technology	4
Field upgradeable	yes
Inverter/rectifier topology	transformer-free IGBT with PWM
Audible noise	<50 dB
Altitude (max)	1000 m without derating (max 2000 m)

Input

Input wiring	3 ph + N + PE
Nominal voltage rating (configurable)	220/380, 230/400, 240/415 V 50/60 Hz
Input voltage range	Low -20% at 100% load/-50% at 50% load without battery discharge; High +10%/max +20%
Input frequency range	45-65 Hz
Input power factor	0.99
Input ITHD	less than 4.5%
Soft start capability	Yes
Internal backfeed protection	Yes

Output

Output wiring	1 ph or 3 ph + N + PE
Nominal voltage rating (configurable)	220/380, 230/400, 240/415 V 50/60 Hz

Output UTHD	<3% (100% linear load); <5% (reference non- linear load)
Output power factor	0,9 (e.g. 27 kW at 30 kVA)
Permitted load power factor	0,7 lagging - 0,8 leading
Overload on inverter	10 min 100-110%; 1 min 110-125%; 5 sec 125-150%; 300 ms >150%
Overload when bypass available	60 min 100-110%, 10 min 110-125%; 1 min >125-150%

Battery

Type	Maintenance-free VRLA batteries, NiCd
Charging method	ABM technology or Float
Temperature compensation	Optional
Battery nominal voltage (lead-acid)	432 V (36x12 V, 216 cells)
Charging current / Model	Default 3 A *Max 60 A

*May be limited by maximum UPS input current rating

Accessories

	Isolation transformer, long-life batteries, external battery cabinets, X-Slot connectivity (Web/SNMP, ModBus/Jbus, Relay, Hot Sync, ViewUPS-X remote display), Hot Sync parallel tie cabinet, integrated manual bypass, external maintenance bypass switch

Communications

X-Slot	2 communication bays
Serial ports	1 available
Relay inputs/outputs	2/1 programmable

Compliance with standards

Safety (CB certified)	IEC 62040-1, IEC 60950-1
EMC	IEC 62040-2
Performance	IEC 62040-3

Standard UPS with 3-phase input

Part number 9355	Description	Rating	Runtime (p.f 0.7)	Dimensions (HxWxD)	Weight
1025061/1026598	9355/9155-20-N-5-1x9Ah-MBS	20 kVA / 18 kW	5 min	1684x494x762 mm	300 kg
1025062/1026599	9355/9155-20-N-13-2x9Ah-MBS	20 kVA / 18 kW	13 min	1684x494x762 mm	400 kg
1025063/1026600	9355/9155-20-N-22-3x9Ah-MBS	20 kVA / 18 kW	22 min	1684x494x762 mm	500 kg
1025064/1026601	9355/9155-20-N-31-4x9Ah-MBS	20 kVA / 18 kW	31 min	1684x494x762 mm	600 kg
1025065/1026602	9355/9155-30-N-7-2x9Ah-MBS	30 kVA / 27 kW	7 min	1684x494x762 mm	400 kg
1025066/1026603	9355/9155-30-N-13-3x9Ah-MBS	30 kVA / 27 kW	12 min	1684x494x762 mm	500 kg
1025067/1026604	9355/9155-30-N-20-4x9Ah-MBS	30 kVA / 27 kW	20 min	1684x494x762 mm	600 kg
1025795	9355-40-N-8-3x9Ah-MBS	40 kVA / 36 kW	8 min	1684x494x762 mm	517 kg
1025796	9355-40-N-12-4x9Ah-MBS	40 kVA / 36 kW	12 min	1684x494x762 mm	617 kg

External battery cabinets 9155/9355

Part number	Description	Rating	Dimensions (HxWxD)	Weight
1025169	9355-BAT-1x24Ah (30 kVA)	1x36x24 Ah	1684x494x758 mm	510 kg
1025170	9355-BAT-2x24Ah (30 kVA)	2x36x24 Ah	1684x494x758 mm	870 kg

9355 20-40 kVA runtimes

Runtimes for UPS with internal batteries, p.f. 0.7 (typical IT server/computer load)

Battery	Qty	5	10	15	20	25	30	35	40	kVA
7 Ah 12 V	1 x 36	24	8	5	-	-	-	-	-	min
9 Ah 12 V	1 x 36	30	12	7	5	-	-	-	-	min
7 Ah 12 V	2 x 36	60	24	14	10	6	-	-	-	min
9 Ah 12 V	2 x 36	70	28	18	13	10	7	5	-	min
7 Ah 12 V	3 x 36	103	41	26	17	12	10	7	5	min
9 Ah 12 V	3 x 36	115	46	31	22	16	13	10	8	min
7 Ah 12 V	4 x 36	152	55	40	26	18	15	11	9	min
9 Ah 12 V	4 x 36	158	63	42	31	23	20	15	12	min

For assistance with your power quality needs, contact your local Eaton service and sales representatives.

www.eaton.eu

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Powering Business Worldwide

Windows 10 Desktop Operating System

Contents

Introduction

Windows 10 helps you achieve more and transform your business with the most secure Windows ever.

Microsoft Commercial Licensing solutions provide the most flexible and cost-effective way to give your organization access to the latest Windows Desktop technologies. Whether you want to upgrade your PCs to Windows 10, gain access to exclusive offerings such as Windows 10 Enterprise edition and the Microsoft Desktop Optimization Pack, or use Windows with greater flexibility, there's a Commercial Licensing option that's right for your organization.

This document provides an overview of the products available through Commercial Licensing, information about the products that are eligible for upgrades, and the key choices you have for using Windows in your organization.

Content included is for informational purposes only and isn't meant to replace or override other licensing documentation such as the Windows 10 End User License Agreement or [Commercial Licensing Product Terms](#).

Windows 10 Editions and Related Products

Windows 10 Editions

There's an edition of Windows software designed to meet the needs of every organization, from a small, growing business to a multinational enterprise. The following table lists the editions of Windows 10 available through each Microsoft distribution channel.

🛒 Full Packaged Product (Retail)	🖥️ Preinstalled on PC (OEM)	🎖️ Commercial Licensing
Windows 10 Pro Windows 10 Home	Windows 10 Pro Windows 10 Home*	Windows 10 Pro Windows 10 Enterprise Windows 10 Enterprise LTSC Windows 10 Education

*In select emerging markets, a local language-only edition of Windows 10 (Windows 10 Single Language) may be available.

Volume Licensing Reference Guide for Windows 10 Desktop Operating System

Windows Desktop Offerings available through Commercial Licensing

The following offerings are available for purchase through [Microsoft Commercial Licensing](#):

Product	Description
Windows 10 Pro Upgrade	Windows 10 Pro is designed for small and medium businesses and enables organizations to manage their devices and apps, protect their business data, facilitate remote and mobile scenarios, and take advantage of the cloud technologies for their organizations. Windows 10 Pro devices are a good choice for organizations that support CYOD programs and "prosumer" customers. The Windows 10 Pro Upgrade in Commercial Licensing upgrades a device from a previous version of Windows Pro.
Windows 10 Enterprise E3	Windows 10 Enterprise E3 builds on Windows 10 Pro by adding more advanced features designed to address the needs of large and mid-size organizations. Examples include advanced protection against modern security threats, the broadest range of options for operating system deployment and update control, and comprehensive device and app management. Windows 10 Enterprise E3 is available per device or per user and includes Software Assurance in some Commercial Licensing programs.
Windows 10 Enterprise E5	Windows 10 Enterprise E5 is for organizations that want to take advantage of everything in Windows 10 Enterprise E3 with the addition of Windows Defender Advanced Threat Protection (Windows Defender ATP), a new service that helps enterprises detect, investigate, and respond to advanced attacks on their networks. Windows 10 Enterprise E5 is available per device and includes Software Assurance in some Commercial Licensing programs.
Windows 10 Enterprise LTSC	Windows 10 Enterprise LTSC is designed for systems that have strict change management policies with only security and critical bug fixes. By using a Long Term Servicing Channel, you can apply regular Windows 10 security updates for specialized devices while holding back new-feature updates for an extended period of time, up to 10 years.
Windows 10 Education E3	Windows 10 Education E3 offers the benefits of Windows 10 Enterprise to academic institutions, and is designed to address advanced security and comprehensive device control and management needs. Available to staff, administrators, and students through academic Commercial Licensing, it's built to simplify deployment by allowing in-place upgrades from Windows 10 Home or Pro without needing to wipe and reload the operating system.
Windows 10 Education E5	Windows 10 Education E5 includes all of the benefits of Education E3 with the addition of Windows Defender Advanced Threat Protection (Windows Defender ATP), which provides a new layer of post-breach security that enables you to detect, investigate, and respond to advanced attacks on your network. Note that WDATP doesn't come with student use benefits; students must be covered explicitly.
Windows Virtual Desktop Access (VDA) Subscription License	The Windows VDA subscription license provides the right to access virtual Windows desktop environments from devices that aren't covered by a Commercial Licensing offer that includes VDA rights, such as thin clients. Windows VDA is available on a per device or per user basis.

Licensing Microsoft Office 2016

Volume Licensing

MICROSOFT® OFFICE 2016 EDITIONS and CHANNEL AVAILABILITY

		Home and Student	Home and Business	Professional	Standard	Professional Plus	Office 365 Business	Office 365 ProPlus
	Channel Availability				O/OV MPSA	O/OV EA/ESA MPSA	O/OV	O/OV EA/ESA MPSA
Word	Word processing	✓	✓	✓	✓	✓	✓	✓
Excel	Spreadsheets	✓	✓	✓	✓	✓	✓	✓
PowerPoint	Presentation graphics	✓	✓	✓	✓	✓	✓	✓
OneNote	Note-taking program	✓	✓	✓	✓	✓	✓	✓
Outlook	Messaging and collaboration client		✓	✓	✓	✓	✓	✓
Publisher	Desktop publishing (brochures, flyers etc)			✓	✓	✓	✓	✓
Access	Database software			✓		✓		✓
Skype for Business	Communications software					✓		✓
Office Online	Browser based versions of some applications	✓	✓	✓			✓	✓
Commercial Use Rights	The right to use Microsoft Office for business purposes		✓	✓	✓	✓	✓	✓

OEM FPP Volume Licensing Microsoft Online Subscription Program Cloud Solution Provider

O/OV = Open / Open Value
EA/ESA = Enterprise Agreement / Enterprise Subscription Agreement

Perpetual License Per Device
1 PC/Mac install only, which may not be separated for use on more than one computer

Subscription License Per User
- *5 PC/Mac installs*
- *5 Smartphone installs*
- *5 Tablet installs*

ADDING SOFTWARE ASSURANCE

Volume Licensing:
▸ SA can be added to Office Standard or Office Professional Plus
▸ A step-up license can be purchased to move from Standard to Professional Plus editions

FPP and OEM
▸ SA can be added to Office Professional purchased through OEM only
▸ SA must be added within 90 days
▸ Rights are to Office Standard 2016

OFFICE 2016 USAGE RIGHTS BY CHANNEL
for device-licensed products

	OEM	FPP	Volume Licensing
License Reassignment Rights *The right to uninstall software from one device and re-install on a different device*		✓	✓
Downgrade Rights *The right to run an older version (same edition) of Office in place of Office 2016*			✓
Portable Use Rights *Allows the primary user of a device licensed with Office 2016 to install and use Office on a secondary, portable device*			✓
Rights to install with Windows To Go *Allows Office to be installed in a Windows To Go environment*			✓
Rights to install on a server *Allows Office to be installed on a server for delivery through an RDS or VDI infrastructure*			✓
Rights to run Office for Mac Standard 2016 *The option to deploy Office for Mac if required*			✓

FREQUENCY OF OFFICE UPDATES

	Feature Updates	Security Updates
All perpetually-licensed editions (see table above)	With New Version	Monthly, as needed
Office 365 Business and Office 365 ProPlus *(Current Channel)*	✓ Monthly ✓ A Current Channel release is only supported until the next Current Channel release is available ✓ Default for Office 365 Business	Monthly, as needed
Office 365 Business and Office 365 ProPlus *(Deferred Channel)*	✓ Every 4 months ✓ Only two Deferred Channel releases are available and supported at any one time ✓ Default for Office 365 ProPlus	

PRODUCT ACTIVATION

Product activation is required for all of the latest Office suites. Volume Activation allows Volume Licensing customers to automate the activation process with a choice of:

▸ KMS (Key Management Services)
▸ MAK (Multiple Activation Key)

Office 365 Business/ProPlus automatically obtain a product key and are activated by cloud-based services associated with Office 365.

Further Microsoft Licensing handouts and exams: GetLicensingReady.com

Microsoft

Bullet Recovery System

EMT Electronics is manufacturing Bullet Recovery Water Tank Systems, with over 8 years experience in fabrication. Our systems have been installed many facilities of law enforcement agencies in Turkey. We can customize our Bullet Recovery Water Tank Systems to meet any client size or needs.

System recover the commercially/NATO and Former Warsaw Pact Standards loaded handgun and reduced powder rate rifle ammunitions' bullets without deformation or damage on characteristics of rifling marks after powder adjustment of ammunitions.

General Specifications:

Stainless steel construction
Underwater lighting to avoid surface reflection
Water filtration
Air-tight lid and exhaust system
Assisted lifting system
Nonskid shooting platform
Secure drain system to preclude bullet loss
Light colored interior finish to improve visibility
Convenient work surface on shooting platform
Connection to a floor drain
Demountable
Easy- to- use control panel with LCD display
Visual and aural alarm
Adjustable port
Water level indicator
Easy- clean, easy-replaceable parts

All of the metal surfaces ares resistent against corrosion and damp.

Test-Fire Bullet Recovery Water Tank is demountable and all of the joint points are water resist.

Each steel wall exterior sides will be covered with sound isolation material.

Bullet proof inner opposite surface with NIJ Type IIIA protection level.

.If bullet proof material is damaged during the shooting, it will be easily changed.
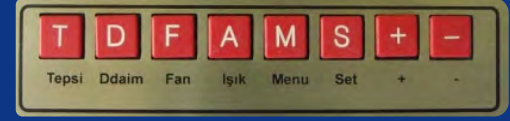
EMT ELECTRONICS

Bullet Recovery System

Adjustable Firing Port:

Firing port has a guide system in case of dangerous vertical and horizontal angle firings.

Firing Port has a blockading mechanism which not allow to fire while the Bullet Recovery Tank Door is open.

ATIS TEHLIKELI
SU DOLUYOR
LUTFEN BEKLEYINIZ
118 Saniye

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Tepsi	Ddaim	Fan	Işık	Menu	Set	+	-

-- ATIS SERBEST --
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DDM × SEV ▯ 16:20:09

Lifting mechanism in order to recover the bullet after the test fire: The lifting mechanism can be operated via mains and also manual.

Advanced LCD info screen and easy set-up :All of system information is indicated in LCD screen.

Menu guided user interface, comfortable and simple to operate.

Advanced ventilation system :

The ventilation system will be able to ventilate the lead,unburned powder and gases to outdoor.

Bullet Recovery Water Tank has a shooting cabin which will cover the firing port in order to protect the shooter against the shooting residues and handgun defects.

Firing port diameter: 120mm
Interior Dimensions:
Width: 90cm
Length: 291cm
Height: 100cm
Weight: below 3000 Kg (water loaded)