

Basic framework of uninterruptible power supply

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When high levels of power quality and dependability are required, UPS is a crucial component of the electrical infrastructure.

An Uninterruptible Power Supply Schematic represents the electrical blueprint of a system designed to provide immediate backup power when the primary power source fails. This ...

This article introduces the working principles of uninterruptible power supply, main types including standby (offline) UPS, line-interactive UPS, online (double-conversion) UPS, ...

Everything you ever wanted to know about uninterruptible power supplies but were afraid to ask. Budgeting for electricity, securing adequate supplies of it and finding ways to use less of it are ...

Figure below shows a simple static UPS schematic. The static uninterruptible power supply (SUPS) basically consists of four major blocks. They are the battery rectifier/charger, battery ...

The article provides an overview of how uninterruptible power supply (UPS) systems work, including their operating modes and key components.

Course Content
OPERATION
Normal Mode Operation
Upset Mode Conditions
Offline
2) Online Protection
UPS or Line Interactive UPS
3) Double conversion (On-line)
MAJOR COMPONENTS
CHARACTERISTICS
Rectifier
Inverter
Ferroresonant
Disadvantages
Transfer Switch
Design and Operation
Batteries
Battery Charger
STATIC UPS SYSTEM RATING & SIZE SELECTION
Determining load kVA and Power Factor
Determining load inrush kVA
TESTING
Battery supported Motor Generator (M-G) set
Rotary systems with a transfer switch to a bypass source
Paralleling of redundant rotary systems
MOTOR
Synchronous motors
DC motors
GENERATOR
SDC

generatorsExcitersAdvantages and disadvantages of rotary UPS systemsRotary DisadvantagesSELECTING AN UPSDetermine needDetermine the purpose Determine the power requirementsSelect the Type of UPSDetermine maintainabilityDetermine if affordableAn UPS system is an alternate or backup source of standby power with the electric utility company being the primary source. The UPS provides protection of load against line frequency variations, elimination of power line noise and voltage transients, voltage regulation, and uninterruptible power for critical loads during failures of normal utility ...See more on

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pdhonline Missing: frameworkMust include: frameworkol#b_results li.b_ad,ol#b_topw.b_results_eml
li.b_ad,ol#b_topw li.b_ad{background-color:transparent;border-right:0;border-bottom:1px solid
#ebebeb;margin-bottom:1px;padding-right:20px;padding-bottom:5px}ol#b_results
li.b_adBottom,ol#b_topw.b_results_eml li.b_adBottom{border-top:1px solid
#ebebeb;border-bottom:0;padding-bottom:0}ol#b_context li.b_ad,ol#b_rrat_cont
li.b_ad{background-color:transparent}.sb_add cite{text-transform:lowercase}#b_results .b_ad .sb_adTA
.b_caption,#b_topw.b_results_eml .b_ad .sb_adTA .b_caption,#b_results .b_ad .sb_adTA .b_vlist2col
li,#b_topw.b_results_eml .b_ad .sb_adTA .b_vlist2col li,#b_results .b_ad .sb_adTA
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.sb_adTA .b_factrow,#b_topw .b_ad .sb_adTA .b_bcfactrow,#b_topw .b_ad
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h2:hover{cursor:pointer}.b_ad
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.b_dark #b_results>li.b_ad{background-color:inherit} .b_dark
#b_topw.b_results_eml>li.b_ad{background-color:inherit}.pa_item .pa_img.white_bg,.pa_hover
.pa_hover_img.white_bg{background-color:#f5f5f5}@media(forced-colors:none){.pa_item .pa_img.white_bg
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.pa_carousel_mlo .see_more .carousel_seemore
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.pa_carousel_mlo .see_more .carousel_seemore
a.b_moreLink::before{content:"";position:absolute;width:48px;height:48px;top:var(--smtc-gap-between-content-medium);left:50%;-webkit-transform:translate(-50%,0);-moz-transform:translate(-50%,0);-ms-transform:translate(-50%,0);-o-transform:translate(-50%,0);transform:translate(-50%,0);background-color:var(--bing-smtc-background-card-on-primary-alt-pressed);border-radius:10px;opacity:0;-webkit-transition:opacity .1s ease;-moz-transition:opacity .1s ease;-ms-transition:opacity .1s ease;-o-transition:opacity .1s ease;transition:opacity .1s ease}#b_content .pa_carousel_mlo .see_more .carousel_seemore
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a.b_moreLink:focus::before,#b_content .pa_carousel_mlo .see_more .carousel_seemore
a.b_moreLink:active::before{opacity:1}#b_content .pa_carousel_mlo .see_more .carousel_seemore
a.b_moreLink::after{content:"";position:absolute;width:13px;height:13px;bottom:var(--smtc-padding-content-xx-large);left:50%;border-style:solid;border-width:3px 3px 0 0;border-color:var(--bing-smtc-foreground-content-brand-rest);-webkit-transform:translate(-75%,-50%) rotate(45deg);-moz-transform:translate(-75%,-50%) rotate(45deg);-ms-transform:translate(-75%,-50%) rotate(45deg);-o-transform:translate(-75%,-50%) rotate(45deg);transform:translate(-75%,-50%) rotate(45deg);border-radius:2px}#b_content .pa_carousel_mlo .see_more .carousel_seemore a.b_moreLink
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.btn{z-index:8}
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.b_adBottom .pa_carousel_mlo{margin:var(--mai-smtc-padding-card-default) 0 0 0!important}
.narrpole .pa_carousel_ml{padding-right:20px}
.pa_carousel_mlo.expanded .pa_carousel_ml{padding-right:var(--smtc-gap-between-content-xx-large)}
.pa_carousel_ml .slide{border-collapse:separate}
.pa_carousel_ml .slide.anim{visibility:hidden;animation:slideInFromLeft .05s cubic-bezier(.3,.5,.1,1) .3s 1 normal forwards}@-webkit-keyframes slideInFromLeft{0%{visibility:visible;transform:translateX(100%)}100%{visibility:visible;transform:translateX(0)}}@keyframes slideInFromLeft{0%{visibility:visible;transform:translateX(100%)}100%{visibility:visible;transform:translateX(0)}}
.pa_carousel_ml .slide:focus-visible{text-decoration:underline}
.li .pa_mlo{padding-bottom:0}
#b_content ol#b_results li.b_ad,#b_content ol#b_topw.b_results_eml li.b_ad{border-bottom:0}
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.b_adPATitle
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top-foreground-ad-slug-default);border-radius:var(--bing-ads-smtc-ad-slug-corner)}.sb_adTA
.b_adSlug{font:var(--bing-smtc-text-global-caption2);line-height:var(--bing-ads-smtc-ad-slug-line-height);bor
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```

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t);opacity:unset}#b_content .pa_carousel_mlo .pa_item.pa_vCard .pa_caption .b_secondaryText,#b_content
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.pa_caption
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l-secondary-alt)}#b_content .pa_carousel_mlo .pa_item.pa_vCard .pa_caption .b_secondaryText
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0;transform:rotate(45deg);border-radius:0;top:var(--smtc-padding-ctrl-text-top);left:var(--smtc-padding-ctrl-s
m-text-top);position:relative;box-shadow:none;margin:0}#b_content .pa_carousel_mlo .b_overlay .btn
.cr>div::after{content:"";display:none}#b_content .pa_carousel_mlo .b_overlay
.btn.next{margin-right:6px}#b_content .pa_carousel_mlo .b_slideexp
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.b_slidesContainer{width:100%}html[dir="rtl"] #b_content .pa_carousel_mlo .b_overlay .btn
.cr>div{transform:rotate(135deg);left:calc(-1*var(--smtc-padding-ctrl-sm-text-top))}html[dir="rtl"]
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.pa_carousel_mlo{margin-right:0}.pa_item.pa_vCard{word-wrap:break-word;line-height:20px;overflow:hidd
en}.pa_item.pa_vCard p strong,.pa_item.pa_vCard .pa_price strong{color:#111}.pa_item.pa_vCard
```

```
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p,#b_rrat_cont .pa_item.pa_vCard p{line-height:20px}#b_content .pa_item.pa_vCard
.pa_title{line-height:20px;overflow:hidden}.pa_item.pa_vCard
.b_footnote{line-height:17px;padding-bottom:0}.pa_item.pa_vCard
.pa_caption{padding-bottom:8px}.pa_item.pa_vCard .pa_caption,.pa_item.pa_vCard
.pa_title{padding-left:4px;padding-right:4px}.pa_item.pa_vCard
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4px;bottom:8px}.pa_item.pa_vCard
.cico{display:block;padding-bottom:0;margin-bottom:8px;margin-left:auto;margin-right:auto;border-radius:0}
.pa_item.pa_vCard .pa_img{position:relative}.pa_item.pa_vCard .pa_price:hover,.pa_item.pa_vCard
.b_attribution:hover,.pa_item.pa_vCard .b_footnote:hover{cursor:pointer}.pa_carousel .slide{box-shadow:0 0
0 1px rgba(0,0,0,.1)!important}.pa_carousel .slide.see_more{box-shadow:0 0 0 0
rgba(0,0,0,0)!important}.pa_caption .pa_price:hover strong,.pa_hover .pa_hover_content .pa_price:hover
strong{text-decoration:underline;text-decoration-color:#111}.pa_caption .b_attribution:hover,.pa_hover
.pa_hover_content
.b_attribution:hover{text-decoration:underline}.pa_caption>.b_secondaryText:hover,.pa_hover
.pa_hover_content>.b_secondaryText:hover{color:#444}.b_ads1line{white-space:nowrap;overflow:hidden;te
xt-overflow:ellipsis;display:block}.pa_item .b_attribution cite,#b_context .pa_item .b_attribution
cite,.pa_hover .b_attribution cite,.pa_item .b_footnote .pa_url cite,#b_rrat_cont .pa_item .b_attribution
cite{color:#111;opacity:.8}#bpage.b_drk .pa_item .b_footnote .pa_url
cite{color:#d2d0ce}.pa_item.pa_vCard{cursor:pointer}@supports(-webkit-line-clamp:2){.b_adsTrunTx{displ
ay:-webkit-box;overflow:hidden;-webkit-box-orient:vertical;white-space:normal;visibility:visible}.b_ellipsis{
display:none}.b_adsTrunTx
.b_hiddenTx{display:inline}}.b_hiddenTx{display:none}.pa_item.pa_vCard,.pa_item.pa_hCard{position:relat
ive}.pa_hover{z-index:4}.pa_carousel .b_overlay .btn{z-index:5!important}.pa_item.pa_vCard
.pa_newtab_icon{display:none}.pa_item.pa_vCard .pa_newtab_icon,.pa_item.pa_hCard:hover
.pa_newtab_icon,.pa_hover
.pa_newtab_icon{position:absolute;background-color:rgba(0,0,0,.35);background-size:10px
10px;background-position:4px
4px;background-repeat:no-repeat;border-radius:var(--smtc-corner-circular);height:18px;width:18px;z-index:1
}.pa_item.pa_vCard .pa_newtab_icon,.pa_hover
.pa_newtab_icon{right:4px;top:4px}.pa_item.pa_hCard:hover
.pa_newtab_icon{left:110px;top:8px}.pa_item.pa_vCard .pa_newtab_icon,.pa_item.pa_hCard:hover
.pa_newtab_icon,.pa_hover
.pa_newtab_icon{background-image:url(
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SUE2utkAAAAEIFTkSuQmCC)}.pa_rating{white-space:nowrap;text-overflow:ellipsis;min-height:17px}#b
_results .pa_item .pa_ratingssmaller>span,#b_topw.b_results_eml .pa_item
.pa_ratingssmaller>span{transform:translateZ(0)}#b_results .pa_item .pa_ratingssmaller .sw_st,#b_results
.pa_item .pa_ratingssmaller .sw_sth,#b_results .pa_item .pa_ratingssmaller .sw_ste,#b_topw.b_results_eml
.pa_item .pa_ratingssmaller .sw_st,#b_topw.b_results_eml .pa_item .pa_ratingssmaller
.sw_sth,#b_topw.b_results_eml .pa_item .pa_ratingssmaller .sw_ste{transform:scale(calc(10/12));margin:-1px
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.b_secondaryText .b_colorBlend,#b_results>.b_ad .b_colorBlend,#b_topw.b_results_eml>.b_ad
.b_colorBlend,#b_results>.b_ad .b_accentColor,#b_context>.b_ad .b_accentColor,#b_rrat_cont>.b_ad
.b_accentColor,#b_topw.b_results_eml>.b_ad .b_accentColor,#b_context>.b_ad
.b_colorBlend,#b_rrat_cont>.b_ad .b_colorBlend,#b_dynRail>.b_ad .b_colorBlend,.pa_hover
.b_secondaryText .b_colorBlend,#b_pole .pa_carousel .b_secondaryText
.b_colorBlend{color:var(--bing-ads-smtc-desktop-foreground-snippet-default)}.b_ad .csrc,.pa_item
.csrc{padding-right:0}.csrc .sw_rtc_color{color:#d32f2f;font-weight:bold;font-family:"Segoe
UI",Arial,Helvetica,Sans-Serif}.b_dark .csrc .sw_rtc_color{color:#f66}.csrc .sw_rtright{padding-left:5px}.csrc
.sw_rtleft{padding-right:5px}.csrc .nobg{background-image:none}.csrc
.rms_st{padding-right:1px;vertical-align:inherit;max-height:14px;max-width:14px}.b_secondaryText
.pa_targ{line-height:20px}.pa_ml .pa_targ img.pa_targImage,.pa_sb .pa_targ
img.pa_targImage{float:left;margin:2px 2px 0 0}.pa_targ .pa_tgt_icon{display:inline-block;margin:3px 2px 0
0;width:12px;height:12px}.pa_targ
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Q1AAAAEIFTkSuQmCC")}.b_dark .pa_targ
.pa_shipping_icon{background-image:url("
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lEX+M+aq4jzP1TBB2BknJdYNvu+f6IuiKwaKAlOSyljW0kCxW+4yGrpebXlgLfYdV3Ht9CO46Se5+kZG/
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')}.b_dark .pa_targ
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.pa_condition_icon{background-image:url("
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zcz6QLUK/gcay2Kj1EE/gwAAAABJRu5ErkJggg==")}.b_dark .pa_targ
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EVRZU8nZKbvtHJ0R4/ZTRNEMC011oovCux/EdBOneMAAAAASUVORK5CYII=")}.pa_targ
.rms_img,.pa_targ_text{vertical-align:top}.pa_hov_border
.pa_targ_longtext{font-size:12px;line-height:14px}.pa_hover{background-color:var(--smtc-background-web-
page-primary);box-shadow:none;position:absolute;opacity:0;visibility:hidden;word-wrap:break-word;cursor:p
ointer;overflow:hidden;z-index:4;pointer-events:none}.pa_hover
.pa_hover_content{padding-bottom:var(--smtc-gap-between-content-x-small)}.pa_hover
.pa_hover_title,.pa_hover .pa_price,.pa_hover .b_attribution,.pa_hover .b_secondaryText,.pa_hover
.pa_additionTx,.pa_hover>div>.b_ads1line,.pa_hover .b_footnote,.pa_hover
.pa_hover_content>.pa_locInv{padding-left:var(--smtc-padding-ctrl-horizontal-default);padding-right:var(--s
mtc-padding-ctrl-horizontal-default)}.pa_hover .pa_hover_img{position:relative}.pa_hover .pa_hover_img
img{display:block;margin-left:auto;margin-right:auto}.pa_hover
.pa_hover_title{font:var(--bing-smtc-text-global-body3)!important;color:var(--smtc-ctrl-link-foreground-bran
d-rest);margin-bottom:var(--smtc-gap-between-content-x-small)}.pa_hover
.pa_hover_title:hover{text-decoration:underline}.pa_hover
.pa_price{margin-bottom:var(--smtc-gap-between-content-xx-small)}.pa_hover .pa_price
.prc_clr_grn{color:var(--smtc-status-success-tint-foreground)}.pa_hover .pa_price
strong{color:var(--smtc-foreground-content-neutral-primary);font:var(--bing-smtc-text-global-caption1-strong
)}.pa_hover .pa_price
.original_price{font:var(--bing-smtc-text-global-caption1);padding-left:var(--smtc-gap-between-content-x-sma
ll)}.pa_hover .pa_installmentDesc,.pa_hover .pa_unitprice,.pa_hover .vertical_converted_price,.pa_hover
.pa_shippingcost{font:var(--bing-smtc-text-global-caption1);margin-bottom:var(--smtc-gap-between-content-
xx-small);color:var(--bing-smtc-foreground-content-neutral-secondary-alt);padding-bottom:0}.pa_hover
.b_attribution{margin-bottom:var(--smtc-gap-between-content-xx-small);color:var(--bing-smtc-foreground-co
ntent-neutral-secondary-alt);border-bottom:0;font:var(--bing-smtc-text-global-caption1)}.pa_hover
.b_attribution
cite{font:var(--bing-smtc-text-global-caption1);color:var(--bing-smtc-foreground-content-neutral-secondary-al
t);opacity:unset}.pa_hover .pa_bcSeparator{margin:var(--smtc-gap-between-content-xx-small)
0;border-top:1px solid #ecec}.pa_hover
.b_secondaryText{font:var(--bing-smtc-text-global-caption1);color:var(--bing-smtc-foreground-content-neutra
l-secondary-alt)}.pa_hover .b_secondaryText
.pa_rebateText{font:var(--bing-smtc-text-global-caption1);color:var(--bing-smtc-foreground-content-neutral-s
econdary-alt)}.pa_hover .b_secondaryText .pa_promo
a{color:var(--smtc-ctrl-link-foreground-brand-rest)}.pa_hover .b_secondaryText .pa_rating
a{color:var(--bing-smtc-foreground-content-neutral-secondary-alt)}.pa_hover .b_secondaryText
.b_colorBlend{color:var(--bing-smtc-foreground-content-neutral-secondary-alt)!important}.pa_hover
.pa_additionTx,.pa_hover
.pa_locInv{font:var(--bing-smtc-text-global-caption1);color:var(--bing-smtc-foreground-content-neutral-secon
dary-alt)}a.pa_hover_adLink:hover{text-decoration:none}.pa_hover:has(.pa_hover_content.pa_hcgp){border-
radius:var(--smtc-corner-card-rest)}.pa_hover.ad_scpah.pa_animation{background-color:var(--smtc-backgrou
```

```
nd-card-on-primary-default-hover);box-shadow:var(--acf-elevation-3);pointer-events:auto}.pa_item.pa_vCard
>a: hover{ text-decoration:none}.pa_hover: not(:has(.b_pa_hov_indicator_c)).pa_hover_img
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ht var(--acf-animation-duration-default) var(--acf-animation-ease-default),background-color
var(--acf-animation-duration-default) var(--acf-animation-ease-default),box-shadow
var(--acf-animation-duration-default) var(--acf-animation-ease-default)}.b_slideexp
.b_hoverFading{ background:linear-gradient(90deg,rgba(255,255,255,.4) 0%,#fff
80%);position:absolute;top:0;right:-40px;width:40px;height:100%}.b_dark
.b_hoverFading{ background:linear-gradient(90deg,rgba(27,26,25,.4) 0%,#fff
80%)}.b_slideexp.hoverFading: hover .b_overlay>div:nth-child(3){ width:calc(100%
+ 40px)}#slideexp1_F921D1 .slide { width: 140px; margin-right: 16px; }#slideexp1_F921D1c .b_slidebar .slide
{ border-radius: 6px; }#slideexp1_F921D1 .slide:last-child { margin-right: 1px; }#slideexp1_F921D1c {
margin: -4px; } #slideexp1_F921D1c .b_viewport { padding: 4px 1px 4px 1px; margin: 0 3px; }
#slideexp1_F921D1c .b_slidebar .slide { box-shadow: 0 0 0 1px rgba(0, 0, 0, 0.05); -webkit-box-shadow: 0 0
0 1px rgba(0, 0, 0, 0.05); } #slideexp1_F921D1c .b_slidebar .slide.see_more { box-shadow: 0 0 0 0px rgba(0,
0, 0, 0.00); -webkit-box-shadow: 0 0 0 0px rgba(0, 0, 0, 0.00); } #slideexp1_F921D1c .b_slidebar
.slide.see_more .carousel_seemore { border: 0px; }#slideexp1_F921D1c .b_slidebar .slide.see_more: hover {
box-shadow: 0 0 0 0px rgba(0, 0, 0, 0.00); -webkit-box-shadow: 0 0 0 0px rgba(0, 0, 0, 0.00); }Sponsored
```

This uninterruptible power supply book provides a comprehensive overview of UPS systems, encompassing their fundamental principles, diverse architectures, advanced control strategies, ...

Its aim is to introduce core sector themes, technologies and product considerations around Uninterruptible Power Supply (UPS).

Uninterruptible Power Supply (UPS) Basic: Power-Delivery Methods, Capacity Ranges, and How to Select the Right System. UPS ...

This article introduces the working principles of uninterruptible power supply, main types including standby (offline) UPS, line-interactive ...

Uninterruptible Power Supply (UPS) Basic: Power-Delivery Methods, Capacity Ranges, and How to Select the Right System. UPS systems are widely used in offices, server ...

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