

Felipe Guimaraes Cortes

De: Bárbara Mundim <adm@copersonaudiovideo.com.br>
Enviado em: terça-feira, 16 de janeiro de 2024 15:25
Para: Felipe Guimaraes Cortes
Cc: copersonaudio@gmail.com
Assunto: Re: Manifestação sobre o recurso da empresa SEAL - Pregão Eletrônico 90004-2024
Anexos: INDICAÇÃO QUE A PLACA RTX 3070 É COMPATIVEL COM DELL XPS 8960XPS 8960 Setup and Specifications _ Dell Brasil.pdf; Anatel - Consulta de Produtos CERTIFICADO SWITCHER.pdf; CARTA 02 - SENADO 90004-2024 - CONTRARRAZÃO.pdf; NVIDIA GeForce RTX 3070 Specs _ TechPowerUp GPU Database.pdf; Adapter_User_Guide.pdf; Workstation em torre Precision 3660_workstations _ Dell Brasil.pdf; Torre Precision 3660 Instalação e especificações - ss-3660.pdf; PROPOSTA 001-2023 - SENADO 90004-2024 - REAJUSTADA.pdf

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Boa tarde Felipe,

Segue tempestivamente, contra razão e proposta reajustada.

Favor confirmar o recebimento.

Em seg., 15 de jan. de 2024 às 12:02, Felipe Guimaraes Cortes <felipec@senado.leg.br> escreveu:

Prezada Licitante, bom dia!

Informo que a empresa SEAL TELECOM COMÉRCIO E SERVIÇOS DE TELECOMUNICAÇÕES LTDA apresentou, intempestivamente, por mensagem eletrônica, recurso em face da declaração dessa empresa como vencedora do Pregão Eletrônico nº 90004/2024 (vide anexo).

Apesar da intempestividade do recurso, em razão do princípio da autotutela, formalmente previsto no art. 53 da Lei nº 9.784/1999, as razões foram examinadas pelos órgãos técnicos (ILB e SEC/SECOM), que se manifestaram pelo provimento parcial do recurso (vide mensagem anexa).

Porém, como se tratam de erros na proposta, especificamente quanto aos produtos ofertados para alguns dos itens, com base nos art. 12, III, e art. 59, I e V, da Lei nº 14.133/2021, bem como nos itens 10.2.2, 13.2.1 e 18.4 do edital, oportunizo a essa empresa a apresentação de nova proposta, contendo a alteração das marcas/modelos dos produtos mencionados na manifestação da área técnica.

Fixo o mesmo prazo previsto na lei e no edital para a apresentação de contrarrazões de recurso: 3 (três) dias úteis, ou seja, até 18/01/2024.

Obrigado,

Atenciosamente,

Felipe Guimarães Côrtes

Agente de Contratação

Coordenação de Processamento Externo de Licitações

Senado Federal | Sadcon | Copeli

Av. N2 | Bloco 16 | 1º pavimento | CEP 70165-900 | Brasília/DF
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De: Guilherme Costa Guimarães Fernandes <guilherme.fernandes@senado.leg.br>

Enviada em: sexta-feira, 12 de janeiro de 2024 16:37

Para: Felipe Guimaraes Cortes <felipec@senado.leg.br>

Cc: Marcus Vinicius de Miranda Castro <MVCASTRO@senado.leg.br>; Yves Maia Salvatori <yvesmaia@senado.leg.br>

Assunto: Manifestação sobre o recurso da empresa SEAL - Pregão Eletrônico 90004-2024

Prezado Felipe,

Segue a manifestação do órgão técnico a respeito do recurso apresentado pela empresa SEAL. Estamos à disposição para discutir o teor e as conclusões do nosso documento com você antes de oficializá-lo dentro do processo.

1. Esta manifestação do órgão técnico (SECOM/SEC/COENGTVR) abrange os parágrafos de 6 a 24 do recurso interposto pela recorrente SEAL Telecom, presentes na Seção II – Do Mérito. Sem prejuízo à impessoalidade do processo, serão utilizados ao longo deste texto os nomes das empresas envolvidas – SEAL e COPERSON – para melhor compreensão do conteúdo.
2. **Quanto aos parágrafos 7, 11 e 12 do recurso**, tem-se que, de acordo com o item 35.8.1 do edital, são exigidas duas interfaces de rede, integradas. O item 35.8.2 rejeita dispositivos do tipo USB, PCMCIA, EXPRESS CARD ou similares.

3. A COENGTVR esclarece que o termo “integrada” no item 35.8.1 refere-se a portas de rede que estejam fixas no chassi no computador, eliminando a possibilidade de se fornecer um adaptador externo. Já a utilização do termo “similares” no item 35.8.2 tem como justificativa técnica vedar a utilização destes adaptadores externos supracitados, exemplificados pelos padrões USB, PCMCIA e EXPRESS CARD. Este termo não impede o aceite de dispositivos baseados no barramento PCI EXPRESS (PCIe) para a segunda interface, que é instalado na placa-mãe do computador e é mais resiliente a falhas de conexão como as que podem ocorrer com o uso de adaptadores externos.
4. Desta forma, a COENGTVR esclarece que soluções que ofereçam a segunda interface de rede utilizando adequadamente os barramentos PCIe podem ser aceitas.
5. **Quanto aos itens 6, 8, 9 e 10**, a COENGTVR repetiu a consulta ao produto XPS 8950 no site da fabricante DELL (<https://www.dell.com/pt-br/search/xps%208950>) e verificou evidências de que os resultados mostrados para tal pesquisa, na verdade, são inadvertidamente redirecionados para o modelo XPS 8960, conforme o código do produto.
6. Juntamente ao e-mail enviado pela recorrente SEAL com a representante de vendas da DELL, a COENGTVR reconhece que o modelo 8950 saiu de linha, embora esteja indicado como referência no edital.
7. A COENGTVR entende que a retificação deste item por parte da COPERSON não prejudica substancialmente a proposta, mas entende que cabe à COPEL a decisão final de desclassificá-la ou permitir a retificação.
8. **Quanto aos itens de 13 a 20**, referentes à interface de rede PCIe oferecida na proposta da COPERSON, após verificação da referência com especificações do fabricante (<https://www.intel.com.br/content/www/br/pt/products/sku/58954/intel-ethernet-converged-network-adapter-x540t2/specifications.html>), a COENGTVR acolhe a argumentação de que o modelo oferecido está descontinuado e não pode ser aceito.
9. Acerca da compatibilidade da placa oferecida com o computador, a COENGTVR acolhe a argumentação apresentada pela SEAL de que não haveria barramentos PCIe disponíveis no computador para se instalar o modelo de placa de rede oferecido, considerando-se outras placas a serem instalado no computador.
10. **Quanto aos itens de 21 a 24**, a COENGTVR pesquisou a base de todos os equipamentos homologados pela Anatel (na página <https://informacoes.anatel.gov.br/paineis/certificacao-de-produtos>) e, de fato, não encontrou o modelo do switch oferecido entre os produtos homologados da fabricante Netgear. Desta forma, não é possível que ele seja fornecido neste certame.

11. Ressalta-se que os modelos de referência foram indicados com base no Art. 41, I, d da Lei 14.133 a fim de melhorar a compreensão da descrição do objeto desejado. O fato de o modelo de switch oferecido pela COPERSON estar listado dentre os modelos de referência atesta suas especificações técnicas, mas não se sobrepõe à necessidade de homologação pela Anatel.

12. **Em síntese**, em face dos argumentos apresentados pela recorrente, a COENGTVR entende que:

12.1. A segunda interface de rede baseada em placa PCIe satisfaz o que se entende como “integrada”.

12.2. Dadas as novas informações apresentadas, o computador Dell XPS 8950 oferecido na proposta não pode ser aceito por estar fora de linha.

12.3. Dadas as novas informações apresentadas, a placa de rede oferecida não pode ser aceita por estar fora de linha e apresentar potencial incompatibilidade com o computador.

12.4. Dadas as novas informações apresentadas, o switch oferecido não pode ser aceito por não ser homologado pela Anatel.

12.5. Do ponto de vista técnico, a apresentação de novos modelos pela recorrida não significaria que haveria alteração substancial da solução. Entretanto, entende que cabe à COPEL a decisão de desclassificar a proposta ou permitir que a COPERSON a retifique.

Atenciosamente,

Guilherme Costa Guimarães Fernandes

Analista Legislativo – Engenharia Eletrônica e Telecomunicações

Senado Federal – SECOM – SEC – COENGTVR (Coordenação de Engenharia de TV e Rádio)

Anexo II, Térreo

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Bárbara Mundim

Diretora Administrativa

Administrativo | Coperson Áudio e
Vídeo



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Ilmo. Sr.
Pregoeiro do Pregão Eletrônico nº 90004/2024
SENADO FEDERAL
Via N2, Senado Federal, Bloco 16, 1º Pavimento, COPEL.
Brasília/DF, CEP: 70.165-900

Ref.: Pregão Eletrônico nº 90004/2024 - Contrarrazão Coperson

COPERSON SERVIÇOS E COMERCIO DE PRODUTOS DE INFORMATICA E SEGURANÇA LTDA ("Coperson"), pessoa jurídica de direito privado inscrita no CNPJ nº 07.648.642/0001-40, estabelecida no SHCS CR 516, BLOCO B, N° 69, PAVIMENTO 1, PARTE C0236, CEP: 70.381-525 – ASA SUL, BRASÍLIA-DF, telefone/fax (61) 3346-6638, por sua representante legal, Sra. Bárbara Maia Mundim, RG nº 2.742.427 - SSP/DF e CPF nº 033.723.221-00, vem tempestivamente, nos termos do Edital do Pregão Eletrônico nº 90004/2024 ("Pregão"), apresentar

CONTRARRAZÃO

ao recurso interposto, **intempestivamente**, pela licitante SEAL TELECOM COMÉRCIO E SERVIÇOS DE TELECOMUNICAÇÕES LTDA. ("SEAL") nos termos a seguir expostos.

I. Dos Fatos

1. A COPERSON foi, adequadamente, declarada vencedora do Pregão em epígrafe, por ofertar proposta onde os equipamentos ofertados estão de acordo com as especificações técnicas do Edital, conforme declarado em chat pelo i. Sr. Pregoeiro.
2. A Seal, interpôs recurso, **intempestivamente**, meramente protelatório, alegando, em síntese, que a Coperson não teria apresentado proposta de acordo com as exigências do Edital, requerendo, ao final, a desclassificação da Coperson.



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3. O recurso não merece prosperar, eis que a decisão recorrida não merece reparos, sendo certo que a proposta da Coperson atende integralmente ao Edital e TDR, conforme já declarado por este r. Órgão, além do recurso ter sido apresentado intempestivamente não podendo ser aceito por esta Administração.
4. Senão vejamos.

II. Do Mérito.

II.1 – Da Proposta da Coperson – Atendimento ao TRD

5. Em sua proposta, documento totalmente vinculativo, a Coperson tem a seguinte declaração:

“FORNECEREMOS PARA TODOS OS ITENS TODOS OS EQUIPAMENTOS, MATERIAIS (CABOS, FONTES, CONVERSORES, SUPORTES, CONECTORES, ADAPTADORES, ACESSÓRIOS ETC.), SERVIÇOS, SOFTWARES E HARDWARES NECESSÁRIOS, SEM CUSTO ADICIONAL, E QUE SEJAM NECESSÁRIOS PARA O PERFEITO FUNCIONAMENTO DA SOLUÇÃO CONFORME EXIGIDO EM EDITAL E SEUS ANEXOS, MESMO QUE NÃO DISCRIMINADOS NO TERMO DE REFERÊNCIA E/OU EM NOSSA PROPOSTA;”

6. E em todos os itens também é informado o seguinte:

“+ ACESSÓRIO, LICENÇAS, SOFTWARES E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO”

7. Além disso o item 10.2.2, 13.2.1 e 18.4 do edital prevê o seguinte:

10.2.2 - Havendo falhas na proposta, o Pregoeiro deverá empreender diligências para a sua correção e/ou saneamento, de modo que a desclassificação da proposta somente será cabível se os vícios porventura existentes forem insanáveis, observando-se, para tanto, o disposto no inciso III do art. 12 da Lei nº 14.133/2021.

13.2.1 – Na análise do recurso, a Administração poderá promover diligências destinadas a esclarecer ou complementar a instrução do processo, constituindo meio legal de prova os documentos obtidos.

18.4 – É facultado ao Pregoeiro, em qualquer fase do pregão, promover diligências destinadas a esclarecer ou complementar a instrução do processo desta licitação, constituindo meio legal de prova os documentos obtidos.



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8. E ainda, na Lei 14.133/2021 art. 12, III, e art. 59, I e V:

Art. 12. No processo licitatório, observar-se-á o seguinte:

(...)

III - o desatendimento de exigências meramente formais que não comprometam a aferição da qualificação do licitante ou a compreensão do conteúdo de sua proposta não importará seu afastamento da licitação ou a invalidação do processo;

Art. 59. Serão desclassificadas as propostas que:

I - contiverem vícios insanáveis;

(...)

V - apresentarem desconformidade com quaisquer outras exigências do edital, desde que insanável.

9. Com base nos itens acima passaremos aos fatos do porquê a proposta da Coperson atende plenamente ao edital e entrega uma solução completa e compatível com o exigido em edital, necessitando apenas de uma Correção de Mero Erro Material, e é mais vantajosa para a Administração.

a) Item 35 – Estação de Trabalho

10. Quanto ao equipamento XPS8950, informamos que houve erro meramente material e entendemos, com corroboração da equipe técnica que a retificação deste item por parte da COPERSON não prejudica substancialmente a proposta.

11. Logo, informamos que iremos fornecer o item abaixo:

- Torre Precision 3660 da Dell + Placa gráfica Intel UHD 770 aderência conforme pagina 20 na tabela 16, gpu integrada + Placa de vídeo NVIDIA GeForce RTX 3070 aderência conforme pagina 20 tabela 18 gpu dedicada como consta do catalogo anexado + Processador 13ª geração Intel® Core™ i7-13700 (16-cores, 24 threads, cache de 30 MB, 2.10 GHz a 5.20 GHz Turbo, 65 W) + Windows 11 Pro, português (Brasil) + Memória-16GB DDR5 ECC (1x16G) 4400 MT/s + ARMAZENAMENTO-SSD M.2 512GB PCIe NVME™ Classe 40 + Disco rígido SATA de 3.5", 1TB e 7200rpm + Resfriamento Térmico Cooler de Ar de CPU Avançado + Teclado multimídia Dell KB216, preto, em Português (Brasil), ABNT2



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+ Mouse óptico Dell - MS116 (preto) + CHASSIS Precision 3660 Tower with 500W (80 Plus Platinum) PSU, RPL and ADL Compatible + Placa de rede Intel I225 (compatível, conforme tabela 9 na página 16 do catálogo do modelo Torre Precision 3660) + qualificado ENERGY STAR;

12. E informamos que com essa alteração, existem espaços suficientes para instalação das placas necessárias ao funcionamento da estação de trabalho conforme exige a solução.

b) Item 34 – Switch

13. Quanto ao equipamento M4250-26G4F-POE+, da fabricante NETGEAR, informamos que houve erro meramente material e entendemos, com corroboração da equipe técnica que a retificação deste item por parte da COPERSON não prejudica substancialmente a proposta.

14. Logo, informamos que iremos fornecer o item abaixo:

- Modelo DGS-3130-30PS, da marca D-LINK devidamente homologado pela Anatel sob o número 048811801931 e certificação de conformidade técnica número NCC15985/18;

15. Conforme já declarado em nossa proposta e em diligência, reiteramos que, conforme informado em nossa proposta para todos os itens, serão fornecidos todos os ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO CONFORME EXIGIDO EM EDITAL E SEUS ANEXOS, MESMO QUE NÃO DISCRIMINADOS NO TERMO DE REFERÊNCIA E/OU EM NOSSA PROPOSTA.

16. Corroborando com nosso entendimento e do edital, o TCU tem inúmeras decisões a favor de correções de erro meramente material e que mantém a vantajosidade para a Administração, uma vez que o mero erro no preenchimento da planilha/proposta de preços não pode causar a desclassificação das licitantes, sob pena de se revelar rigor excessivo, atentatório contra o princípio da vantajosidade e demais, como proporcionalidade, razoabilidade, competitividade, etc., conforme anotam os julgados do TCU, a seguir transcritos:



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"A desclassificação de licitantes por conta de erro material na apresentação da proposta, fere os princípios da competitividade, proporcionalidade e razoabilidade, sendo medida de extremos rigor, que pode afastar do certame propostas mais vantajosas, com ofensa ao interesse público". (Acórdão nº 1734/2009 – Plenário)

"A mera existência de erro material ou de omissão na planilha de custos e de formação de preços da licitante não enseja, necessariamente, a desclassificação antecipada da sua proposta, devendo a Administração promover diligência junto ao interessado para a correção das falhas, sem permitir, contudo, a alteração do valor global originalmente proposto". (Acórdão 370/2020 – Plenário)

"Não restando configurada a lesão à obtenção da melhor proposta, não se configura a nulidade do ato. Erro no preenchimento da planilha de formação de preço do licitante não constitui motivo suficiente para a desclassificação da proposta, quando a planilha puder ser ajustada sem a necessidade de majoração do preço ofertado". (Acórdão 1811/2014 – Plenário)

"É possível o aproveitamento de propostas com erros materiais sanáveis, que não prejudicam o teor das ofertas, uma vez que isso não se mostra danoso ao interesse público ou aos princípios da isonomia e da razoabilidade." (Acórdão 187/2014 – Plenário)

17. Dessa forma, seria totalmente ilegal eventual entendimento contrário ao do i. Pregoeiro, que, corretamente aceitou a proposta da Coperson.
18. O erro meramente material não implicou qualquer mudança nos valores ofertados pela Coperson, valendo ressaltar, extremamente vantajoso para a Administração.
19. Portanto, sem razão a Recorrente.
20. Ressalta-se novamente que na especificação do item, foram informadas todas as especificações exigidas pelo TRD, logo a apresentação de novos modelos pela Coperson não significa que alteração substancial da solução.



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21. E todas as especificações e declarações contidas na proposta da Coperson são vinculatórias e obrigam a Coperson a fornecer uma solução completa que atenda perfeitamente ao TRD, com todas as suas exigências e funcionalidades mesmo que não discriminadas em sua proposta no TRD ou no edital, pois no momento que estas especificações para o item foram informadas, a Coperson é obrigada a entregar um item que atenda ao informado.
22. Logo, a proposta da Coperson atende plenamente ao exigido no TRD e é a proposta mais vantajosa para a Administração.
23. Cumpre ressaltar que a Coperson teve apenas um erro meramente material e que sua correção não altera a substância ou o valor de sua proposta.
24. **Não admitir essas correções, constitui mácula à juridicidade do procedimento licitatório com excesso de formalismo.** E dessa forma, ao não se permitir saneamento e singelas correções impacta-se na própria funcionalidade do certame.
25. Além disso, os esclarecimentos prestados acima evidenciam a legitimidade da aceitação da proposta de preços ofertada.
26. Cabe também evidenciar algumas decisões recursais ocorridas nos últimos meses em pregões de objetos similares que corroboram com nossas alegações.
27. Edital 11-2023 – Tribunal Regional do Trabalho da 4ª Região. No pregão 11-2023 a vencedora foi a empresa Seal e como pode ser visto na decisão abaixo do Sr. Pregoeiro e equipe técnica do Tribunal, ela foi declarada vencedora mesmo com erros em sua proposta (segue decisão em anexo e pode ser conferida direto no COMPRASNET – UASG 80014 PREGÃO 11-2023).

"(...)

Quanto aos demais itens, sustenta que atendem aos requisitos do Edital, ratificando esclarecimentos prestados em atendimento à diligência realizada na fase de análise da proposta e prestando demais informações técnicas que entende relevantes.

(...)

2. ATENDIMENTO ÀS ESPECIFICAÇÕES TÉCNICAS

A recorrente alega que a proposta da SEAL não atende às especificações técnicas exigidas no Edital em relação à caixa acústica amplificada para sala de controle (subitem



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5.26 do projeto); ao sistema operacional e à placa mãe do PC para software de suíte de vídeo (subitem 5.4 do projeto); ao Pannel de LED (subitem 5.8 do projeto) e ao Cabo de áudio (subitem 6.2 do projeto).

A área técnica requisitante sustenta que a proposta atende às exigências do Edital, sugerindo a manutenção da decisão que declarou a SEAL vencedora do certame, conforme trechos da manifestação a seguir transcritos (fls. 4288-4291):

Em relação aos itens referidos pela recorrente em que a SEAL deixou de atender integralmente às especificações técnicas descritas no edital e seus anexos, tenho a informar o que segue:

2.1. Item 30 do Anexo 1 do Termo de Referência (TR)

A recorrente alega que a caixa acústica amplificada Yamaha HS 5 ofertada pela SEAL não atende ao exigido no subitem 5.29 (na verdade é o 5.26) do Anexo 2 do Termo de Referência, que faz parte do Anexo I do Edital, pois não possui o circuito de proteção térmica e a blindagem magnética exigidos. Inicialmente cabe referir que procede a afirmação da recorrente no sentido de que o equipamento estabelecido como marca de referência efetivamente não possui os requisitos técnicos supracitados, os quais constaram no projeto por equívoco do projetista, conforme manifestação abaixo, extraída da manifestação técnica constante no doc. 283.

"O ambiente onde as caixas solicitadas serão instaladas no Tribunal é um ambiente totalmente controlado, sem problemas de interferências eletromagnéticas e com energia elétrica proveniente de sistemas de alimentação ininterrupta, com filtros de linha eficiente, além termos previsto a utilização de cabos de áudio, vídeo e conectores de alta qualidade.

Assim sendo, não teremos nenhum problema de interferência de ruídos com a utilização das caixas acústicas indicadas como modelo de referência (Yamaha modelo HS5) e ofertadas pela empresa declarada vencedora do PE.

" Todavia, considerando que a SEAL ofertou exatamente o equipamento estabelecido no Anexo 1 do TR como marca e modelo de referência, ao preço total (2 un.) de R\$ 6.042,44, considerando que tal equipamento foi o que foi considerado no projeto de modernização do sistema de som do plenário, porque atende plenamente às necessidades manifestadas por TRT-4, e ainda, em função do montante absolutamente insignificante (0,2%) desse item perante o valor total da contratação, entendemos que deve ser mantida a aceitação de tal equipamento.

"O recurso da Coperson indica que não é possível obter 2 slots operando em x16 simultaneamente na placa-mãe ofertada após a instalação das placas auxiliares.

Analisando todas as placas que serão anexadas à placa-mãe, observa-se que apenas a placa de vídeo irá operar na velocidade x16, com todas as outras placas operando por padrão em x8. Pelo fato do arranjo proposto não implicar em uma perda de performance no computador ofertado, consideramos que esse ponto do TR foi atendido. (...) O modelo de chipset ofertado pela Seal (C422) difere do solicitado no TR



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(X299). Contudo, por possuir características muito semelhantes e ser mais recente do que o modelo do TR, consideramos que o modelo ofertado é equivalente ao solicitado e, portanto, que o mesmo atende a esse ponto do TR.

" O projetista, por sua vez, traz em seu parecer técnico (doc. 283) dois diagramas onde demonstra que a adoção do arranjo possibilitado pela placa mãe ofertada é equivalente ao arranjo especificado e não vai gerar impacto negativo na instalação dos componentes necessários. Pelo exposto, fica ratificado o posicionamento técnico original manifestado por ocasião da análise da proposta apresentada pela SEAL, no sentido de que o equipamento em questão atende plenamente as especificações exigidas no Edital. (...)

2.4. Item 30 do Anexo 1 do TR Quanto a alegação da recorrente de que o cabo de áudio ofertado pela SEAL (Santo Ângelo SC30A) não possui um cabo de cobre estanhado e sem isolamento de 24 AWG, conforme exigido no subitem 6.2 do Anexo 2 do TR, o projetista ratifica, na manifestação técnica (doc. 283), o posicionamento técnico original manifestado por ocasião da análise da proposta apresentada pela SEAL, no sentido de que o cabo em questão atende plenamente as especificações exigidas no Edital, conforme trechos transcritos adiante:

"Na realidade, a malha de folha de alumínio, com 100% de cobertura, é que serve como blindagem a ruídos eletromagnéticos sobre o cabo de áudio. O cabo sem isolamento serve para conectar esta capa de alumínio no aterramento do equipamento onde o cabo será conectado. (...) No caso deste cabo ofertado, a malha está em conexão direta com a capa de alumínio, performando uma segunda camada de isolamento a interferências eletromagnéticas. Na montagem dos conectores, esta malha trançada é soldada no pino 1 do conector, no caso de um conector tipo XLR, e assim é feita a conexão ao terra do equipamento, da mesma forma que seria feito no caso de não existência da malha e existência do cabo de cobre nú. Quanto a bitola do cabo, na escala AWG o diâmetro é inverso ao número, ou seja, um cabo 22 AWG possui um diâmetro maior que um cabo 24 AWG. (...) O cabo ofertado apresenta uma área maior que a solicitada na especificação, ou seja, apresenta uma menor resistência, causando menos atenuação no sinal transmitido.

Nesse sentido, consideramos que o modelo ofertado apresenta rendimento melhor que o solicitado e assim atende ao edital." Diante do exposto, com base na manifestação técnica (doc. 283) do Eng. Wolfran P. Bittencourt Júnior, projetista da Wolfran Engenharia Ltda., contratada por este TRT para elaboração do projeto de modernização do Plenário em questão e do parecer técnico (doc. 285) do corpo técnico da Secretaria de Tecnologia da Informação e Telecomunicações (SETIC) deste TRT4, entendo que existem elementos técnicos suficientes para caracterizar o atendimento da proposta da SEAL às exigências do Edital do Pregão nº 11/2023 e, conseqüentemente, manutenção da decisão do pregoeiro.

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Verifica-se que as áreas técnicas do TRT4 ratificam os pareceres exarados na fase de julgamento, **no sentido de que a proposta declarada vencedora atende às exigências do Edital, embora reconheçam que algumas especificações pouco relevantes não foram atendidas em relação aos itens apontados no recurso.**

O projetista reconhece que foram especificadas características não presentes no equipamento estabelecido como marca e modelo de referência (pois não possui o circuito de proteção térmica e a blindagem magnética exigidos), mas justifica que o ambiente onde as caixas serão instaladas no Tribunal é um ambiente totalmente controlado, sem problemas de interferências eletromagnéticas e com energia elétrica proveniente de sistemas de alimentação ininterrupta, com filtros de linha eficiente e utilização de cabos de áudio, vídeo e conectores de alta qualidade.

Assim sendo, o projetista entende que não haverá nenhum problema de interferência de ruídos com a utilização das caixas acústicas indicadas como modelo de referência.

Nesse contexto, ainda que reconheça erro material no Instrumento Convocatório, ao especificar características não presentes no equipamento estabelecido como marca e modelo de referência no mesmo Edital, **a área técnica do Tribunal entende que deve ser mantida a aceitação de tal equipamento, em função do montante insignificante desse item perante o valor total da pretendida contratação (0,2%).**

Entende-se, portanto, que se trata de caso de aplicação do princípio do formalismo moderado de que trata o Acórdão do Plenário do Tribunal de Contas da União n. 357/2015, cujo enunciado transcreve-se em parte: "(...) No curso de procedimentos licitatórios, a Administração Pública deve pautar-se pelo princípio do formalismo moderado, que prescreve a adoção de formas simples e suficientes para propiciar adequado grau de certeza, segurança e respeito aos direitos dos administrados, promovendo, assim, a prevalência do conteúdo sobre o formalismo extremo, respeitadas, ainda, as praxes essenciais à proteção das prerrogativas dos administrados." Na mesma linha o enunciado do Acórdão da Segunda Câmara do TCU n. 11907/2011: "Não se desclassifica propostas de licitante pelo descumprimento de exigências pouco relevantes, em respeito ao princípio do formalismo moderado e da obtenção da proposta mais vantajosa à Administração." Diante disso, com base nas manifestações das áreas técnicas deste TRT4, mantém-se o julgamento que declarou a empresa SEAL TELECOM COMÉRCIO E SERVIÇOS DE TELECOMUNICAÇÕES LTDA vencedora do Pregão Eletrônico n. 11/2023 (...)"

28. Edital 21-2023 – Supremo Tribunal Federal. Neste pregão, 21-2023, tem se o mesmo ocorrido, a vencedora foi a empresa Seal e como pode ser visto na decisão abaixo do Sr. Pregoeiro e equipe técnica do Tribunal, ela foi declarada vencedora mesmo com falhas e omissões em sua proposta (segue decisão em anexo e pode ser conferida direto no COMPRASNET – UASG 40001 PREGÃO 21-2023).



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"(...)

Em resumo, a recorrente alega que a empresa SEAL TELECOM COMÉRCIO E SERVIÇOS DE TELECOMUNICAÇÕES LTDA:

Anexou proposta no sistema Comprasnet e, enviou após a fase de lances, proposta em desacordo com as especificações dos itens 5 e 6 ocasionando um "erro substancial em sua proposta e não meramente (...) um erro formal ou material (...) em flagrante ofensa ao item 5.2 do Edital e aos princípios norteadores das licitações públicas"

Ao cadastrar sua proposta no sistema, não ofereceu todos os acessórios e itens necessários ao perfeito funcionamento da solução e conforme exigido em edital. A empresa teria deixado de cotar os cabos RS-LC-CANON-PNP (For Digital Lenses + Extender) e que, após diligência realizada, o Pregoeiro deu margem " a SEAL (...) adicionar a inclusão do fornecimento de todos os demais acessórios (...) para o perfeito funcionamento da solução".

3. Requer, portanto, que a empresa SEAL TELECOM seja desclassificada do certame e que seja dada a regular continuidade ao Pregão

CONTRARRAZÕES RECURSAIS – SEAL TELECOM COMÉRCIO E SERVIÇOS DE TELECOMUNICAÇÕES LTDA. (doc. 2232903, 2233442 e 2233460)

4. A empresa recorrida argumenta que houve erro material no preenchimento da proposta e que foram ofertados todos os cabos e acessórios necessários para o completo e perfeito funcionamento do sistema.

(...)

NO MÉRITO

APRESENTAÇÃO DE PROPOSTA EM DESACORDO COM A ESPECIFICAÇÃO DOS ITENS 5 E 6

7. Em relação ao primeiro ponto, a especificação dos itens 5 e 6 constantes do Edital do Pregão Eletrônico nº21/2023 é a seguinte:

Item 5 - Serviço de Instalação e Configuração - Deverão ser realizados todos os serviços de desmontagem, instalação, configuração e integração com os sistemas legados para a perfeita operação do Sistema. Deverão ser fornecidos, sem custos, quaisquer cabos, conectores e acessórios necessários para a perfeita operação e integração com os sistemas legados da emissora mesmo que não explicitados neste documento, considerando a natureza turn key da licitação. O prazo de instalação é de 10 (dez) dias corridos, após a autorização da fiscalização do Contrato.



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Item 6 - Serviço de Treinamento - Deverá ser ministrado treinamento técnico-operacional do sistema fornecido para 02 turmas, com 7 profissionais cada turma. A carga horária de cada turma será de 02 horas, divididas em 02 dias. Uma turma será realizada no período matutino e a outra no período vespertino.

8. A proposta da empresa (doc. 2221270) traz em seu primeiro quadro, uma descrição sucinta de cada um dos itens que compõem o grupo 1 da solução que o STF pretende adquirir. Especificamente quanto aos itens 5 e 6 a empresa SEAL, nesse primeiro quadro, descreve simplificada e (é fato) os serviços dos itens como "Serviço de Instalação e Configuração" para o item 5 e "Serviço de Treinamento" para o item 6.

9. Porém, logo abaixo ao quadro mencionado, ao pormenorizar cada um dos itens do grupo 1 em "marcas e modelos", a empresa SEAL consignou em sua proposta o "Serviço técnico em informática, inclusive instalação, configuração e manutenção de programas de comp" para o item 5 e "Instrução, treinamento, orientação pedagógica e educacional, avaliação de conhecimentos" para o item 6.

(...)

11. É visível que houve um equívoco de natureza material da empresa SEAL ao detalhar os serviços dos itens 5 e 6. A presente contratação refere-se a uma solução, não restando dúvida de que os itens 1 a 6 do grupo 1 são claramente interdependentes. Não seria razoável o Pregoeiro presumir que a empresa recorrida estaria cotando em sua proposta "Serviço de Instalação e Configuração" e "Serviço de Treinamento" para solução diversa, serviço diverso ou equipamentos diversos dos mencionados nos itens 1 a 4 conforme tenta demonstrar a recorrente. Desclassificar uma proposta (potencialmente) mais vantajosa por erros dessa natureza, seria sim rigor excessivo ou desrespeito aos princípios da proporcionalidade e da razoabilidade.

12. Dessa forma, o Pregoeiro (após suscitado, inclusive, pela área técnica) por meio de diligência, apenas solicitou que a empresa ajustasse sua proposta de forma a detalhar/esclarecer o conteúdo de sua proposta (dox. 2221540 e 2228317, fl. 12) conforme preconiza o Edital no subitem 17.8 e o Art. 43 § 3º, da Lei 8.666/93:

Edital do Pregão Eletrônico nº 21/2023

17.8 O pregoeiro poderá, no julgamento da habilitação e das propostas, sanar erros ou falhas que não alterem a substância das propostas, dos documentos e da validade jurídica, mediante decisão fundamentada, registrada em ata e acessível aos licitantes, e



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lhes atribuirá validade e eficácia para fins de habilitação e classificação.

Art. 43 § 3º da Lei 8.666/93

É facultada à Comissão ou autoridade superior, em qualquer fase da licitação, a promoção de diligência destinada a esclarecer ou a complementar a instrução do processo, vedada a inclusão posterior de documento ou informação que deveria constar originariamente da proposta.

13. A empresa SEAL apresentou a proposta corrigida no documento 2223844 aprovada pela área técnica no documento 2223846. **Não admitir essa hipótese, constitui mácula à juridicidade do procedimento licitatório com excesso de formalismo.** E dessa forma, ao não se permitir saneamento e singelas correções impacta-se na própria funcionalidade do certame. Além disso, os esclarecimentos prestados tanto pela área técnica quanto pela recorrida evidenciam a legitimidade da aceitação da proposta de preços ofertada.

AUSÊNCIA DE EQUIPAMENTO (CABOS RS-LC-CANON-PNP - FOR DIGITAL LENSES + EXTENDER)

14. A recorrente afirma que a SEAL deixou de cotar os cabos "RS-LC-CANON-PNP - For Digital Lenses + Extender". A COPERSON afirma que o cabo mencionado é necessário para controlar remotamente a câmera ofertada, fazendo a conexão entre o controle remoto e a cabeça robótica da marca Telematics (modelo especificado no Edital).

15. Por sua vez, a SEAL, em suas contrarrazões, assevera que no item 3 da proposta apresentada "foram ofertados todos os cabos e acessórios necessários para o completo e perfeito funcionamento do sistema, uma vez que a cabeça robótica PTZ ofertada, modelo PT-HP-S5, será fornecida com todos os seus respectivos cabos e demais acessórios de montagem, justamente parte do kit de conexão do equipamento da Fabricante Telematics com os demais itens do Edital do Pregão.

16. A SEAL acrescenta, ainda, que "validou a configuração ofertada com a fabricante da câmera (Sony), que por sua vez, também validou o projeto junto com a fabricante Telematics, atestando que todos os acessórios necessários ao funcionamento e integração do sistema estão incluídos na proposta da SEAL" conforme constante do documento 2233460.

17. A área técnica no documento 2233639 corrobora a premissa da COPERSON de que o "elemento principal das conexões dos equipamentos (itens 1, 2 e 3) é a cabeça robótica do fabricante Telematics", porém observa que a afirmação da recorrente de



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que os cabos (RS-LC-CANON-PNP) seriam imprescindíveis para a conexão do sistema não encontra guarida na própria documentação anexada pela COPERSON em sua peça recursal : "...registramos que no diagrama "System Configuration" (doc. 2232881, página 18) indicado pela COPERSON não encontramos o cabo de modelo RS-LC-CANON-PNP, mas apenas identificação de modelos de cabos para interconexão com painéis próprios da fabricante da lente (Canon), o que não é o caso presente"

18. Menciona ainda, que a SEAL, por outro lado, apresentou diagrama (2233460) e carta (2233442) onde o fabricante Telemetrics afirma expressamente no documento 2233442 que:

"Referente ao edital do Supremo Tribunal Federal, informamos que o modelo da Cabeça PTZ Telemetrics PT-HP-S5 utiliza o modelo de cabo de conexão CA-CANON-EXT-28 (CABLE-LENS CANON EXTENDER 28) para interligação com a Câmera HDC-P31 (SONY) e lente KJ22ex7.6B ITS-RE (CANON), conforme diagrama fornecido juntamente com esta declaração.

Ademais, informamos que todos os cabos de conexão bem como acessórios de montagem necessários para interconexão da PT-HP-S5, do adaptador de fibra FTS-FBA-VCG da Câmera HDC-P31 (SONY) e da lente KJ22ex7.6B ITS-RE (CANON) são fornecidos como acessórios incluídos no pacote fornecido (PT-HP-S5 Bundle)."

19. Considerando que consta na proposta da empresa SEAL TELECOM, como bem observou a área técnica, o fornecimento dos cabos mencionados na carta (declaração) do fabricante Telemetrics conclui-se que a conexão entre os equipamentos será realizada conforme proposta apresenta pela empresa.

CONCLUSÃO

20. Por fim, proponho o conhecimento do recurso interposto pelo COPERSON SERVIÇOS E COMÉRCIO DE PRODUTOS DE INFORMÁTICA E SEGURANÇA., e, quanto ao mérito, o parecer é no sentido do indeferimento do pedido, mantendo a decisão proferida pelo pregoeiro que declarou a empresa SEAL TELECOM COMÉRCIO E SERVIÇOS DE TELECOMUNICAÇÕES LTDA., vencedora do certame, visto que foram cumpridos todos os requisitos de qualificação técnica exigidos pelo edital do Pregão Eletrônico nº 21/2023.

21. Assim, remeto os autos para deliberação do Senhor Diretor-Geral da Secretaria, com a oitiva necessária da Assessoria Jurídica da Secretaria do Tribunal.



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29. Além das decisões acima, o próprio Edital prevê a possibilidade de realização de diligências e sanar erros ou falhas, como já mencionado anteriormente.
30. Nesse sentido, ressalta-se que a análise não se resume ao modelo ofertado na proposta, mas deve considerar também o descritivo técnico.
31. E, por fim, não é demais ressaltar que o TCU entende de forma pacífica que a Administração Pública deve se pautar pelo princípio do formalismo moderado e razoabilidade para obter a proposta mais vantajosa, como previsto em Lei. Nesse sentido:

"Falhas formais, sanáveis durante o processo licitatório, não devem levar à desclassificação da licitante. No curso de procedimentos licitatórios, a Administração Pública deve pautar-se pelo princípio do formalismo moderado, que prescreve a adoção de formas simples e suficientes para propiciar adequado grau de certeza, segurança e respeito aos direitos dos administrados, promovendo, assim, a prevalência do conteúdo sobre o formalismo extremo, respeitadas, ainda, as praxes essenciais à proteção das prerrogativas dos administrados" (Acórdão 357/2015-Plenário | Relator: BRUNO DANTAS)

"(...)

Nesse contexto, observo que a rejeição da proposta da empresa Informação Publicidade Ltda. se mostra mais desfavorável ao interesse público, do que a sua manutenção, apesar dos erros reportados. Assim, à luz do art. 3º da Lei de Licitações e dos princípios do interesse público, da economicidade, da razoabilidade e da busca pela proposta mais vantajosa na licitação, acolho o encaminhamento sugerido pela unidade instrutiva para se determinar ao Ministério da Educação a adoção de providências no sentido de proceder, no âmbito da Concorrência 1/2013, a anulação do ato de desclassificação da empresa Informação Publicidade Ltda., e dos demais atos dele decorrentes; retornando, no caso de se optar pela continuidade da licitação, à fase de avaliação das propostas (...)" (Acórdão 187/2014-Plenário | Relator: VALMIR CAMPELO)*****

32. Como bem evidenciado nos tópicos anteriores, a proposta da Coperson atende integralmente às exigências do TDR.



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33. Por todo o exposto, a Coperson requer seja integralmente rejeitado o Recurso interposto intempestivamente pela Seal, uma vez que sua proposta atendeu integralmente ao Edital, sendo aquela mais vantajosa para a Administração.
34. Diante disso, se requer seja dada regular continuidade a este processo licitatório, com a adjudicação do resultado que declarou a Proposta da Coperson como a vencedora e, na sequência, seja celebrado o contrato.
35. Eventual dúvida desse r. Órgão deve ser sanada por diligência.
36. A Coperson permanece à disposição para os eventuais esclarecimentos e/ou informações adicionais que ainda se façam necessárias.

Pede deferimento.

COPERSON SERVIÇOS E COMERCIO DE PRODUTOS DE INFORMATICA E SEGURANÇA EIRELI
(Representante Legal: BÁRBARA MAIA MUNDIM; CPF: 033.723.221-00)
CNPJ nº 07.648.642/0001-40



PROPOSTA DE PREÇOS Nº 001/2024

Brasília, 03 de janeiro de 2024.

AO SENADO FEDERAL

Pregão Eletrônico nº: 90004/2024

Objeto: O objeto do presente pregão é a seleção da proposta mais vantajosa para contratação de empresa para o fornecimento de equipamentos para viabilizar cursos e treinamentos na modalidade híbrida em duas salas de aula; para melhoria da qualidade do vídeo no auditório Antônio Carlos Magalhães; e para prestação de serviço de suporte a longo prazo desse sistema, para o Instituto Legislativo Brasileiro (ILB) do Senado Federal, de acordo com os termos e especificações do edital e seus anexos.

DADOS DA EMPRESA	
Razão Social: COPERSON SERVIÇOS E COMÉRCIO DE PRODUTOS DE INFORMÁTICA E SEGURANÇA LTDA	
CNPJ: 07.648.642/0001-40	INSC. ESTADUAL: 07.471.434/001-86
Endereço: SHCS CR 516, BLOCO B, Nº 69, PAVIMENTO 1, PARTE C0236 – ASA SUL, BRASÍLIA-DF	
CEP: 70.381-525	
Telefone: (61) 3346-6638	Celular: (61) 98493-6666
e-mail: copersonaudio@gmail.com ou adm@copersonaudiovideo.com.br	
DADOS DO REPRESENTANTE LEGAL PARA FIM DE APRESENTAÇÃO DA PROPOSTA E ASSINATURA DA ATA E OU CONTRATO	
Nome do representante legal da empresa: Sra. Bárbara Maia Mundim	
CPF: 033.723.221-00	RG/órgão emissor: 2.742.427 SSP-DF
Estado Civil: Solteira	
Cargo: Sócia Gerente	e-mail: barbara.mundim@copersonaudiovideo.com.br
Instrumento de outorga de poderes: Contrato Social	

Prezados Senhores, a empresa **COPERSON SERVIÇOS E COMÉRCIO DE PRODUTOS DE INFORMÁTICA E SEGURANÇA LTDA**, por intermédio de sua sócia gerente a Sra. Bárbara Maia Mundim, em atendimento ao Edital do Pregão à epígrafe, apresenta, nossa proposta técnica e comercial.

Declaramos que estamos de pleno acordo com todas as condições estabelecidas no edital e seus anexos, bem como aceitamos todas as obrigações e responsabilidades especificadas no termo de referência e seus anexos. Segue a descrição completa dos equipamentos e materiais a serem utilizados, todos em conformidade ao edital:



PROPOSTA DE PREÇOS Nº 001/2024

PROPOSTA COMERCIAL					
ITEM	PRODUTO	UND	QTD	VL UNIT R\$	VL TOTAL R\$
1	CÂMERA DE VÍDEO PTZ UHD 4K NDI	UN	4	21.000,00	84.000,00
2	PAINEL DE CONTROLE REMOTO DA CÂMERA	UN	2	10.000,00	20.000,00
3	MICROFONE DE MATRIZ DE TETO	UN	2	53.000,00	106.000,00
4	PROCESSADOR DE ÁUDIO DSP	UN	2	15.000,00	30.000,00
5	CAIXA PARA SONORIZAÇÃO	UN	4	6.000,00	24.000,00
6	MONITOR 85" TOUCHSCREEN	UN	2	30.000,00	60.000,00
7	SUORTE MÓVEL	UN	2	5.000,00	10.000,00
8	RECEPTOR PARA MICROFONES	UN	4	10.000,00	40.000,00
9	MICROFONE AURICULAR SEM FIO	UN	2	8.000,00	16.000,00
10	MICROFONE BASTÃO SEM FI	UN	2	8.000,00	16.000,00
11	BATERIA PARA MICROFONE	UN	6	1.920,00	11.520,00
12	CARREGADOR DE BATERIA	UN	2	6.000,00	12.000,00
13	UNIDADE DE CAPTURA	UN	2	1.261,67	2.523,34
14	DISTRIBUIDOR HDMI	UN	2	286,33	572,66
15	TELA DIGITALIZADORA 15,6"	UN	1	5.500,00	5.500,00
16	BOLSA PROTETORA	UN	1	234,78	234,78
17	NOBREAK	UN	2	5.005,63	10.011,26
18	MATRIZ HDMI 4X2	UN	1	1.500,00	1.500,00
19	APRESENTADOR SEM FIO	UN	3	183,29	549,87
20	CABO HDMI 2.1 FIBRA ÓPTICA 30M	UN	7	473,54	3.314,78
21	CABO DE REDE	UN	3	951,85	2.855,55
22	CONECTOR PARA CABO DE REDE	UN	100	0,78	78,00
23	CABO XLR PARA XLR	UN	4	34,73	138,92
24	CABO HDMI PARA HDMI DE 10 METROS	UN	4	101,28	405,12
25	CABO HDMI PARA HDMI DE 5 METROS	UN	8	45,00	360,00
26	EMENDA HDMI PARA HDMI	UN	8	22,88	183,04
27	CABO USB-A PARA USB-B	UN	4	20,00	80,00
28	CABO EXTENSOR USB-A DE 10 METROS	UN	4	85,00	340,00
29	CABO USB-C PARA HDMI DE 4 METROS	UN	4	283,33	1.133,32
30	ADAPTADOR HDMI PARA DVI	UN	7	25,87	181,09
31	CONVERSOR ATIVO	UN	4	72,30	289,20
32	LÃ PARA ISOLAMENTO METROS QUADRADOS	UN	40	25,00	1.000,00
33	BANDA ACÚSTICA 40 METROS	UN	40	5,59	223,60
34	SWITCH DE REDE 24 PORTAS	UN	2	8.484,58	16.969,16
35	ESTAÇÃO DE TRABALHO	UN	6	16.000,00	96.000,00
36	MONITOR PARA ESTAÇÃO	UN	12	1.036,80	12.441,60
37	SERVIÇO DE INSTALAÇÃO	UN	1	20.000,00	20.000,00
38	TREINAMENTO	UN	1	5.000,00	5.000,00
39	SUORTE MENSAL	UN	54	3.700,00	199.800,00
VALOR TOTAL DA PROPOSTA R\$ 811.205,29 (OITOCENTOS E ONZE MIL DUZENTOS E CINCO REAIS E VINTE E NOVE CENTAVOS)					

PROPOSTA TÉCNICA			
ITEM	DESCRIÇÃO	MARCA	MODELO

PROPOSTA DE PREÇOS Nº 001/2024

1	CÂMERA DE VÍDEO PTZ UHD 4K NDI 1.1. Câmera de vídeo com circuito e mecanismo PTZ (<i>pan, tilt</i> e <i>zoom</i>) embutido a própria câmera; 1.2. Resolução efetiva do sensor: ≥ 8 Megapixel (3840 x 2160); 1.3. Taxa de zoom óptico mínimo: 20x; 1.4. Taxa de zoom digital mínimo: 16x; 1.5. Iluminação mínima: aproximadamente 1,5 lux; 1.6. Modos de balanço de branco: Auto e manual; 1.7. Modos de ajuste de foco: Auto e manual; 1.8. Movimento: 1.8.1. Faixa de movimento panorâmico: 340° (-170 a 170°); 1.8.2. Possui velocidade de operação panorâmica: $\geq 100^\circ/s$; 1.8.3. Faixa de movimento de inclinação vertical 120° (-30° a +90°); 1.8.4. Possui velocidade de operação de inclinação: $\geq 69^\circ/s$; 1.9. Ângulo de visão horizontal mínimo: 60° (em <i>Wide</i>); 1.10. Possui saída de vídeo 3G-SDI em conector BNC; 1.11. Possui saída de vídeo NDI em conector RJ45; 1.12. Possui porta de comunicação serial totalmente compatível com painel fornecido; 1.13. Possui protocolo NDI HX ou superior; 1.14. NDI habilitado e totalmente funcional; 1.15. Formato de saída de vídeo: 1.15.1. SDI/BNC 1.15.1.1. 1920 x 1080p - 50/59.94/29.97/25 fps; 1.15.1.2. 1920 x 1080i - 50/59.94 fps; 1.15.1.3. 1280 x 720 - 59.94 fps; 1.15.2. RJ45 1.15.2.1. 3840 x 2160 (4K) - 29.97 fps; 1.15.2.2. 1920 x 1080 - 59.94/29.97 fps; 1.15.2.3. 1280 x 720 - 59.94 fps; 1.16. Protocolos controle suportados: VISCA sobre IP, VISCA padrão serial e/ou outro protocolo via IP (rede) e totalmente compatível com modelo do painel remoto fornecido no item 2; 1.17. É fornecido 1 (um) suporte para montagem da câmera no teto para cada câmera fornecida; 1.18. Fonte de alimentação: 1.18.1. Permitir alimentação PoE+ via conector LAN (IEEE802.3 compatível);	PTZOPTICS	PT20X-4K + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
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	1.19. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos, acessórios, firmwares, licenças, softwares, entre outros; 1.20. Manual de operação em língua portuguesa ou inglesa.		
2	PAINEL DE CONTROLE REMOTO DA CÂMERA 2.1. painel remoto de mesa; 2.2. Possui manche (<i>Joystick</i>) para ajuste de movimento de <i>PAN</i> e <i>TILT</i>; 2.3. Possui ajuste de <i>Zoom</i> (<i>zoom in / zoom out</i>) que poderá ser em botões específicos ou no próprio <i>Joystick</i>; 2.4. Possui ajuste de velocidade <i>Zoom</i>; 2.5. Possui botões ou knob para ajuste de foco; 2.6. Possui knobs de controle manual de vermelho e azul para ajuste de <i>White Balance</i> (balanço de branco); 2.7. Possibilita seleção rápida de ao menos 6 câmeras através de botões; 2.8. Possui visor para acesso de informações de operações e menu de vconfigurações; 2.9. Possui porta de comunicação em conector RJ45; 2.10. Possui porta de comunicação serial totalmente compatível com câmera fornecida; 2.11. Protocolos controle suportados: <i>VISCA</i> sobre IP, <i>VISCA</i> padrão serial e/ou outro protocolo via IP (rede) e totalmente compatível com modelo de câmeras fornecidas no item 01; 2.12. Fonte de alimentação: 2.12.1. Possui fonte de alimentação de tensão AC de 100 a 240Vac 50/60Hz; 2.13. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos, acessórios, fontes, firmwares, softwares, entre outros; 2.14. Manual de operação em língua portuguesa ou inglesa.	PTZOPTICS	PT-SUPERJOY-G1 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
3	MICROFONE DE MATRIZ DE TETO 3.1. Microfone de matriz para uso em teto; 3.2. Conectividade: RJ-45; 3.3. Protocolo de saída de áudio: Dante; 3.4. Especificações de áudio: 3.4.1. Saída de áudio: Dante; 3.4.2. Latência total com processamento: 60 ms; 3.4.3. Resposta de frequência: 160 Hz – 16 kHz; 3.4.4. Nível máximo de SPL (0dBFS): ≥ 95 dB SPL; 3.4.5. Relação sinal ruído (Ref. 94 dB SPL a 1 kHz): 75 a 95 dBA;	SENNHEISER	TEAMCONNECT CEILING 2 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO

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	3.5. Funcionalidades: 3.5.1. Área de Cobertura Dinâmica, diretamente ou integrado com processador DSP; 3.5.2. AEC (Cancelamento do Eco acústico), diretamente ou integrado com processador DSP; 3.5.3. Possibilita zonas de Exclusão; 3.5.4. Possibilita zona Prioritária; 3.6. Característica direcional: Padrão de feixe; 3.7. Área de cobertura: ≥ 75 metros quadrados; 3.8. Certificado para uso no <i>Microsoft Teams</i>; 3.9. Montagem: em teto; 3.10. Potência de consumo máxima: 11W; 3.11. Dimensões aproximadas: 60 x 60 x 10 cm; 3.12. Cor: Branco; 3.13. Alimentação de tensão através de conexão RJ-45 via PoE (IEEE 802.3af, Classe 3); 3.14. Fornece software de configuração e controle, compatível com Windows 10 ou superior; 3.15. Acessórios: Todos acessórios necessários à instalação de cada microfone conforme descritos no item, em teto com forro de gesso, para tipo montagem incluso no teto; 3.16. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos, acessórios, firmwares, licenças, softwares, entre outros; 3.17. Manual de operação em língua portuguesa ou inglesa.		
4	PROCESSADOR DE ÁUDIO DSP 4.1. Processador DSP para conferências; 4.2. totalmente compatível com microfone especificado no item 03; 4.3. DSP integrado com as seguintes funcionalidades: 4.3.1. AEC (cancelamento de eco acústico), 4.3.2. Redução de ruído automático; 4.3.3. AGC (Controle de ganho automático); 4.3.4. Mixagem de sinais automático; 4.3.5. Delay; 4.3.6. Roteamento de sinais; 4.3.7. Taxa de amostragem: 48 kHz; 4.3.8. Profundidade de bits: 24 bits; 4.4. Protocolos suportados: 4.4.1. Dante; 4.4.2. AES 67; 4.5. Entradas de áudio: 4.5.1. Canal de entrada analógico: 02 (dois) canais	shure	IntelliMix P300 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO

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	balanceados XLR, com nível mic e linha (serão aceitos cabos adaptadores); 4.5.2. Porta Dante com 10 canais; 4.5.3. Porta USB; 4.6. Saídas de áudio: 4.6.1. Canal de saída analógico: 02 (dois), nível de linha; 4.6.2. Porta Dante com 8 canais; 4.6.3. Porta USB; 4.7. Conectividade: 4.7.1. Conexão USB: USB2.0; 4.7.2. Porta de rede RJ-45; 4.8. Resposta de frequência: 20 Hz a 20 kHz; 4.9. Latência com processamento ativado: 20 ms; 4.10. Fornece software de controle para configurações e operações; 4.10.1. Sistema operacional suportado: Windows 10 ou superior; 4.11. Certificado para uso nos seguintes softwares: 4.11.1. Microsoft Teams; 4.11.2. Zoom Meeting; 4.12. Alimentação de tensão através de conexão RJ-45 via PoE+ (IEEE 802.3at PoE+, Classe 4); 4.13. Consumo máximo: 20W; 4.14. Acessório para montagem modular sob a mesa; 4.15. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, firmwares, licenças, softwares, entre outros; 4.16. Manual de operação em língua portuguesa ou inglesa.		
5	CAIXA PARA SONORIZAÇÃO 5.1. Caixa amplificada para sonorização ambiente com alimentação PoE+ via rede Ethernet; 5.2. Resposta de frequência: 120 Hz a 20 kHz; 5.3. Adequada tanto para voz como música; 5.4. Formato do sinal de entrada de áudio: 5.4.1. Protocolo Dante; 5.4.2. Protocolo AES 67; 5.5. Amplificador de potência integrado; 5.6. Capacidade de potência em PoE+: ≥10W RMS; 5.7. Nível máximo de saída (<i>Maximum Output Level</i>): ≥ 98 dB SPL, a 1 metro; 5.8. Cor: branca; 5.9. Tipo de conexão: RJ-45; 5.10. Tipo de montagem: teto ou linear em coluna; 5.11. Fornecer software de controle para configurações e operações;	SOUND-TUBE	IPD-SM500I-II + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO

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	5.11.1. Sistema operacional suportado: Windows 10 ou superior; 5.12. Alimentação de tensão através de conexão RJ-45 via PoE+ (IEEE 802.3at PoE+, Classe 4); 5.13. Peso aproximado: ≤ 5 kg; 5.14. Acessórios: 5.14.1. Todos os acessórios necessários para montagem física da caixa no teto ou em coluna linear, conforme especificação do fabricante; 5.15. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, firmwares, licenças, softwares, entre outros; 5.16. Manual de operação em língua portuguesa ou inglesa.		
6	MONITOR 85" TOUCHSCREEN 6.1. Tela: 6.1.1. Tamanho diagonal da área de vídeo em polegadas: ≥ 85"; 6.1.2. Tela interativa com recurso de <i>touchscreen</i> habilitado e totalmente funcional; 6.1.2.1. Pontos de multitoque: 20; 6.1.2.2. Interface USB-B; 6.1.2.3. Permitir ferramentas de escrita na tela sensível ao toque: caneta e dedo; 6.1.3. Resolução: 3.840 x 2.160; 6.1.4. Proporção da imagem: 16:09; 6.1.5. Brilho típico: 330 cd/m²; 6.1.6. Contraste: 1100:1; 6.1.7. Ângulo de visão (horizontal / vertical): 178/178; 6.1.8. Tempo de resposta: 10 ms; 6.2. Conectividade: 6.2.1. Entrada HDMI: 02 (três); 6.2.2. Portas USB: 03 (três); 6.3. Possui sistema operacional integrado; 6.4. Potência da saída de áudio com autofalantes embutido: 20W (10+10W); 6.5. Alimentação de energia: AC 100 - 240 V, 50/60 Hz; 6.6. Possui alças; 6.7. Especificação mecânica: Suporte padrão VESA; 6.8. Peso aproximado: 76 kg; 6.9. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, fontes, firmwares, softwares, licenças, módulos, entre outros; 6.10. Manual de operação em língua portuguesa ou inglesa.	LG	86TR3DJ-B.AUWQ + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
7	SUPORTE MÓVEL	TECHLUMENS	TI-6500G

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	7.1. Suporte metálico com rodízios totalmente compatível com o monitor especificado no item 6; 7.2. Suporta montagem do mesmo padrão do monitor especificado no item 06; 7.3. A altura mínima do centro do monitor e a base é: ≥ 140 cm; 7.4. Altura é ajustável; 7.5. Capacidade de carga mínima da tela: 76kg; 7.6. Número de Prateleiras: 1; 7.7. Material de Construção: em metal; 7.8. Número de rodízios: 4 (quatro); 7.9. Rodízios possuem travas; 7.10. Acessórios: Parafusos de fixação para Monitor de 85" fornecido; 7.11. São fornecidos todos os acessórios necessários à operação imediata, tais como rodízios, porcas, parafusos, prateleiras, travas, suportes, entre outros; 7.12. Manual de operação em língua portuguesa ou inglesa.		+ ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
8	RECEPTOR PARA MICROFONES 8.1. Receptor para microfones com tecnologia sem fio UHF digital; 8.2. totalmente compatível com itens 09 e 10; 8.3. Tipo: <i>tabletop</i> com opção para montagem em rack padrão de 19" em 1RU (com ou sem adaptador); 8.4. Largura de banda de RF: de 56 a 64 MHz 8.5. Número de canais: 60; 8.6. Intervalo do Passo da Sintonia de RF: 25 kHz; 8.7. Distância de operação: 100 m; 8.8. Latência: < 3 ms; 8.9. Número de antenas: 02 (duas); 8.10. Frequência de operação UHF: contida na banda de 470 a 696 MHz; 8.11. Possui <i>display</i> e indicadores de: Nível AF, Frequência, canal, Mudo, Nível RF, Estado da Bateria do Transmissor; 8.12. Possui, ao menos, 01 (um) canal de saída áudio em conector XLR macho de 3 pinos; 8.13. Resposta de frequência: 20Hz a 20KHz; 8.14. Tensão de alimentação: 100-240VAC, direta ou por adaptador AC/DC incluído e totalmente compatível com item fornecido; 8.15. Acessório: Incluso 02 (duas) antenas para cada de unidade receptora; 8.16. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, fontes, firmwares, softwares, entre outros; 8.17. Manual de operação em língua portuguesa ou	SENNHEISER	EW-D EM Q1-6 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO

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	inglesa.		
9	MICROFONE AURICULAR SEM FIO 9.1. Módulo transmissor para microfones lapela com tecnologia sem fio UHF digital; 9.2. Totalmente compatível com item 08; 9.3. Transmissor tipo <i>bodypack</i>: 9.3.1. totalmente compatível com receptor especificado no item anterior; 9.3.2. Frequência de operação UHF: contida na banda de 470 a 696 MHz; 9.3.3. Potência de transmissão: 10 mW 9.3.4. Largura de banda de RF: de 56 a 64 MHz 9.3.5. Número de canais: 60; 9.3.6. Intervalo do Passo da Sintonia de RF: 25 kHz; 9.3.7. Distância de operação: 100 m; 9.3.8. Latência: < 3 ms; 9.3.9. Deve possuir chave de "mute"; 9.3.10. Varredura de Canal de RF: automática; 9.3.11. Resposta de frequência: 20Hz a 20KHz; 9.3.12. Carcaça em metal; 9.3.13. Entrada de microfone: plenamente compatível com o microfone a ser fornecido conforme especificação do fabricante; 9.3.14. Método de sincronização com a estação receptora: IR ou <i>bluetooth</i>; 9.3.15. Autonomia com baterias alcalinas: mínimo de 9 horas a 10 mW; 9.3.16. Display/indicadores: indicação de <i>mute</i> e sincronismo; 9.4. Cada unidade vai com um microfone auricular com as seguintes especificações: 9.4.1. Cápsula: condensador de eletreto; 9.4.2. Diagrama de captura: Omnidirecional; 9.4.3. Resposta de frequência: 50 Hz a 20 kHz; 9.4.4. Clipes de orelha duplos; 9.4.5. Boom de microfone ajustável e flexível; 9.4.6. Cor: bege; 9.4.7. É fornecido com cabo de conexão plenamente compatível com o fabricante e modelo do transmissor tipo <i>bodypack</i> fornecido; 9.4.8. Tamanho do cabo: ≥ 1m; 9.5. Fonte de alimentação: Bateria específica do próprio fabricante e/ou 02 (duas) baterias tipo AA, de 1,5V; 9.6. Acessórios: 9.6.1. Incluso 01 (uma) antena de ¼ de onda, totalmente compatível, para cada unidade transmissora;	SENNHEISER + POLSEN	EW-D SK QI-6 + ESM-2-35H + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO

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	9.7. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, firmwares, softwares e etc; 9.8. Manual de operação em língua portuguesa ou inglesa.		
10	MICROFONE BASTÃO SEM FIO 10.1. Microfone transmissor com tecnologia sem fio UHF digital; 10.2. Totalmente compatível com item 08; 10.3. Transmissor tipo microfone de mão: 10.3.1. totalmente compatível com receptor especificado no item 08; 10.3.2. Frequência de operação UHF: contida na banda de 470 a 696 MHz; 10.3.3. Potência de transmissão: 10 mW 10.3.4. Largura de banda de RF: de 56 a 64 MHz 10.3.5. Número de canais: 60; 10.3.6. Intervalo do Passo da Sintonia de RF: 25 kHz; 10.3.7. Distância de operação: 100 m; 10.3.8. Latência: < 3 ms; 10.3.9. possui chave de "mute"; 10.3.10. Varredura de Canal de RF: automática; 10.3.11. Resposta de frequência: 20Hz a 20KHz; 10.3.12. Carcaça em metal; 10.3.13. Método de sincronização com a estação receptora: IR ou <i>bluetooth</i>; 10.3.14. Autonomia com baterias alcalinas: mínimo de 9 horas a 10 mW; 10.3.15. Display/indicadores: indicação de <i>mute</i> e sincronismo; 10.3.16. Cápsula: dinâmico; 10.3.17. Diagrama de captura: Cardioide; 10.3.18. Cor: preta; 10.4. Alimentação: Bateria específica do próprio fabricante e/ou 02 (duas) baterias tipo AA, de 1,5V; 10.5. Acessórios: 10.5.1. Incluso 01 (uma) antena de ¼ de onda, totalmente compatível, para cada unidade transmissora; 10.6. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, firmwares, softwares e entre outros; 10.7. Manual de operação em língua portuguesa ou inglesa.	SENNHEISER	EW-DP 835 SET Q1-6 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
11	BATERIA PARA MICROFONE 11.1. Bateria para unidades de microfones sem fio, totalmente compatíveis com modelos e fabricantes	SENNHEISER	BA70 + ACESSÓRIOS,

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	dos itens 09 e 10; 11.2. Bateria recarregável de: íon de lítio; 11.3. Tensão nominal: 3,7 V a 3,8 V; 11.4. Capacidade nominal mínima: 1320 mAh; 11.5. Totalmente compatível com carregador do próprio fabricante		EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
12	CARREGADOR DE BATERIA 12.1. Carregador de bateria para microfone sem fio, totalmente compatível com modelo e fabricante especificado nos itens 09, 10; 12.2. possibilita recarrega com acoplamento direto de até 02 unidades transmissoras; 12.3. Total compatibilidades com baterias fornecidas no item 11 (baterias); 12.4. Tempo de carga total: 03 horas ou menos; 12.5. Capacidade de recarga simultânea de 02 baterias; 12.6. Alimentação de energia: AC 100 - 240 V, 50/60 Hz; 12.7. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, fontes, licenças, módulos, entre outros; 12.8. Manual de operação em língua portuguesa ou inglesa.	SENNHEISER	CHG 70N + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
13	UNIDADE DE CAPTURA 13.1. Unidade modular de mesa; 13.2. Entrada de sinal: HDMI 1080p / 60fps; 13.3. Entrada de áudio: embutido no sinal de vídeo; 13.4. Saída de vídeo (USB 3.0): 1080p / 60fps não comprimido; 13.5. Compatibilidade com sistema operacional: Windows 10 e MacOS; 13.6. Conectividade com microcomputador/notebook: USB 3.0; 13.7. Possibilita alimentação via USB 3.0 ou será fornecido fonte de alimentação de tensão AC de 100 a 240Vac 50/60Hz; totalmente compatível com item fornecido; 13.8. Acessório: Fornecer cabo USB 3.0, de 1 metro, totalmente compatível com conversor fornecido; 13.9. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos, acessórios, fontes, firmwares, softwares, entre outros; 13.10. Manual de operação em língua portuguesa ou inglesa.	AJA	U-TAP-HDMI + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
14	DISTRIBUIDOR HDMI 14.1. Entrada: 01 (uma) entrada HDMI 2.0;	INTELBRAS	VEX 3004 +

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	14.2. Saídas: 04 (quatro) saídas HDMI 2.0; 14.3. Resolução suportada: 4Kx2K@60Hz; 14.4. Conformidade HDCP: HDCP 1.4 e HDCP 2.2; 14.5. Largura de banda: 18 Gbps; 14.6. Tensão de alimentação: 100-240VAC, 60Hz, direta ou através de adaptador, totalmente compatível com item fornecido; 14.7. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, fontes, firmwares, softwares, entre outros; 14.8. Manual de operação em língua portuguesa ou inglesa.		ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
15	TELA DIGITALIZADORA 15,6" 15.1. Tamanho da tela: 15,6 polegadas (medida na diagonal); 15.2. Área ativa: 344 x 194 mm (variação de ± 2mm); 15.3. Relação de aspecto: 16:9; 15.4. Resolução: 1920 x 1080 @ 60 Hz (<i>Full HD</i>); 15.5. Tecnologia da tela: IPS; 15.6. Ângulo de visão: 178°, ou -89° a +89°, horizontal e vertical; 15.7. Tempo de resposta: 30 ms; 15.8. Relação de contraste: 1000:1; 15.9. Brilho mínimo: 200 cd/m²; 15.10. Caneta de pressão é fornecida, com as seguintes características: 15.10.1. A caneta funciona sem fio e/ou pilhas (ressonância eletromagnética); 15.10.2. Resolução da caneta: 5080 LPI; 15.10.3. Níveis de pressão da caneta (sensibilidade): 8192; 15.10.4. São fornecidas pelo menos dez pontas de reposição compatíveis; 15.10.5. Ângulo de inclinação da caneta suportado: 60 graus; 15.11. É compatível com Windows 10 ou versão superior; 15.12. Interface de conexão: USB; 15.13. É fornecido cabo ou adaptador que permita a conexão da mesa em uma porta USB-A no computador; 15.14. Tensão de alimentação: 100-240VAC, 60Hz, totalmente compatível com item fornecido; 15.15. São fornecidos todos os acessórios necessários à operação imediata, como cabos, fontes, firmwares, licenças, softwares, dentre outros; 15.16. Manual de operação em língua portuguesa ou inglesa.	WACON	CINTIQ 16 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO

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16	BOLSA PROTETORA 16.1. Compatível com a tela digitalizadora especificada no item 12; 16.2. Fechamento em zíper; 16.3. Revestimento interno macio para proteção da tela (nylon ou tecido resistente a água com forro); 16.4. Bolsos para armazenamento de acessórios (canetas, cabos, dentre outros);	WACON	ACK52702 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
17	NOBREAK 17.1. Nobreak (UPS) interativo senoidal; 17.2. Potência de saída (RMS): ≥ 2200 W; 17.3. Tensão entrada: AC 180 a 240V – 50/60 Hz; 17.4. Tensão saída: AC 115 a 120V – 50/60 Hz; 17.5. Forma de onda: Senoidal pura; 17.6. Fator de potência de saída: ≥ 0.8 ; 17.7. Filtro de linha interno; 17.8. Conexão de entrada: Plugue NBR 14136; 17.9. Conexão de saída: 08 tomadas NBR 14136; 17.10. Possui internamente banco de baterias seladas; 17.11. Tempo de autonomia: ≥ 13 minutos, com 50% de carga total; 17.12. Fusível de proteção; 17.13. possui microprocessador; 17.14. Sinalizações das principais condições de operação do nobreak: LDC ou/ e Led; 17.15. Alarme sonoro; 17.16. Botão liga/desliga, com temporizador (evita desligamentos acidentais); 17.17. Porta Gerenciamento: USB; 17.18. possui as seguintes proteções para a carga: 17.18.1. Queda de rede (<i>Blackout</i>) 17.18.2. Sobretensão de rede elétrica 17.18.3. Subtensão de rede elétrica 17.18.4. Surtos de tensão na rede 17.19. Acessório: Fornecido para cada nobreak uma régua de AC, com entrada de 220V, 20A e no mínimo 06 (seis) saídas NBR 14136 de 10A; 17.20. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, baterias internas inclusas, cabos, entre outros; 17.21. Manual de operação em língua portuguesa ou inglesa.	SMS	ATRIUM 2200 VA + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
18	MATRIZ HDMI 4X2 18.1. Matriz de vídeo HDMI 4x2;	WYRESTORM	EXP-MX-0402-H2 +

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	18.2. Possui 4 (quatro) entradas HDMI-A fêmea; 18.3. Possui 2 (duas) saídas HDMI-A fêmea; 18.4. Padrão: Suporta HDMI 2.0 e HDCP 2.2 18.5. Suporta resolução de vídeo até 4K (30Hz/60Hz) (4:4:4); 18.6. Compatível com: HDS, DTS e <i>Dolby Digital</i> (ou <i>Dolby Atmos</i>); 18.7. Alimentação de tensão AC direta ou através de adaptador AC de 100 a 240 VAC 50/60Hz, totalmente compatível com item fornecido; 18.8. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos, fontes, entre outros; 18.9. Manual de operação em língua portuguesa ou inglesa.		ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
19	APRESENTADOR SEM FIO 19.1. Controle remoto para apresentações; 19.2. Possui apontador laser vermelho; 19.3. Possui teclas de avanço e retorno de slides; 19.4. Deve possuir receptor com conexão tipo USB-A; 19.5. O sistema (controle remoto e receptor) deve operar em 2.4 GHz; 19.6. tem alcance da rede sem fio (wireless) de pelo menos 10 metros; 19.7. Compatível com sistema operacional Windows 10 e superior, 19.8. compatível com MS PowerPoint; 19.9. Funcionar como plug-and-play no Windows, bastando conectar na porta USB sem necessidade de configurações adicionais; 19.10. É alimentado por pilha AAA ou bateria própria (inclusa); 19.11. Acessório: 19.11.1. Fornecido 8 pilhas alcalinas tipo AAA de 1,5V para cada apresentador fornecido; 19.12. São fornecidos todos os acessórios necessários à operação imediata, tais como modulo receptores, drivers, entre outros; 19.13. Manual de operação em língua portuguesa ou inglesa.	LOGITECH	R500S + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
20	CABO HDMI 2.1 FIBRA ÓPTICA 30M 20.1. Cabo HDMI adequado para alta taxa de transferência, com dois conectores macho HDMI-A; 20.2. Cabo HDMI 2.1; 20.3. Cabo HDMI com tecnologia de fibra óptica; 20.4. Suporta HDR Dinâmico 20.5. Cabo possui tamanho mínimo de 30 (trinta)	CIRILO CABOS	906320 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO

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	metros; 20.6. Suporta resolução 8K; 20.7. Taxa de transferência: 48Gbps;		FUNCIONAMENTO DA SOLUÇÃO
21	CABO DE REDE 21.1. Cabo de rede U/UTP; 21.2. Categoria: CAT 6; 21.3. Aplicação: uso interno; 21.4. Quantidade de Pares: 4 pares; 21.5. Bitola: 24 AWG ou 23 AWG;; 21.6. Cor: diferente de azul, amarelo ou vermelho; 21.7. Cada caixa conte 305 metros ou mais; 21.8. Classe de flamabilidade NBR 14705 CM de acordo com a IEC60332-3; 21.9. Certificação ANATEL; 21.10. Atender as normas: ANSI/TIA-568.2-D; NBR 14703; NBR 14705; ISO/IEC 11801; IEC 60332; 21.11. Suporte a PoE+;	FURUKAWA	23400174 CABO ELET. SOHOPLUS U/UTP 24AWGX4P CAT.6 CMX + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
22	CONECTOR PARA CABO DE REDE 22.1. Conector RJ-45 macho; 22.2. Material do Corpo do Produto: Termoplástico não propagante a chama UL 94V-0 22.3. Específico para o uso em cabo de rede categoria CAT6; 22.4. Aplicação em cabo tipo U/UTP; 22.5. Compatível com cabos de diâmetro do condutor entre 23 a 26 AWG; 22.6. Cor: Transparente; 22.7. Normas aplicáveis: 22.7.1. NBR 14565, 22.7.2. IEC 60603-7 ou ANSI/TIA-1096A (FCC Part 68); 22.7.3. Diretiva RoHS 22.8. Acessórios: 22.8.1. Para cada unidade de conector RJ-45 será fornecida 01 (uma) unidade de capa protetora na cor diferente de azul, amarelo ou vermelho;	FURUKAWA	35050282 ET02155 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
23	CABO XLR PARA XLR 23.1. Cabo balanceado adequado para o uso de microfones; 23.2. Cabo possui tamanho mínimo de 1 metro; 23.3. Bitola do fio: 24 AWG; 23.4. Blindagem trançada: ≥ 95%; 23.5. Possui conector XLR 3 (três) pinos macho; 23.6. Possui conector XLR 3 (três) pinos fêmea;	SANTO ANGELO	CUSTOMIZADO SASL3FNN01/SASL3MNN01 10 METROS + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO

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24	CABO HDMI PARA HDMI DE 10 METROS 24.1. Cabo HDMI adequado para alta taxa de transferência, com dois conectores macho HDMI-A; 24.2. Cabo HDMI 2.0 e compatível com versões 1.4, 1.3b, 1.3; 24.3. Cabo possui tamanho mínimo de 10 metros; 24.4. Suporta resolução 4K 2160p ou 4K60Hz; 24.5. Taxa de transferência mínima: 10.2 Gbps à 340 MHz;	CIRILO CABOS	182230 + ACESSÓRIOS, EQUIPAMENTOS, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
25	CABO HDMI PARA HDMI DE 5 METROS 25.1. Cabo HDMI adequado para alta taxa de transferência, com dois conectores macho HDMI-A; 25.2. Cabo HDMI 2.0 e compatível com versões 1.4, 1.3b, 1.3; 25.3. Cabo possui tamanho mínimo de 5 metros; 25.4. Suporta resolução 4K 2160p ou 4K60Hz; 25.5. Taxa de transferência mínima: 10.2Gbps a 340 MHz;	CIRILO CABOS	182225 + ACESSÓRIOS, EQUIPAMENTOS, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
26	EMENDA HDMI PARA HDMI 26.1. Emenda HDMI com duas entradas HDMI-A padrão fêmea; 26.2. Suporta resolução 4K;	CIRILO CABOS	906564 + ACESSÓRIOS, EQUIPAMENTOS, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
27	CABO USB-A PARA USB-B 27.1. Conector 1: USB tipo A macho; 27.2. Conector 2: USB tipo B macho; 27.3. Compatível com USB 2.0 ou superior; 27.4. Banda passante: 480 Mbps; 27.5. Cabo possui comprimento mínimo de 1 metro;	CIRILO CABOS	241956 + ACESSÓRIOS, EQUIPAMENTOS, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
28	CABO EXTENSOR USB-A DE 10 METROS 28.1. Cabo extensor USB-A amplificado; 28.2. Possui um conector USB-A macho; 28.3. Possui um conector USB-A fêmea; 28.4. Cabo possui tamanho mínimo de 10 metros; 28.5. Compatível com USB 2.0 a anteriores;	CIRILO CABOS	801026 + ACESSÓRIOS, EQUIPAMENTOS, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
29	CABO USB-C PARA HDMI DE 4 METROS 29.1. Cabo USB-C macho para HDMI-A macho; 29.2. Cabo possui tamanho mínimo de 4 metros;	STARTECH	CDP2HDM5MH + ACESSÓRIOS,

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	29.3. Cabo padrão HDMI 2.0; 29.4. Suporta HDCP 2.2; 29.5. Resolução suportada: 4K60;		EQUIPAMENTOS, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
30	ADAPTADOR HDMI PARA DVI 30.1. Adaptador de sinais HDMI/DVI; 30.2. Possui conector DVI-D Macho; 30.3. Possui conector HDMI-A fêmea; 30.4. Compatível com DVI-D <i>dual-link</i> ;	CIRILO CABOS	242200 + ACESSÓRIOS, EQUIPAMENTOS, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
31	CONVERSOR ATIVO 31.1. Conversor ativo de sinais HDMI/VGA; 31.2. Compatível com HDMI 1.3, HDCP 1.4; 31.3. Possui entrada de sinal em conector HDMI-A fêmea; 31.4. Possui saída de sinal em conector VGA fêmea; 31.5. Resolução de saída VGA: suporta 1920 x 1080@60Hz; 31.6. Fornecido a fonte de alimentação de tensão AC de 100 a 240Vac 50/60Hz, totalmente compatível com equipamento fornecido no item; 31.7. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos, acessórios, fontes, firmwares, softwares, entre outros; 31.8. Manual de operação em língua portuguesa ou inglesa.	CABLETRONIX	CT-HD/VGA-CONV-V2 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
32	LÃ PARA ISOLAMENTO METROS QUADRADOS 32.1. Manta para isolamento acústica; 32.2. Tipo de material: Lã de PET; 32.3. Material é auto-extinguível; 32.4. Largura: 600 mm; 32.5. Espessura: 50 mm; 32.6. Densidade: $\geq 7\text{Kg/m}^3$; 32.7. Área total: 40 m 2;	TRISOFT	IE50 + ACESSÓRIOS, EQUIPAMENTOS, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
33	BANDA ACÚSTICA 40 METROS 33.1. Fita própria para isolamento acústica em sistemas <i>drywall</i> ; 33.2. Material: de polietileno expandido; 33.3. Largura: 48 a 60 mm; 33.4. Espessura: 3 a 5 mm; 33.5. Comprimento: 40 m;	PLACO	48MM + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO

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			FUNCIONAMENTO DA SOLUÇÃO
34	SWITCH DE REDE 24 PORTAS 34.1. Portas PoE: 24 portas 100/1000 Mb/s, Gigabit Ethernet (RJ45), com PoE+; 34.2. Uplink: 2 portas SFP; 34.3. Gerência: <i>Layer 2</i> e <i>Layer 3</i>; 34.4. Funcionalidades: 34.4.1. Capacidade de ligar/desligar POE, definida por usuário; 34.4.2. Capacidade de desligar o EEE (<i>Energy Efficient Ethernet</i>) e outros recursos de economia de energia de cada porta individualmente; 34.4.3. Permite criação de VLANs; 34.4.4. Suporta qualidade de serviço (QoS) DiffServ (DSCP); 34.4.5. <i>Non-blocking</i>; 34.4.6. é switch <i>layer 3</i> (camada 3), atua na camada 2 e 3 do modelo OSI; 34.5. Padrões IEEE: 802.3af e 802.3at; 34.6. Throughput total: ≥ 48 Gbps; 34.7. Capacidade de potência total de alimentação PoE+: $\geq 300W$; 34.8. Padrão rack, 1RU; 34.9. Tensão de alimentação: 100-240VAC; 34.10. Acessórios: Todos acessórios necessários para montagem em rack; 34.11. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, fontes, firmwares, softwares e etc; 34.12. Manual de operação em língua portuguesa ou inglesa.	D-LINK	DGS-3130-30PS + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
35	ESTAÇÃO DE TRABALHO 35.1. Processador: 35.1.1. Arquitetura de 64 bits; 35.1.2. Processador com no mínimo 6 (seis) núcleos físicos e 12 <i>threads</i> (linhas de execução); 35.1.3. Frequência mínima do <i>clock</i> de 2,0 GHz; 35.1.4. Processador lançado no mercado a partir do primeiro trimestre de 2022 (Q1'22); 35.1.5. Possui recurso de <i>turboboost</i> com clock máximo $\geq 4,0$ GHz; 35.1.6. Memória <i>cache</i> de 16 MB no mínimo; 35.1.7. Deve possuir placa de vídeo integrada; 35.1.8. Suporte à virtualização de CPU; 35.1.9. O processador esta e se manterá em linha de produção por pelo menos 90 (noventa) dias após a publicação do edital.	DELL + NVIDIA + INTEL	Torre Precision 3660 + Placa gráfica Intel UHD 770 + Placa de vídeo NVIDIA GeForce RTX 3070 + Processador 13ª geração Intel® Core™ i7-13700 (16-

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35.2. Memória: 35.2.1. Memória RAM de 16 GB (dezesseis gigabytes) pelo menos, do tipo DDR4-3200 ou superior; 35.3. Placa Principal: 35.3.1. compatível com o processador solicitado obedecendo às seguintes características: 35.3.1.1. do mesmo fabricante do computador ou fabricada sob sua especificação para uso exclusivo (OEM, homologado pelo fabricante do computador). 35.3.1.2. Possui suporte a velocidades de barramento de sistema (<i>system bus</i>) compatíveis com o processador e com a memória solicitada; 35.3.1.3. Possui BIOS com suporte a UEFI; 35.3.1.4. compatível com Windows 11 Pro, 64 bits, ou superior; 35.3.1.5. Possui tecnologia de segurança TPM (<i>Trusted Platform Module</i>), versão 2.0 ou superior, integrado à placa principal; 35.3.1.6. Para a implementação e uso dos recursos que o TPM possui, em conjunto com o sistema de segurança oferecido, deverão ser fornecidos todos os programas de computador necessários para a utilização destas tecnologias. 35.4. BIOS/UEFI 35.4.1. Considerando a necessidade de cadastramento patrimonial dos equipamentos, bem como a ativação do sistema operacional via <i>hardware</i> de forma automática, o BIOS dos produtos obedece às seguintes características: 35.4.1.1. possui campo apropriado para a gravação de informações patrimoniais (<i>Asset Tag</i>); 35.4.1.2. Permite a colocação de no mínimo 15 (quinze) caracteres, composto do endereço lógico e patrimônio, no campo <i>Asset Tag</i>; 35.4.1.3. compatível com a tecnologia OEM 3.0, possuindo a chave de ativação do Windows gravada na mesma, para que o Windows possa ser ativado automaticamente; 35.4.2. Além das características citadas acima, o BIOS atende ao que segue: 35.4.2.1. lançado a partir de 2018 e entregue na versão mais atual disponibilizada pela fabricante; 35.4.2.2. desenvolvido pelo próprio fabricante do equipamento, ou com direitos de <i>copyright</i>, garantindo que o fabricante possui direito de livre edição do BIOS, com capacidade de implementar atualizações e correções de segurança, informando o	cores, 24 threads, cache de 30 MB, 2.10 GHz a 5.20 GHz Turbo, 65 W) + Windows 11 Pro + Memória-16GB DDR5 ECC (1x16G) 4400 MT/s + ARMAZENAMENTO-SSD M.2 512GB PCIe NVME™ Classe 40 + Disco rígido SATA de 3.5", 1TB e 7200rpm + Cooler de Ar de CPU Avançado + Teclado multimídia Dell KB216, preto, em Português (Brasil), ABNT2 + Mouse óptico Dell - MS116 (preto) + CHASSIS Precision 3660 Tower with 500W (80 Plus Platinum) PSU, RPL and
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modelo e a versão da mesma. Caso o BIOS seja ofertado em regime de <i>copyright</i>, o fabricante do BIOS deverá atestar que o fabricante do equipamento possui livre direito de edição sobre o mesmo, garantindo assim adaptabilidade e manutenibilidade do conjunto adquirido; 35.4.2.3. Possui sistema de autorrecuperação em caso de falha, restabelecendo o BIOS a partir de uma cópia segura disponível no próprio equipamento; 35.4.2.4. Suporta o recurso WOL (<i>Wake on LAN</i>) e PXE (<i>Pré-boot Execution Environment</i>); 35.4.2.5. Suporta ACPI 2.0 (<i>Advanced Configuration and Power Interface</i>) com controle automático de rotação do ventilador da CPU; 35.4.2.6. Suporta a tecnologia de provisão/contingenciamento de falhas de disco rígido S.M.A.R.T; 35.4.2.7. Possui a funcionalidade de salvar as configurações do BIOS e recuperação posterior; 35.4.2.8. Suporta atualizações remotas via software; 35.4.3. O fabricante do equipamento deverá disponibilizar todas as atualizações de BIOS, inclusive com versões anteriores, permitindo assim a escolha pelo upgrade ou downgrade. 35.5. Gerenciamento <i>Out-Of-Band</i> (OOBM): 35.5.1. O equipamento entregue permite, por meio de código de acesso ou senha, acessar e controlar o vídeo, o mouse e o teclado dos usuários, dando acesso gráfico também ao BIOS e ao POST da máquina, independentemente do estado ou versão do sistema operacional, através de protocolo TCP/IP. Todo o hardware necessário para suporta esta funcionalidade (placa principal, placa de rede e processador) também fazem parte do escopo de contratação; 35.5.2. A tecnologia de gerenciamento remoto sinaliza enquanto o equipamento estiver sendo acessado remotamente pelo gerenciamento <i>out-of-band</i>; 35.5.3. As configurações das funcionalidades de gerenciamento presentes na placa principal deverão poder ser feitas sem a necessidade de intervenção presencial junto à máquina; 35.6. Unidades de armazenamento: 35.6.1. O equipamento será entregue com uma unidade de disco de estado sólido (SSD do tipo M.2) para o sistema operacional e aplicativos dos usuários, conectado diretamente à placa principal através de		ADL Compatible + Placa de rede Intel I225 + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
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interface do tipo PCI-e NVMe. Esta unidade d=terá capacidade mínima de 512 GB (Quinhentos e doze Gigabytes) e desempenho mínimo de 2000 MB/s para leitura sequencial e de 1000 MB/s para gravação sequencial. 35.6.2. O equipamento irá com um segundo dispositivo de armazenamento interno instalado, padrão SATA 3.0 ou superior, com capacidade mínima de 1 TB (um terabyte) e desempenho mínimo de 500 MB/s para leitura e gravação sequencial; 35.7. A controladora de vídeo: 35.7.1. Possui placa de vídeo dedicada com as seguintes características: 35.7.1.1. Mínimo de 6 GB de memória VRAM GDDR6; 35.7.1.2. Largura de barramento de memória de 192 bits; 35.7.1.3. Velocidade mínima de 14 Gbps; 35.7.1.4. GPU <i>Clock</i> mínimo de 1,5 GHz; 35.7.2. Possui pelo menos 2 (dois) conectores para monitor de vídeo externo sendo HDMI ou DisplayPort; 35.7.3. Possui suporte a DirectX 12 ou superior; 35.7.4. capaz de suporta a operação do software (suíte) OBS Studio para gravação e transmissão simultâneas na resolução 1080p/60Hz; 35.8. Comunicação: 35.8.1. O equipamento entregue possui 02 (duas) interfaces de rede local Ethernet, integrada, LAN – 100/1000 Mbps, “AUTONSENSING”, com interface UTP RJ-45 fêmea; 35.8.2. Não serão aceitos dispositivos do tipo USB, PCMCIA, EXPRESS CARD ou similares. 35.9. Conexões externas mínimas integradas: 35.9.1. O equipamento entregue possui, pelo menos, 6 (seis) portas padrão USB (Universal Serial Bus), integradas ao gabinete, sendo: 35.9.1.1. No mínimo 4 (quatro) portas de padrão USB 3.x ou superiores; 35.9.1.2. Ao menos uma das portas de padrão USB 3.x será do tipo USB-C; 35.9.2. O equipamento entregue permite a conexão de fones de ouvido e/ou microfones, obedecendo às características: 35.9.2.1. possui ao menos 1 (um) conector de entrada para microfone; 35.9.2.2. possui ao menos 1 (um) conector de saída de áudio; 35.9.2.3. Os conectores de entrada de microfone e		
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saída de áudio, referidos acima, podem ser substituídos por um do tipo combo; 35.9.3. O equipamento entregue possui ao menos 2 (duas) portas RJ-45 para Ethernet. 35.10. O equipamento será entregue com: 35.10.1. Gabinete 35.10.1.1. O gabinete possui sistema de resfriamento, monitorado pelo BIOS, dimensionado para perfeita refrigeração dos componentes internos; 35.10.1.2. O gabinete possui um botão de acionamento (liga/desliga), além de LEDs indicadores de funcionamento (power on) e de atividade da unidade de armazenamento; 35.10.1.3. O equipamento será em graduação da cor preta ao cinza, uma cor ou combinação dessas; 35.10.2. Teclado, obedecendo às características: 35.10.2.1. Acentuação na língua portuguesa, incluindo a cedilha e caracteres especiais; 35.10.2.2. Possui no mínimo 104 teclas; 35.10.2.3. Possui total compatibilidade com o padrão ABNT2; 35.10.2.4. A impressão sobre as teclas é do tipo permanente, não podendo apresentar desgaste por abrasão ou uso prolongado; 35.10.2.5. A conexão do teclado ao computador é com fio na porta USB; 35.10.2.6. inclui teclado numérico destacado, disposto à direita do periférico; 35.10.2.7. segue o mesmo padrão de cores do gabinete; 35.10.3. Mouse 35.10.3.1. O equipamento será entregue com 1 (um) mouse com fio conectado na porta USB; 35.10.3.2. segue o mesmo padrão de cores do gabinete; 35.11. Alimentação elétrica: 35.11.1. O equipamento será entregue com fonte de alimentação bivolt automática de 100-240 volts, 50-60 Hz com potência suficiente para seu perfeito funcionamento, considerando todos os componentes instalados conforme especificado neste item. 35.12. Requisitos de segurança: 35.12.1. O equipamento entregue possui mecanismo de controle de acesso ao interior do gabinete, por meio do uso de cadeado ou travas de segurança (padrões kensington, wedge dentre outros); 35.12.2. O equipamento entregue possui mecanismo de fixação do equipamento ao mobiliário;		
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35.12.3. Os mecanismos de segurança física anteriores fazem parte da estrutura do gabinete do computador, originais de fabricação. 35.12.4. Os mecanismos de segurança física anteriores são entregues com todos os acessórios necessários, como cabos, cadeados, parafusos, chaves, dentre outros; 35.13. Sistema operacional e programas: 35.13.1. Será apresentado todos os drivers e programas necessários ao funcionamento dos componentes dos equipamentos, acompanhados de instruções de instalação; 35.13.2. Os equipamentos serão fornecidos licenciados para o sistema operacional da Microsoft, Windows 11 Pro (ou mais recente), 64 bits, em português do Brasil, com sua chave de ativação gravada no BIOS; 35.13.3. Os equipamentos serão entregues com uma imagem de disco padrão instalada em todas as unidades. Esta imagem será elaborada pelo contratante em equipamento modelo fornecido previamente; 35.14. Requisitos de documentação: 35.14.1. É obrigatória a apresentação da documentação original do fabricante de todos os componentes ofertados na proposta técnica, em inglês e/ou português, incluindo manuais de operação, instalação e configuração, que possam atestar as características técnicas; 35.14.2. Entenda-se como documentação original do fabricante toda a informação disponibilizada pelo fabricante em seu sítio na internet referente aos equipamentos ofertados; 35.14.3. Os itens que não puderem ser comprovados através da análise da amostra, da documentação do fabricante, ou sítios da Internet, serão motivo de diligência ou enviados para laboratório especializado. 35.15. Requisitos de compatibilidade: 35.15.1. Todos os componentes, drivers e programas serão compatíveis entre si e com o sistema operacional entregue. 35.16. Outros requisitos: 35.16.1. Todos os equipamentos a serem entregues serão idênticos, ou seja, todos os componentes externos e internos com os mesmos modelos e marca dos utilizados nos equipamentos enviados para avaliação/homologação; 35.16.2. O fabricante do equipamento garante que		
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	todos os componentes do produto sejam novos (sem uso, reforma ou recondicionamento) e que não estejam fora de linha de fabricação por pelo menos 90 (noventa) dias após a publicação do edital; 35.17. Critério sustentável: o equipamento possui certificação de conformidade sustentável de acordo com os padrões: Energy Star (obrigatório) e WEEE (Waste Electrical and Electronic Equipment) ou Lei nº 12.305/2010, art. 33 (Política Nacional de Resíduos Sólidos, Logística Reversa);		
36	MONITOR PARA ESTAÇÃO 36.1. Monitor com tamanho de tela de: 21 a 23 polegadas; 36.1.1. Resolução: Full HD (1920 x 1080) ou superior; 36.1.2. Relação de aspecto: 16:9; 36.1.3. Brilho típico: $\geq 250 \text{ cd/m}^2$; 36.1.4. Relação de contraste: $\geq 3000:1$; 36.1.5. Ângulo de visão (horizontal / vertical): 178/178; 36.1.6. Profundidade de cores mínima é de 16,7 milhões; 36.2. possui conectividade de entrada: HDMI e DisplayPort; 36.3. Taxa de atualização: $\geq 75 \text{ Hz}$; 36.4. Tempo de resposta GtG (cinza-cinza rápido): $\leq 5 \text{ ms}$; 36.5. A base do suporte dos monitores permite ajuste de altura ergonômico; 36.6. Alimentação de energia: AC 100 - 240 V, 50/60 Hz; 36.7. Acessórios: 36.7.1. São fornecidos todos os cabos para conexão com a estação de trabalho especificada no item 35; 36.8. Critério sustentável: o equipamento possui certificação de conformidade sustentável de acordo com os padrões: Energy Star (obrigatório) e WEEE (Waste Electrical and Electronic Equipment) ou Lei nº 12.305/2010, art. 33 (Política Nacional de Resíduos Sólidos, Logística Reversa); 36.9. São fornecidos todos os acessórios necessários à operação imediata, tais como cabos acessórios, licenças, base, parafusos, entre outros; 36.10. Manual de operação em língua portuguesa ou inglesa.	LG	22BN550Y-B.AWZM + ACESSÓRIOS, EQUIPAMENTOS, LICENÇAS, SOFTWARES, MATERIAS E QUAISQUER ITENS NECESSÁRIOS AO PERFEITO FUNCIONAMENTO DA SOLUÇÃO
37	SERVIÇO DE INSTALAÇÃO	COPERSON	COPERSON
38	TREINAMENTO	COPERSON	COPERSON
39	SUPORTE MENSAL	COPERSON	COPERSON

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CONDIÇÕES GERAIS DA PROPOSTA:

- **VALIDADE DA PROPOSTA:** PROPOSTA VÁLIDA SOMENTE POR 60 (SESSENTA) DIAS;
- **PRAZO DE ENTREGA:** MATERIAIS E EQUIPAMENTOS REFERENTES AOS ITENS 32 E 33: 30 (TRINTA) DIAS CORRIDOS; MATERIAIS E EQUIPAMENTOS REFERENTES AOS DEMAIS ITENS (1 A 31 E 34 A 36): 120 (CENTO E VINTE) DIAS CORRIDOS; AMBOS CONTADOS DA DATA DE CELEBRAÇÃO DO CONTRATO.
- **PRAZO DE EXECUÇÃO:**

3.4.2 – SERVIÇOS DE INSTALAÇÃO (ITEM 37): NO MÁXIMO, 5 (CINCO) DIAS CORRIDOS, A CONTAR DA DATA DA EMISSÃO DA ORDEM DE SERVIÇO PARA EXECUÇÃO DA INSTALAÇÃO; INÍCIO DA INSTALAÇÃO EM ATÉ 10 (DEZ) DIAS CORRIDOS A CONTAR DA DATA DE RECEBIMENTO PROVISÓRIO DOS EQUIPAMENTOS E MATERIAIS, COM CONCLUSÃO EM, NO MÁXIMO, 30 (TRINTA) DIAS CORRIDOS;

3.4.3 – SERVIÇO DE TREINAMENTO (ITEM 38): NO MÁXIMO, 5 (CINCO) DIAS CORRIDOS, A CONTAR DA DATA DA EMISSÃO DA ORDEM DE SERVIÇO PARA EXECUÇÃO DO TREINAMENTO; INÍCIO DO TREINAMENTO EM ATÉ 07 (SETE) DIAS CORRIDOS A CONTAR DA DATA DE FINALIZAÇÃO DO SERVIÇO DE INSTALAÇÃO, COM CONCLUSÃO EM, NO MÁXIMO, 05 (CINCO) DIAS CORRIDOS;

3.4.4 – SERVIÇOS DE SUPORTE E MANUTENÇÃO (ITEM 39): A EXECUÇÃO SE INICIARÁ A CONTAR DA DATA DE RECEBIMENTO DEFINITIVO DOS TODOS MATERIAIS E EQUIPAMENTOS A SEREM FORNECIDOS (ITENS 1 A 36) E DO SERVIÇO DE INSTALAÇÃO A SER PRESTADO.
- **PRAZO DE GARANTIA CONTRA DEFEITOS DE FABRICAÇÃO:** PRAZO DE GARANTIA DAS INSTALAÇÕES, DOS EQUIPAMENTOS E DOS MATERIAIS UTILIZADOS DE, NO MÍNIMO, 12 (DOZE) MESES, A CONTAR DO RECEBIMENTO DEFINITIVO DO OBJETO (FUNCIONAMENTO PLENO DO SISTEMA), CONFORME PARÁGRAFO DÉCIMO DA CLÁUSULA QUARTA DO CONTRATO (ANEXO 3 DO EDITAL).
- **CONDIÇÕES DE PAGAMENTO:** O PAGAMENTO SERÁ EFETUADO PELO CONTRATANTE EM CONFORMIDADE COM AS CONDIÇÕES ESTABELECIDAS NO EDITAL;
- **INCLUSOS TODOS OS CUSTOS, TAIS COMO:** SALÁRIO, ÔNUS TRIBUTARIOS, FISCAIS, PARAFISCAIS, TRABALHISTAS E SOCIAIS, SEGURO TRANSPORTE E, GARANTIA INCLUSIVE A DESMONTAGEM, MONTAGEM E TRANSPORTE DOS



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MATERIAIS PARA FINS DE REPAROS DURANTE O PERÍODO DE GARANTIA E DEMAIS DESPESAS NECESSÁRIAS AO CUMPRIMENTO INTEGRAL DO OBJETO;

- *FORNECEREMOS PARA TODOS OS ITENS TODOS OS EQUIPAMENTOS, MATERIAIS (CABOS, FONTES, CONVERSORES, SUPORTES, CONECTORES, ADAPTADORES, ACESSÓRIOS E ETC.), SERVIÇOS, SOFTWARES E HARDWARES NECESSÁRIOS, SEM CUSTO ADICIONAL, E QUE SEJAM NECESSÁRIOS PARA O PERFEITO FUNCIONAMENTO DA SOLUÇÃO CONFORME EXIGIDO EM EDITAL E SEUS ANEXOS, MESMO QUE NÃO DISCRIMINADOS NO TERMO DE REFERÊNCIA E/OU EM NOSSA PROPOSTA;*
- *TODOS OS EQUIPAMENTOS PROPOSTOS SÃO NOVOS E DE PRIMEIRO USO, FABRICADOS EM SÉRIE, E NÃO SERÃO PRODUZIDOS COM CARACTERÍSTICAS EXCLUSIVAS, MATERIAIS DIFERENCIADOS OU ADAPTAÇÕES FEITAS PARA ADEQUAÇÃO AO TERMO DE REFERÊNCIA, GARANTINDO ASSIM A ASSISTÊNCIA TÉCNICA E REPOSIÇÃO DE PEÇAS COMPATÍVEIS;*

DECLARAÇÃO UNIFICADA

A COPERSON SERVIÇOS E COMERCIO DE PRODUTOS DE INFORMATICA E SEGURANÇA LTDA, inscrita no CNPJ nº **07.648.642/0001-40**, Inscrição Estadual nº **07.471.434/001-86**, sediada na SHCS CR 516, BLOCO B, Nº 69, PAVIMENTO 1, PARTE C0236, CEP: 70.381-525 – ASA SUL, BRASÍLIA-DF, telefone nº **(61) 3346-1869 / (61) 3346-6638**, por intermédio de sua representante legal a **Sra. Bárbara Maia Mundim**, portadora do CPF nº **033.723.221-00** e RG nº **2.742.427 SSP-DF**, DECLARA que:

1. Temos o pleno conhecimento de todas as condições previstas no edital, atendemos aos requisitos de habilitação e que a proposta apresentada está em conformidade com as exigências contidas no edital e em seus anexos;
2. Está ciente de que a apresentação da presente proposta implica na plena aceitação das condições estabelecidas no Edital e seus Anexos.
3. Está ciente da necessidade de apresentação dos documentos de habilitação exigidos, bem como dos critérios de sustentabilidades a serem comprovados e dos demais documentos previstos no Edital.
4. Em caso de divergência da nossa proposta com o edital prevalecerá o edital;
5. Que estamos legalmente estabelecidos e que exploramos ramo de atividade pertinente e compatível com o objeto do Edital e anexos.



PROPOSTA DE PREÇOS Nº 001/2024

6. Que o fornecimento do material ou a prestação do serviço será realizada de acordo com as especificações contidas no edital do pregão e seus anexos;

DECLARAÇÃO DE RESPONSABILIDADE AMBIENTAL

7. Em atendimento à Instrução Normativa nº 01/2010 de 19 de janeiro de 2010, declara, sob as penas da lei, em especial o art. 299 do Código Penal Brasileiro, que:

a) A proponente está ciente de sua responsabilidade ambiental e se compromete em adotar as práticas ecologicamente corretas realizando as seguintes ações: - Descartar o material utilizado (lâmpadas, cartuchos, recipientes de tintas, caixas de papelão), fazendo a separação dos resíduos recicláveis, tendo o cuidado necessário com acondicionamento dos materiais tóxicos: lâmpadas a base de vapor de mercúrio, sódio ou similar, cartuchos e recipientes de tintas e outros, de modo a evitar a evaporação de produtos tóxicos no meio ambiente. - Utilizar papéis originários de áreas de reflorestamento para reprodução de documentos;

b) A empresa reconhece sua responsabilidade com o meio ambiente, adotando todas as medidas necessárias para evitar, atenuar ou reparar os impactos resultantes desta atividade, mantendo-se disponível à fiscalização pelos órgãos responsáveis.

c) Que está plenamente ciente do teor e da extensão desta declaração e que detém plenos poderes e informações para firmá-la.

DECLARAÇÃO DE DISPENSA DE VISTORIA

8. A empresa COPERSON SERVIÇOS E COMÉRCIO DE PRODUTOS DE INFORMÁTICA E SEGURANÇA EIRELI, declara, sob as penalidades da lei, de que tem pleno conhecimento das condições e peculiaridades inerentes à natureza dos serviços previstos no Edital supracitado, assumindo total responsabilidade por esse fato e informando que não poderá alegar desconhecimento de qualquer detalhe, incompreensão, dúvida ou esquecimento que acarretem imprevistos ou gere inconsistências na apresentação da proposta ou nas características e/ou condições requeridas no objeto e não utilizará para quaisquer questionamentos futuros que ensejem avenças técnicas ou financeiras com o órgão contratante, assumindo, incondicionalmente, a RESPONSABILIDADE de executar os serviços em conformidade com todas as condições e exigências estabelecidas nesta licitação.

DECLARAÇÃO DE EPP



PROPOSTA DE PREÇOS Nº 001/2024

9. A empresa **COPERSON SERVIÇOS E COMERCIO DE PRODUTOS DE INFORMATICA E SEGURANÇA LTDA**, DECLARA que é empresa de pequeno porte enquadrada no artigo 34 da Lei nº 11.488, de 2007, cumprindo, assim, os requisitos legais para tal qualificação, nos termos da Lei Complementar nº 123/06, e que não possui quaisquer dos impedimentos da referida norma, estando apta a exercer o direito de tratamento privilegiado na forma prevista pela legislação em vigor.

DECLARAÇÃO DE COMPLIANCE

10. Nós, colaboradores, diretores e proprietários da COPERSON ÁUDIO E VÍDEO, conduzimos os projetos seguindo e aplicando os mais altos padrões de ética e profissionalismo, inseridos num processo de Compliance totalmente rígido e ativo, atuando de forma íntegra e transparente. Faz parte da nossa política de negócios o comprometimento em entregar o melhor aos nossos clientes. Com ênfase, divulgamos nosso Código de Ética e Conduta, estabelecendo políticas e procedimentos voltados ao cumprimento das normas.
- Avaliamos os riscos do negócio e promovemos um relacionamento ético e profissional com nossos clientes, fornecedores, parceiros e colaboradores. Analisamos e ponderamos a reputação, situação administrativa e financeira dos nossos parceiros antes de firmarmos contratos, para que assim, possamos estar alicerçados no mais alto grau de ética e compliance.
- Acreditamos que é nosso direito, como cidadãos, buscar a conquista de mercados, mas não apenas em função de nossa competência profissional, mas também por estarmos engajados e alinhados aos princípios que fortalecem a transparência e a ética, moldando a cada dia uma sociedade mais justa e realizada.

MENOR APRENDIZ

11. Para fins do disposto no inciso "V" Art. 27 da Lei no 8.666, de 21 de junho de 1993, acrescido pela Lei no 9.854, de 27 de outubro de 1999, e do inteiro teor do art. 403 da Consolidação das Leis do Trabalho – CLT, alterado pela Lei nº 10.097, de 19 de dezembro de 2000, que **NÃO EMPREGA MENORES** de 18 (dezoito) anos em trabalho noturno, perigoso ou insalubre e menores de 16 (dezesseis) anos de idade, salvo na condição de aprendiz, a partir de 14 (quatorze) anos. O trabalho de menor não será realizado em locais prejudiciais a sua formação, ao seu desempenho físico, psíquico, moral e social e em horários que não permitam a frequência à escola.

DECLARAÇÃO DE INEXISTÊNCIA DE FATO IMPEDITIVO DE HABILITAÇÃO

12. Cumpre plenamente todos os requisitos de habilitação, nos termos do artigo 4º, inciso VII, da Lei nº 10.520/2002, estando ciente da responsabilidade administrativa, civil e penal, que



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INEXISTEM FATOS IMPEDITIVOS para a nossa habilitação no presente processo licitatório, que estamos cientes da obrigatoriedade de declarar ocorrências posteriores e que não se encontra em processo de Falência ou Concordata.

DECLARAÇÃO DE INIDÔNIEDADE

13. DECLARO, sob as penas da Lei, que a referida empresa não foi declarada inidônea pela Administração Pública e nem por nenhuma entidade do Sistema S, e nem está suspensa ou impedida de licitar ou contratar com a Administração Pública, entidades do Sistema S e demais entes contratantes, não havendo nenhum fato que desabone sua reputação.

DECLARAÇÃO DE ELABORAÇÃO INDEPENDENTE DE PROPOSTA

14. A empresa declara ainda que, sob penas da lei, em especial o art. 299 do Código Penal Brasileiro:

I. A proposta apresentada para participar do presente processo licitatório foi elaborada de maneira independente pela COPERSON ÁUDIO E VÍDEO, e o conteúdo da proposta não foi, no todo ou em parte, direta ou indiretamente, informado, discutido ou recebido de qualquer outro participante potencial ou de fato processo em questão, por qualquer meio ou por qualquer pessoa;

II. A intenção de apresentar a proposta elaborada para participar do presente processo licitatório não foi informada, discutida ou recebida de qualquer outro participante potencial ou de fato do presente processo licitatório, por qualquer meio ou por qualquer pessoa;

III. Que não tentou, por qualquer meio ou por qualquer pessoa, influir na decisão de qualquer outro participante potencial ou de fato do presente processo licitatório quanto a participar ou não da referida licitação;

IV. Que o conteúdo da proposta apresentada para participar do presente processo licitatório não será, no todo ou em parte, direta ou indiretamente, comunicado ou discutido com qualquer outro participante potencial ou de fato do presente processo licitatório antes da adjudicação do objeto da referida licitação;

V. Que o conteúdo da proposta apresentada para participar do presente processo licitatório não foi, no todo ou em parte, direta ou indiretamente, informado, discutido ou recebido de qualquer integrante do presente processo licitatório antes da abertura oficial das propostas; e que está plenamente ciente do teor e da extensão e que detém plenos poderes e informações para firmá-la.

DECLARAÇÃO CONJUNTA

15. A **COPERSON SERVIÇOS E COMERCIO DE PRODUTOS DE INFORMATICA E SEGURANÇA LTDA**, DECLARA, sob as penas da lei:



PROPOSTA DE PREÇOS Nº 001/2024

- a) Que não possui empregados(as) executando trabalho degradante ou forçado, conforme disposto nos incisos III e IV do art. 1º e no inciso III do art. 5º da Constituição Federal de 1988;
- b) Que não possui, em seu quadro societário, cônjuge, companheiro ou parente em linha reta, colateral ou por afinidade, até o terceiro grau, inclusive, dos magistrados ocupantes de cargos de direção ou no exercício de funções administrativas, assim como de servidores ocupantes de cargos de direção, chefia e assessoramento vinculados direta ou indiretamente às unidades da área encarregada da licitação deste órgão, nos termos do art. 2 da Resolução n.º 07, de 18.10.2005, do Conselho Nacional de Justiça.
- c) DECLARA, ainda, sob as penas da lei, que não possui, em seu quadro funcional, cônjuges, companheiros ou parentes em linha reta, colateral ou por afinidade, até o terceiro grau, inclusive, de ocupantes de cargos de direção e de assessoramento, de membros vinculados a este Órgão; e
- d) Declara, por fim, sob as penas da lei, não ter sido condenada, a empresa ou seus dirigentes, por infringir as leis de combate à discriminação de raça ou de gênero, ao trabalho infantil e ao trabalho escravo, conforme previsão dos artigos 1º e 170 da Constituição Federal de 1988; do artigo 149 do Código Penal Brasileiro; do Decreto nº 5.017, de 12 de março de 2004 (promulga o Protocolo de Palermo); das Convenções da OIT nos 29 e 105 e do Guia de Contratações Sustentáveis da Justiça do Trabalho.

Declaro que tenho ciência e concordo com todas as condições estabelecidas no Edital e seus anexos.

**COPERSON SERVIÇOS E COMÉRCIO DE PRODUTOS DE INFORMÁTICA E SEGURANÇA
EIRELI**

(Representante Legal: BÁRBARA MAIA MUNDIM; CPF: 033.723.221-00)



Intel® Ethernet Adapters and Devices User Guide

Release 28.3

December 15, 2023

1. Overview

Welcome to the User Guide for Intel® Ethernet Adapters and devices. This guide covers hardware and software installation, setup procedures, and troubleshooting tips for Intel network adapters, connections, and other devices.

1.1 Intended Audience

This document is intended for information technology professionals with a high level of knowledge, experience, and competency in Ethernet networking technology.

1.2 Supported Operating Systems

The drivers in this release have been tested with the following operating systems (OSs). Additional OSs may function with our drivers but are not tested.



NOTE: Not all devices support all operating systems listed. Refer to the release notes for detailed OS support information for your device.

Microsoft* Windows Server*, Azure Stack HCI, and Windows*

- Microsoft Windows Server 2022
- Microsoft Windows Server 2019, Version 1903
- Microsoft Windows Server 2016
- Microsoft Azure Stack HCI
- Microsoft Windows 11
- Microsoft Windows 10 version 21H2 (build 19044)
- Microsoft Windows 10 RS5, Version 1809 (build 17763)
- Microsoft Windows 10 RS1, Version 1607 (build 14393)



NOTE:

- Devices based on the following do not support Microsoft Windows or Windows Server:
 - Intel® Ethernet Connection E822-C
 - Intel® Ethernet Connection E822-L
- Microsoft Windows 32-bit operating systems are only supported on Intel 1GbE Ethernet Adapters.
- Some older Intel Ethernet adapters do not have full software support for the most recent versions of Microsoft Windows. Many older Intel Ethernet adapters have base drivers supplied by Microsoft Windows.

VMware* ESXi*

- VMWare ESXi 8.0
- VMware ESXi 7.0

Please refer to VMWare's download site for the latest ESXi drivers for Intel® Ethernet® devices.

Linux*

- Linux Real Time Kernel 5.x and 4.x (only on Intel Ethernet E810 Series)
- Linux, v2.4 kernel or higher
- Red Hat* Enterprise Linux* (RHEL) 9.3
- Red Hat Enterprise Linux 8.9
- SUSE* Linux Enterprise Server (SLES) 15 SP5
- SUSE Linux Enterprise Server 12 SP5
- Canonical* Ubuntu* 22.04 LTS
- Canonical Ubuntu 20.04 LTS
- Debian* 11

FreeBSD*

- FreeBSD 14.0
- FreeBSD 13.1

Oracle* Solaris*

- Basic software and drivers are supported on Oracle Solaris. Drivers and support are provided by the operating system vendor.

Discontinued OS Support

NOTE: See "Discontinued Support" on page 156 for information on the last release to support particular versions of an operating system.

1.3 Supported Devices

For help identifying your network device and finding supported devices, click the link below:

<http://www.intel.com/support>

Compatibility Notes

NOTE: Available features and settings are dependent on your device and operating system. Not all settings described in this user guide are available on every device/OS combination.

In addition, note the following limitations for Intel Ethernet devices and connections.

Device Family	Details
Intel Ethernet 800 Series	• Devices based on the Intel® Ethernet Controller E810-C have an expected total throughput for the entire device of 100 Gb/s in each direction if one 100G cable is connected or if two 100G cables are connected. • Devices based on the Intel® Ethernet 800 Series do not support RDMA when operating in multiport mode with more than 4 ports.
Intel Ethernet 700 Series	• Devices based on the Intel® Ethernet Controller XL710 (4x10 GbE, 1x40 GbE, and 2x40 GbE) have an expected total throughput for the entire device of 40 Gb/s in each direction.

	• The first port of Intel® Ethernet 700 Series adapters will display the correct branding string. All other ports on the same device will display a generic branding string. • For an Intel® Ethernet 700 Series adapter to reach its full potential, you must install it in a PCIe Gen3 x8 slot. Installing it in a shorter slot, or a Gen2 or Gen1 slot, will limit the throughput of the adapter. • Devices based on the Intel® Ethernet Controller X722 do not support the following features: • Intel® PROSet for Windows* Device Manager • Intel® Advanced Network Services (Intel® ANS) teams or VLANs (LBFO is supported)
Intel Ethernet 500 Series	• Devices based on the Intel® Ethernet Connection X552 and Intel® Ethernet Connection X553 do not support the following features: • Energy Efficient Ethernet (EEE) • Intel PROSet for Windows Device Manager • Intel ANS teams or VLANs (LBFO is supported) • Data Center Bridging (DCB) • IPSec Offloading • MACSec Offloading In addition, SFP+ devices based on the Intel Ethernet Connection X552 and Intel Ethernet Connection X553 do not support the following features: • Speed and duplex auto-negotiation • Wake on LAN • 1000BASE-T SFP Modules

1.4 Related Documentation

The following files are available in the download for this software release.

Document	Description	Location
readme.txt	Release-specific information	Root folder of software download package
license.pdf	Licenses pertaining to this software release	Root folder of software download package

You can find additional resources, configuration guides, and technical documentation for Intel Ethernet products on the [Intel Resource & Documentation Center](#). Some documents may require a login.

1.4.1 Release Notes

Release notes for this software release are available on the [Intel Resource & Documentation Center](#). Please see the following document for details about new or removed features, supported operating systems per device family, and known issues and limitations:

- [Intel® Ethernet Controller Products Release Notes](#)

1.4.2 User Guides for Specific Devices

Some adapters and devices have user guides with detailed configuration and setup information. You can access public versions of these documents in the [Intel Resource & Documentation Center](#).

Refer to the following documentation for advanced configuration.

Type of Document + Link	Affected Products
User guide	Intel® Ethernet Network Adapter E810-XXV-4T
User guide	Intel® Ethernet Network Adapter E810-C-Q2T

1.4.3 Feature Support Matrix

See the following documents for additional details on supported features, cables, media types, operating systems, and more.

Device Family	Available Documents
Intel Ethernet 800 Series	Intel® Ethernet Controller E810 Feature Support Matrix
Intel Ethernet 700 Series	Intel® Ethernet Controller X710/XXV710/XL710 Feature Support Matrix Intel® Ethernet Connection X722 Feature Support Matrix Intel® Ethernet Controller X710-TM4/AT2 and V710-AT2 Feature Support Matrix
Intel Ethernet 500 Series	Intel® Ethernet Controller X550 Feature Support Matrix

1.5 Customer Support

Intel support is available on the web or by phone. Support offers the most up-to-date information about Intel products, including installation instructions, troubleshooting tips, and general product information.

1.5.1 Web and Internet Sites

Support: <http://www.intel.com/support>

Corporate Site for Network Products: <http://www.intel.com/products/ethernet/overview.htm>

Intel Wired Networking project hosted by Sourceforge: <http://sourceforge.net/projects/e1000>

2. Installation

This chapter covers how to install Intel Ethernet adapters, drivers, and other software.

At a high level, installation involves the following steps, which are covered in more detail later in this chapter.

If you are installing a network adapter, follow this procedure from step 1.

If you are upgrading the driver software, start with step 5.



NOTE: If you update the firmware, you must update the driver software to the same family version.

1. Make sure that you are installing the latest driver software for your adapter. [Visit Intel's support website](#) to download the latest drivers.
2. Review [system requirements](#).
3. [Insert the adapter\(s\) in the computer](#).
4. Attach the [copper](#) or [fiber](#) network cable(s).
5. [Install the driver](#).
6. For Windows systems, install the [Intel® PROSet](#) software.

If you have any problems with basic installation, see [Troubleshooting](#).

You can now set up advanced features, if necessary. The available features and the configuration process varies with the device and your operating system. Refer to "Device Features" on page 25 for more information; for Linux and FreeBSD drivers, refer to the README file inside the driver tarball.

2.1 Hardware Compatibility

Before installing the adapter, check your system for the following:

- The latest BIOS for your system
- One open PCI Express slot



NOTE:

- For devices that support bifurcation, make sure PCI slot bifurcation is enabled in your system's BIOS.
- The Intel® 10 Gigabit AT Server Adapter will only fit into x8 or larger PCI Express slots. Some systems have physical x8 PCI Express slots that actually support lower speeds. Please check your system manual to identify the slot.

2.2 Installing the Adapter

2.2.1 Select the Correct Slot

One open PCI-Express slot, x4, x8, or x16, depending on your adapter.



NOTE: Some systems have physical x8 PCI Express slots that actually only support lower speeds. Please check your system manual to identify the slot.

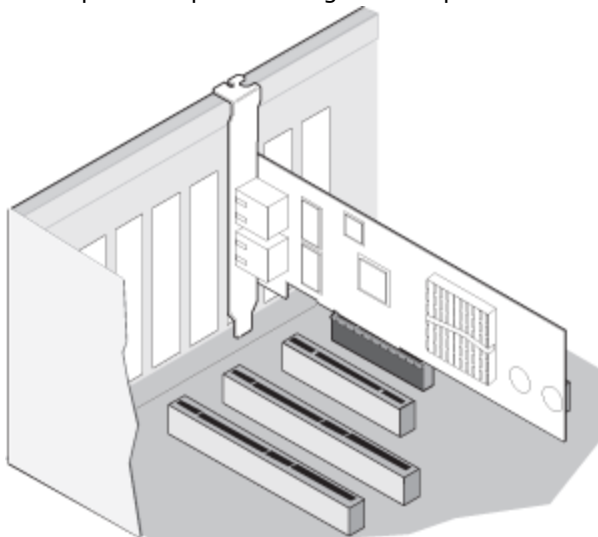
2.2.2 Insert the Adapter into the Computer

1. If your computer supports PCI Hot Plug, see your computer documentation for special installation instructions.
2. Turn off and unplug your computer. Then remove the cover.



CAUTION: Turn off and unplug the power before removing the computer's cover. Failure to do so could endanger you and may damage the adapter or computer.

3. Remove the cover bracket from an available slot.
4. Insert the adapter, pushing it into the slot until the adapter is firmly seated. You can install a smaller PCI Express adapter in a larger PCI Express slot.



CAUTION: Some PCI Express adapters may have a short connector, making them more fragile than PCI adapters. Excessive force could break the connector. Use caution when pressing the board in the slot.

5. Secure the adapter bracket with a screw, if required.
6. Replace the computer cover and plug in the power cord.
7. Power on the computer.

2.2.3 PCI Hot Plug Support

Most Intel® Ethernet Server Adapters are enabled for use in selected servers equipped with Hot Plug support. Exceptions: Intel Gigabit Quad Port Server adapters do not support Hot Plug operations.

If you replace an adapter in a Hot Plug slot, do not place the removed adapter back into the same network until the server has rebooted (unless you return it to the same slot and same team as before). This prevents a conflict in having two of the same Ethernet addresses on the same network.

The system will require a reboot if you

- Change the primary adapter designator.
- Add a new adapter to an existing team and make the new adapter the primary adapter.
- Remove the primary adapter from the system and replace it with a different type of adapter.



NOTE: To replace an existing SLA-teamed adapter in a Hot Plug slot, first unplug the adapter cable. When the adapter is replaced, reconnect the cable.

2.2.3.1 PCI Hot Plug Support for Microsoft* Windows* Operating Systems

Intel® network adapters are enabled for use in selected servers equipped with PCI Hot Plug support and running Microsoft* Windows* operating systems. For more information on setting up and using PCI Hot Plug support in your server, see your hardware and/or Hot Plug support documentation for details. PCI Hot Plug only works when you hot plug an identical Intel network adapter.



NOTES:

- The MAC address and driver from the removed adapter will be used by the replacement adapter unless you remove the adapter from the team and add it back in. If you do not remove and restore the replacement adapter from the team, and the original adapter is used elsewhere on your network, a MAC address conflict will occur.
- For SLA teams, ensure that the replacement NIC is a member of the team before connecting it to the switch.

2.3 Connecting Network Cables

Connect the appropriate network cable, as described in the following sections.

2.3.1 Supported SFP+, SFP28, QSFP+, and QSFP28 Modules

Devices Based on the Intel Ethernet 800 Series and Intel Ethernet 700 Series

See "Feature Support Matrix" on page 5 for more information on supported media types for your device.



NOTES:

- Some Intel branded network adapters based on the X710/XL710 controller only support Intel branded modules. On these adapters, other modules are not supported and will not function.
- For connections based on the 710 series of controllers, support is dependent on your system board. Please see your vendor for details.
- In all cases Intel recommends using Intel optics; other modules may function but are not validated by Intel. Contact Intel for supported media types.
- In systems that do not have adequate airflow to cool the adapter and optical modules, you must use high temperature optical modules.
- For XXV710 based SFP+ adapters, Intel recommends using Intel optics and cables. Other modules may function but are not validated by Intel. Contact Intel for supported media types.

82599-Based Adapters



NOTES:

- If your 82599-based Intel® Network Adapter came with Intel optics, or is an Intel® Ethernet Server Adapter X520-2, then it only supports Intel optics and/or the direct attach cables listed below.
- 82599-Based adapters support all passive and active limiting direct attach cables that comply with SFF-8431 v4.1 and SFF-8472 v10.4 specifications.

Supplier	Type	Part Numbers
<i>SR Modules</i>		
Intel	DUAL RATE 1G/10G SFP+ SR (bailed)	AFBR-703SDZ-IN2
Intel	DUAL RATE 1G/10G SFP+ SR (bailed)	FTLX8571D3BCV-IT
Intel	DUAL RATE 1G/10G SFP+ SR (bailed)	AFBR-703SDDZ-IN1
<i>LR Modules</i>		
Intel	DUAL RATE 1G/10G SFP+ LR (bailed)	FTLX1471D3BCV-IT
Intel	DUAL RATE 1G/10G SFP+ LR (bailed)	AFCT-701SDZ-IN2
Intel	DUAL RATE 1G/10G SFP+ LR (bailed)	AFCT-701SDDZ-IN1
<i>QSFP Modules</i>		
Intel	TRIPLE RATE 1G/10G/40G QSFP+ SR (bailed) (40G not supported on 82599)	E40GQSFP SR

The following is a list of 3rd party SFP+ modules that have received some testing. Not all modules are applicable to all devices.

Supplier	Type	Part Numbers
Finisar	SFP+ SR bailed, 10G single rate	FTLX8571D3BCL
Avago	SFP+ SR bailed, 10G single rate	AFBR-700SDZ
Finisar	SFP+ LR bailed, 10G single rate	FTLX1471D3BCL
Finisar	DUAL RATE 1G/10G SFP+ SR (No Bail)	FTLX8571D3QCV-IT
Avago	DUAL RATE 1G/10G SFP+ SR (No Bail)	AFBR-703SDZ-IN1
Finisar	DUAL RATE 1G/10G SFP+ LR (No Bail)	FTLX1471D3QCV-IT

Avago	DUAL RATE 1G/10G SFP+ LR (No Bail)	AFCT-701SDZ-IN1
Finisar	1000BASE-T SFP	FCLF8522P2BTL
Avago	1000BASE-T SFP	ABCU-5710RZ
HP	1000BASE-SX SFP	453153-001

82598-Based Adapters



NOTES:

- Intel® Network Adapters that support removable optical modules only support their original module type (i.e., the Intel® 10 Gigabit SR Dual Port Express Module only supports SR optical modules). If you plug in a different type of module, the driver will not load.
- 82598-Based adapters support all passive direct attach cables that comply with SFF-8431 v4.1 and SFF-8472 v10.4 specifications. Active direct attach cables are not supported.
- Hot Swapping/hot plugging optical modules is not supported.
- Only single speed, 10 Gigabit modules are supported.
- LAN on Motherboard (LOMs) may support DA, SR, or LR modules. Other module types are not supported. Please see your system documentation for details.

The following is a list of SFP+ modules and direct attach cables that have received some testing. Not all modules are applicable to all devices.

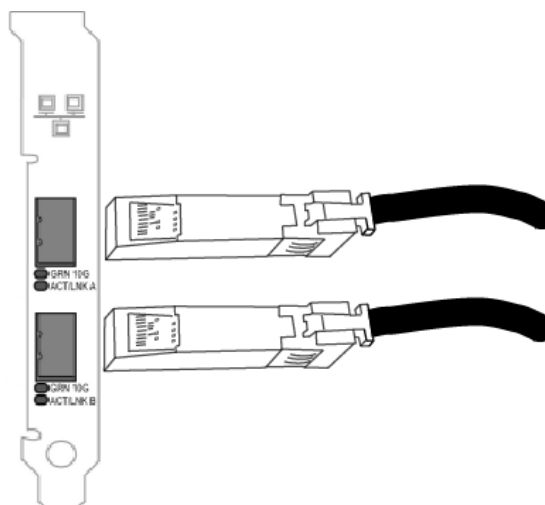
Supplier	Type	Part Numbers
Finisar	SFP+ SR bailed, 10G single rate	FTLX8571D3BCL
Avago	SFP+ SR bailed, 10G single rate	AFBR-700SDZ
Finisar	SFP+ LR bailed, 10G single rate	FTLX1471D3BCL
Molex	1m - Twin-ax cable	74752-1101
Molex	3m - Twin-ax cable	74752-2301
Molex	5m - Twin-ax cable	74752-3501
Molex	10m - Twin-ax cable	74752-9004
Tyco	1m - Twin-ax cable	2032237-2

Tyco	3m - Twin-ax cable	2032237-4
Tyco	5m - Twin-ax cable	2032237-6
Tyco	10m - Twin-ax cable	1-2032237-1

THIRD PARTY OPTIC MODULES AND CABLES REFERRED TO ABOVE ARE LISTED ONLY FOR THE PURPOSE OF HIGHLIGHTING THIRD PARTY SPECIFICATIONS AND POTENTIAL COMPATIBILITY, AND ARE NOT RECOMMENDATIONS OR ENDORSEMENT OR SPONSORSHIP OF ANY THIRD PARTY'S PRODUCT BY INTEL. INTEL IS NOT ENDORSING OR PROMOTING PRODUCTS MADE BY ANY THIRD PARTY AND THE THIRD PARTY REFERENCE IS PROVIDED ONLY TO SHARE INFORMATION REGARDING CERTAIN OPTIC MODULES AND CABLES WITH THE ABOVE SPECIFICATIONS. THERE MAY BE OTHER MANUFACTURERS OR SUPPLIERS, PRODUCING OR SUPPLYING OPTIC MODULES AND CABLES WITH SIMILAR OR MATCHING DESCRIPTIONS. CUSTOMERS MUST USE THEIR OWN DISCRETION AND DILIGENCE TO PURCHASE OPTIC MODULES AND CABLES FROM ANY THIRD PARTY OF THEIR CHOICE. CUSTOMERS ARE SOLELY RESPONSIBLE FOR ASSESSING THE SUITABILITY OF THE PRODUCT AND/OR DEVICES AND FOR THE SELECTION OF THE VENDOR FOR PURCHASING ANY PRODUCT. THE OPTIC MODULES AND CABLES REFERRED TO ABOVE ARE NOT WARRANTED OR SUPPORTED BY INTEL. INTEL ASSUMES NO LIABILITY WHATSOEVER, AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF SUCH THIRD PARTY PRODUCTS OR SELECTION OF VENDOR BY CUSTOMERS.

2.3.2 Connect the Direct Attach Cable

Insert the Direct Attach network cable as shown below.

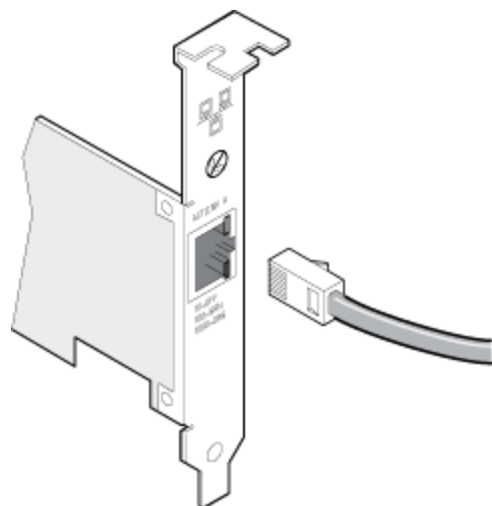


The following table shows the types of direct attached cabling you can use.

Speed	Cable Type	Max Cable Length	Notes
100 Gbps	QSFP28 Direct Attach Cable	5 meters	
40 Gbps	SFP+ Direct Attached Cable (Twinaxial)	7 meters	
25 Gbps	SFP28 Direct Attached Cable (Twinaxial)	5 meters	For optimal performance, must use CA-25G-L with RS-FEC and 25GBASE-C.
10 Gbps	SFP+ Direct Attached Cable (Twinaxial)	7 meters	

2.3.3 Connect the RJ-45 Network Cable

Connect the RJ-45 network cable as shown:



The following table shows the maximum lengths for each cable type at a given transmission speed.

Speed	Category 5	Category 6	Category 6a	Category 7
1 Gbps	100m	100m	100m	100m
10 Gbps	NA	55m	100m	100m
25 Gbps	NA	NA	NA	50m
40 Gbps	NA	NA	NA	50m



CAUTION: If using less than 4-pair cabling, you must manually configure the speed and duplex setting of the adapter and the link partner. In addition, with 2- and 3-pair cabling the adapter can only achieve speeds of up to 100Mbps.



NOTE: For the Intel® 10 Gigabit AT Server Adapter, to ensure compliance with CISPR 24 and the EU's EN55024, this product should be used only with Category 6a shielded cables that are properly terminated according to the recommendations in EN50174-2.

In all cases:

- The adapter must be connected to a compatible link partner, preferably set to auto-negotiate speed and duplex for Intel gigabit adapters.
- Intel Gigabit and 10 Gigabit Server Adapters using copper connections automatically accommodate either MDI or MDI-X connections. The auto-MDI-X feature of Intel gigabit copper adapters allows you to directly connect two adapters without using a cross-over cable.

2.3.4 Connect the Fiber Optic Network Cable



CAUTION: The fiber optic ports contain a Class 1 laser device. When the ports are disconnected, always cover them with the provided plug. If an abnormal fault occurs, skin or eye damage may result if in close proximity to the exposed ports.

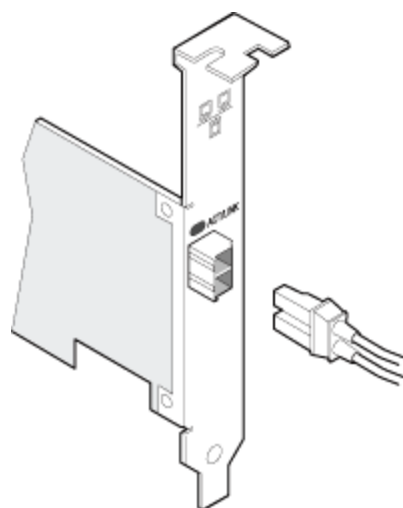
Remove and save the fiber optic connector cover. Insert a fiber optic cable into the ports on the network adapter bracket as shown below.

Most connectors and ports are keyed for proper orientation. If the cable you are using is not keyed, check to be sure the connector is oriented properly (transmit port connected to receive port on the link partner, and vice versa).

The adapter must be connected to a compatible link partner operating at the same laser wavelength as the adapter.

Conversion cables to other connector types (such as SC-to-LC) may be used if the cabling matches the optical specifications of the adapter, including length limitations.

Insert the fiber optic cable as shown below.



The following table shows the connection requirements for fiber optic cables.

Device	Laser Wavelength	Connector Type	Cable Type	Max Cable Length
Intel Ethernet LR Server Adapters	1310 nanometer (not visible)	LC	Single-mode fiber with 9.0µm core diameter	10 kilometers
Intel Ethernet 10 Gigabit SR Server Adapters	850 nanometer (not visible)	LC or SC	Multi-mode fiber with 62.5µm core diameter	33 meters
			Multi-mode fiber with 50µm core diameter	300 meters
Intel Ethernet Gigabit SR Server Adapters	850 nanometer (not visible)	LC or SC	Multi-mode fiber with 62.5µm core diameter	275 meters
			Multi-mode fiber with 50µm core diameter	550 meters

2.4 Install Drivers and Software

2.4.1 On Windows Operating Systems

There are two ways to install device drivers and software on Microsoft Windows:

- **Download and install the complete driver pack.** This option will install Windows drivers and [Intel® PROSet](#) but is a very large download.
- **Download and install only Windows drivers and Intel PROSet tools.** This option will require you to download and install two separate packages but is a much smaller download.

You must have administrative rights to the operating system to install the drivers and software.

Refer to the following for more detailed information:

- "About Intel PROSet®" on page 15
- "Microsoft* Windows* Driver and Software Installation and Configuration" on page 84

2.4.2 On Linux

2.4.2.1 Installing Linux Drivers from Source Code

1. Download and expand the driver tar file.
2. Compile the driver module.
3. Install the module using the modprobe command.
4. Assign an IP address using the ifconfig command.

2.4.2.2 Installing Linux Drivers from RPMs

1. Download and expand the driver tar file.
2. Install the driver using the rpm command or another software management tool appropriate for your distribution.

3. About Intel PROSet®

Intel PROSet is a suite of software tools to configure Intel Ethernet devices on Microsoft Windows operating systems. Intel PROSet software includes the following:

Component	Description
Intel® PROSet for Windows* Device Manager	An extension to the Windows Device Manager. When you install Intel PROSet for Windows Device Manager, additional tabs are automatically added to Device Manager.
Intel® PROSet Adapter Configuration Utility (Intel® PROSet ACU)	A graphical user interface that allows you to configure and manage supported Intel Ethernet adapters.
Intel® PROSet for Windows PowerShell* software	Software that contains several cmdlets that allow you to configure and manage the Intel Ethernet adapters and devices present in your system.

For more information on installing or using Intel PROSet, refer to the following:

- "Compatibility Notes for Intel Ethernet Cmdlets and Intel PROSet" below
- "Installing Intel PROSet" on page 17
- "Configuring Device Features in Microsoft Windows" on page 20



NOTES:

- You must have administrator rights to install or use Intel PROSet.
- Intel PROSet requires the latest driver and software package for your Intel Ethernet devices.

3.1 About Intel® Ethernet Cmdlets

In addition to [Intel PROSet](#), Intel provides Ethernet cmdlets for Windows PowerShell to:

- Display information about Intel Ethernet devices in the system
- Configure device settings
- Configure and gather [firmware logs](#) for debugging supported devices
- Blink the LED on the specified port of an Intel Ethernet device for a defined number of seconds

These Ethernet cmdlets do not require Intel PROSet to be installed on the system. For more information on installing or using Intel Ethernet cmdlets, refer to the following:

- "Compatibility Notes for Intel Ethernet Cmdlets and Intel PROSet" below
- "Installing Intel Ethernet Cmdlets" on page 17
- "Configuring with Windows PowerShell" on page 21
- "Firmware Logging" on page 104

3.2 Compatibility Notes for Intel Ethernet Cmdlets and Intel PROSet

Note the following compatibility requirements for [Intel Ethernet cmdlets](#) and [Intel PROSet](#). For Intel PROSet, the installer will automatically detect and install the components compatible with your operating system.

3.2.1 Device Compatibility

The following devices either do not support Intel Ethernet cmdlets, Intel PROSet, or some of its components.

Device	Ethernet Cmdlets	Intel PROSet	
	No Support	No Support ¹	PowerShell Only ²
Any platform with a System on a Chip (SoC) processor	Varies		X ³
Intel® Ethernet Connection E822	X ⁴	X ⁴	
Intel® Ethernet 500 Series and lower	X		
Intel® 82567V-3 Gigabit Network Connection	X		X
Notes: 1. No support for Intel PROSet or any of its components. 2. Supports only Intel PROSet for Windows PowerShell software. Does not support Intel PROSet ACU or Intel PROSet for Windows Device Manager. 3. This includes a platform with either a server controller (designated by an initial E or X, such as X552 or X722) or both a server and client controller (designated by an initial I, such as I218). 4. This device or family does not support any Microsoft operating systems. As a result, it also does not support Intel Ethernet cmdlets and/or Intel PROSet.			



NOTE: On recent operating systems, older hardware may not support Intel PROSet. In this case, the Intel PROSet tabs may not be displayed in the Windows Device Manager user interface, and the Windows PowerShell cmdlets may display an error message stating that the device does not have an Intel driver installed.

3.2.2 Operating System Compatibility

The following table lists compatible operating systems for Intel Ethernet cmdlets, Intel PROSet, or its components. **Not all OS versions listed in the following table are supported in the newest releases of Intel Ethernet software;** refer to "Supported Operating Systems" on page 2 for currently supported versions.



NOTE: Intel PROSet is not supported on Microsoft Windows 11. Microsoft Windows 10 is the last Windows operating system that supports Intel PROSet.

Component	Operating System Compatibility
Intel Ethernet cmdlets	Microsoft Windows Server 2016 and later Microsoft Azure Stack HCI Microsoft Windows PowerShell version 5.1 and later
Intel PROSet for Windows PowerShell software	Any supported version of Microsoft Windows Server Any supported version of Microsoft Windows Microsoft Azure Stack HCI
Intel PROSet Adapter Configuration Utility	Microsoft Windows Server 2019 and later Microsoft Windows 10 Version 1809, and later versions of Microsoft Windows 10
Intel PROSet for Windows Device Manager	Microsoft Windows Server 2016, and earlier versions Microsoft Windows 10 Version 1709, and earlier versions

3.3 Installing Intel Ethernet Cmdlets



NOTE: We strongly recommend you install the latest base driver and NVM before installing [Intel Ethernet cmdlets](#), or functionality could be reduced.

To install Intel Ethernet cmdlets:

1. Download the [zip file with the adapter cmdlets](#) from the Intel Download Center.
2. Save the zip file to the system you're trying to configure or debug.
3. Extract files from the zip file.
4. In the extracted files, double-click on the .exe file. The cmdlets will automatically install to the current user's PowerShell module directory (for example, to `C:\Users\Administrator\Documents\WindowsPowerShell\Modules\IntelEthernetCmdlets`).

After installation, you can run the cmdlets at the PowerShell prompt without manually importing the module.

Refer to the following for more information:

- The readme.txt file included in the download
- The cmdlet help in PowerShell
- In this user guide:
 - "Configuring with Windows PowerShell" on page 21
 - "Firmware Logging" on page 104

3.4 Installing Intel PROSet



NOTES:

- Intel PROSet is not installed by default when you install only the [device drivers](#). You must install device drivers before installing Intel PROSet.
- You must have administrator rights to install or use Intel PROSet.

- You must install Intel PROSet if you want to use [Intel® Advanced Network Services](#) (Intel® ANS) or VLANs. Intel ANS teams and VLANs are not supported on all operating systems or devices. Refer to "Adapter Teaming" on page 25 and "Virtual LANs" on page 80 for more information.
- Intel PROSet requires the latest driver and software package for your Intel Ethernet devices.

To download and install only Intel PROSet:

1. After the [driver installation](#) has finished, download and extract the **Wired_PROSet_XX.X_*.zip** file for your version of Windows, where XX.X is the release number. This file will install Intel PROSet on your system.
 - If you are running a 32-bit operating system, download **Wired_PROSet_XX.X_32.zip**.
 - If you are running a 64-bit operating system, download **Wired_PROSet_XX.X_x64.zip**.
2. In the extracted files, double-click on the **.exe** file to launch the installation of Intel PROSet.
3. In the install wizard that opens, follow the onscreen prompts to select the features you want to install.
4. The Intel PROSet software will install. Click **Finish** when prompted.



NOTE: You can also run DxSetup.exe from the files downloaded from [Customer Support](#). Refer to "Command Line Installation for Intel PROSet" below for details.

If Intel PROSet was installed without [Intel ANS](#) support, you can install support by running DxSetup.exe, and then selecting the **Modify** option when prompted. From the Setup Options window, select **Intel® Advanced Network Services** then click Next to continue with the installation wizard.

3.4.1 Command Line Installation for Intel PROSet

The install utility DxSetup.exe allows unattended installation of Intel PROSet from a command line.



NOTES:

- Intel PROSet cannot be installed with msixec.exe. You must use DxSetup.exe.
- If the operating system and installed adapters do not support a given feature, that feature will not be installed even if the command line option specifies it for installation.

DxSetup.exe Command Line Options

By setting the parameters in the command line, you can enable and disable management applications. If software is already installed and parameters are not specified, only existing components are updated.

You can also use DxSetup.exe to modify or upgrade software. If a feature is already installed, the public property for that feature will default to 1 and if a feature is not installed, the public property for that feature will default to 0. Running DxSetup.exe without specifying properties will upgrade all installed software. You can remove installed software (except for base drivers) by setting the property to 0. If you uninstall Intel PROSet (PROSET=0), all features that rely on Intel PROSet will also be removed.

DxSetup.exe supports the following command line parameters for fresh installations, modifying an installation, or upgrading the software:

Parameter	Definition		
PROSET	Intel PROSet for Windows Device Manager or Intel PROSet ACU depending on operating system. "0", do not install Intel PROSet. If Intel PROSet is already installed, it will be uninstalled. "1", install Intel PROSet feature.  NOTE: If PROSET=0, Intel ANS will not be installed. If PROSET=0 and Intel PROSet and Intel ANS are already installed, Intel PROSet and Intel ANS will be uninstalled.		
ANS	Intel Advanced Network Services "0", do not install Intel ANS. If Intel ANS is already installed, it will be uninstalled. "1", install Intel ANS. The ANS parameter requires PROSET=1.  NOTE: If the ANS parameter is set to ANS=1, both Intel PROSet and Intel ANS will be installed.		
ISCSI	iSCSI "0", do not install iSCSI. If iSCSI is already installed, it will be uninstalled. "1", install iSCSI. The iSCSI parameter requires PROSET=1.		
PROSet_ACU_Shortcut	If Intel PROSet ACU is installed, create or update the "Intel® PROSet Adapter Configuration Utility" desktop shortcut. "0", do not create or update the "Intel® PROSet Adapter Configuration Utility" desktop shortcut. "1", create or update the "Intel® PROSet Adapter Configuration Utility" desktop shortcut. If this parameter is not specified, the shortcut will only be created or updated if it was created by a previous software installation.		
RDMA_ROUTING	RDMA routing "0", do not install RDMA routing. "1", install RDMA routing.		
IWARP_FIREWALL	Installs the iWARP firewall rule. "0", do not install iWARP firewall rule. "1", install iWARP firewall rule. If "1" is selected, the following parameters are allowed in addition to IWARP_FIREWALL. • IWARP_FIREWALL_DOMAIN [0 1] - Applies firewall rule to corporate domains. • IWARP_FIREWALL_PUBLIC [0 1] - Applies firewall rule to public networks • IWARP_FIREWALL_PRIVATE [0 1] - Applies firewall rule to private networks		
FORCE	"0", check that the installed device supports a feature (for example, iSCSI) and only install the feature if such a device is found. "1", install the specified features regardless of the presence of supporting devices.		
/q[r n]	/q --- silent install options <table border="1"> <tr> <td>r</td><td>Reduced GUI Install (only displays critical warning messages)</td></tr> </table>	r	Reduced GUI Install (only displays critical warning messages)
r	Reduced GUI Install (only displays critical warning messages)		

Parameter	Definition								
	<table> <tr> <td>n</td><td>Silent install</td></tr> </table>	n	Silent install						
n	Silent install								
/l[i w e a]	/l --- log file option for PROSet installation. Following are log switches: <table> <tr> <td>i</td><td>log status messages.</td></tr> <tr> <td>w</td><td>log non-fatal warnings.</td></tr> <tr> <td>e</td><td>log error messages.</td></tr> <tr> <td>a</td><td>log the start of all actions.</td></tr> </table>	i	log status messages.	w	log non-fatal warnings.	e	log error messages.	a	log the start of all actions.
i	log status messages.								
w	log non-fatal warnings.								
e	log error messages.								
a	log the start of all actions.								
/l* <path\filename>	Use the log file ability of SetupBD.exe. If you do not specify the path and filename, DxSetup.exe creates a log file (named SetupBD_<timestamp>.log, for example SetupBD_18-04-2022_14-29-20.log) in the same directory as the DxSetup/MSI log.								
/uninstall /x	Uninstall Intel PROSet.								

**NOTES:**

- You must include a space between parameters.
- If you specify a path for the log file, the path must exist. If you do not specify a complete path, the install log will be created in the current directory.
- You do not need to specify default values. To install Intel ANS and Intel PROSet, the following examples are equivalent:


```
DxSetup.exe
```

```
DxSetup.exe PROSET=1 ANS=1
```
- The ANS parameter should only be set to ANS=1 if PROSET=1 is set.
- Even if ISCSI=1 is passed, iSCSI using DCB will not be installed if the operating system and installed adapters do not support it. If FORCE=1 is also passed, iSCSI will be installed if the operating system supports it.
- Public properties are not case sensitive. No white space is allowed between characters. For example:


```
DxSetup.exe /qn PROSET=1
```

Any white space in "PROSET=1" makes the setting invalid.

3.5 Configuring Device Features in Microsoft Windows

This section describes how to use Intel Ethernet cmdlets or Intel PROSet to configure device features on supported Windows operating systems.

For an overview or installation information, refer to the following:

- "About Intel PROSet®" on page 15
- "About Intel® Ethernet Cmdlets" on page 15
- "Compatibility Notes for Intel Ethernet Cmdlets and Intel PROSet" on page 15
- "Installing Intel PROSet" on page 17

3.5.1 Configuring with Windows PowerShell

You can configure and manage the Intel Ethernet devices present in your system using the following:

- [Intel Ethernet cmdlets](#)
- Intel PROSet for Windows PowerShell software



NOTES: Refer to "Compatibility Notes for Intel Ethernet Cmdlets and Intel PROSet" on page 15 for information on support limitations.

Module Names

The following table lists the module name in Windows PowerShell for each component.

Component	Module Name	Additional Information
Intel Ethernet cmdlets	IntelEthernetCmdlets	"Installing Intel Ethernet Cmdlets" on page 17 "Firmware Logging" on page 104
Intel PROSet for Windows PowerShell software	IntelNetCmdlets	"Installing Intel PROSet" on page 17

Importing New Cmdlets

After installing Intel PROSet, use the `Import-Module` cmdlet to import the new cmdlets. You may need to restart Windows PowerShell to access the newly installed cmdlets. Refer to "Module Names" above for the available cmdlet modules.

To use the `Import-Module` cmdlet, you must specify the path. For example:

```
PS c:\> Import-Module -Name "C:\Program Files\Intel\Wired Networking\IntelNetCmdlets"
```



NOTE:

- If you include a trailing backslash ("\") at the end of the `Import-Module` command, the import operation will fail. In Microsoft Windows 10 and Windows Server 2016, the auto-complete function appends a trailing backslash. If you use auto-complete when entering the `Import-Module` command, delete the trailing backslash from the path before pressing Return to execute the command.
- If you encounter issues with Intel Ethernet cmdlets, you may need to manually import the module using the instructions provided above.

See Microsoft TechNet for more information about the `Import-Module` cmdlet.

Changing Intel Ethernet Settings via Microsoft Windows PowerShell

You can use Windows PowerShell software to change most Intel Ethernet settings.

To configure Intel Ethernet device features using Windows PowerShell software, follow these general steps:

1. Install Intel PROSet or Intel Ethernet cmdlets, if you haven't already. See the following for more information:
 - "Installing Intel Ethernet Cmdlets" on page 17
 - "Installing Intel PROSet" on page 17
2. Open PowerShell.
3. At the PowerShell prompt, run your desired cmdlet.

Help Information for PowerShell Cmdlets

To get help information for both Intel Ethernet cmdlets and Intel PROSet for Windows PowerShell software:

- For a complete list of the cmdlets and their descriptions, type the following at the Windows PowerShell prompt. Refer to "Module Names" on the previous page for the available cmdlet modules.

```
PS C:\> get-help <module name>
```

- For detailed usage information for each cmdlet (including examples), type the following at the Windows PowerShell prompt:

```
PS C:\> get-help <cmdlet_name> -full
```

- To show only examples for a cmdlet, type the following at the Windows PowerShell prompt:

```
PS C:\> get-help <cmdlet_name> -examples
```

- To use the Minihelp property for any cmdlet in the module, append `| Select Minihelp`. For example:

```
PS C:\> Get-IntelNetAdapterSetting -Name "<adapter_name>" -  
RegistryKeyword *RSS | Select Minihelp
```



NOTE: Online help (get-help -online) is not supported.

Additional Notes for Intel PROSet for Windows PowerShell Software

- IntelNetCmdlets are digitally signed. Microsoft Windows operating systems check digital signatures online. Depending on your internet connection, this may result in a delay before any cmdlet operation (including get-help). If you have not already done so, make sure you use Import-Module to import the IntelNetCmdlets.
- If an adapter is bound to an Intel ANS team, do not change settings using the Set-NetAdapterAdvanceProperty cmdlet from Windows PowerShell, or any other cmdlet not provided by Intel. Doing so may cause the team to stop using that adapter to pass traffic. You may see this as reduced performance or the adapter being disabled in the Intel ANS team. You can resolve this issue by changing the setting back to its previous state, or by removing the adapter from the Intel ANS team and then adding it back.
- The Get-IntelNetAdapterStatus -Status General cmdlet may report the status "Link Up - This device is not linked at its maximum capable speed". In that case, if your device is set to auto-negotiate, you can adjust the speed of the device's link partner to the device's maximum speed. If the device is not set to auto-negotiate, you can adjust the device's speed manually, but you must ensure the link partner is set at the same speed.

3.5.2 Configuring with Intel PROSet Adapter Configuration Utility

The Intel PROSet Adapter Configuration Utility (Intel PROSet ACU) is a graphical user interface that allows you to configure and manage supported Intel Ethernet Adapters.



NOTE: Refer to "Compatibility Notes for Intel Ethernet Cmdlets and Intel PROSet" on page 15 for information on support limitations.

To configure Intel Ethernet device features using Intel PROSet ACU, follow these general steps:

1. Select an adapter in the Adapter Selection panel.
2. Select a setting to configure from the Adapter Settings panel.
3. Select or enter the desired value(s) for the selected setting.
4. Click the "Apply Changes" button.

3.5.3 Configuring with Intel PROSet for Windows Device Manager



NOTE: Refer to "Compatibility Notes for Intel Ethernet Cmdlets and Intel PROSet" on page 15 for information on support limitations.

To configure Intel Ethernet adapter features using Intel PROSet for Windows Device Manager:

1. Open Device Manager in Windows.
2. Configure your desired settings in the appropriate tab in Device Manager.

Intel PROSet for Windows Device Manager uses the following additional Windows Device Manager tabs:

Tab Name	Description
Link Speed	Allows you to change the adapter's speed and duplex setting, run diagnostics, and use the identify adapter feature.
Advanced	Allows you to customize how the adapter handles QoS packet tagging, Jumbo Packets, Off-loading, and other capabilities. Some of the features might not be available depending on the operating system you are running, the specific adapters installed, and the specific platform you are using.
VLANs	Allows you to create, modify, and delete VLANs. You must install Intel Advanced Network Services in order to see this tab and use the feature.
Teaming	Allows you to create, modify, and delete adapter teams . You must install Intel Advanced Network Services in order to see this tab and use the feature.
Power Management	Replaces the standard Microsoft Windows Power Management tab in Device Manager. The standard Windows power management functionality is included on the Intel PROSet tab. NOTE: • The options available on the Power Management tab are adapter and system dependent. Not all adapters will display all options. There may be BIOS or operating system settings that need to be enabled for your system to wake up. In particular, this is true for Wake from S5 (also referred to as Wake from power off). • The Intel® 10 Gigabit Network Adapters do not support power management. • If your system has a Manageability Engine, the Link LED may stay lit even if WoL is disabled.

3.5.4 Changing Intel Ethernet Settings Under Windows Server Core

You can use the Intel PROSet for Windows PowerShell software or Intel Ethernet cmdlets to change most Intel Ethernet settings under Windows Server Core. Please refer to their cmdlet help in PowerShell for more information.

For iSCSI Crash Dump configuration, use the Intel PROSet for Windows PowerShell software and refer to the aboutIntelNetCmdlets.help.txt help file. iSCSI Crash Dump configuration is not supported in Intel Ethernet cmdlets.

4. Device Features

This chapter describes the features available on Intel Ethernet devices. Major features are organized alphabetically.



NOTE:

- Available settings are dependent on your device and operating system. Not all settings are available on every device/OS combination.
- Some features in this section refer to Intel PROSet, Intel PROSet for Windows Device Manager, Intel PROSet Adapter Configuration Utility (Intel PROSet ACU), or Intel PROSet for Windows PowerShell* software. Refer to "About Intel PROSet®" on page 15 for more information.

4.1 Adapter Teaming

Intel® Advanced Network Services (Intel® ANS) Teaming lets you take advantage of multiple adapters in a system by grouping them together. Intel ANS teaming can use features like fault tolerance and load balancing to increase throughput and reliability.

Before creating a team or adding team members, make sure each team member has been configured similarly. Settings to check include VLANs and QoS Packet Tagging, Jumbo Packets, and the various offloads. Pay particular attention when using different adapter models or adapter versions, as adapter capabilities vary.

Refer to the following subsections for more information on adapter teaming:

- "Configuration and Compatibility Notes" below
- "Configuring Teams with Intel PROSet" on page 28
- "Teaming Modes" on page 31

For more information on VLANs, refer to "Virtual LANs" on page 80.

4.1.1 Configuration and Compatibility Notes

- Microsoft Windows 10 is the last Windows operating system version that supports Intel ANS. Intel ANS is not supported on Microsoft Windows 11 and later.
- Intel ANS is not supported on Microsoft Windows Server 2016 and later.
- To configure teams in Linux, use Channel Bonding, available in supported Linux kernels. For more information see the channel bonding documentation within the kernel source.
- Not all team types are available on all operating systems.
- Be sure to use the latest available drivers on all adapters.
- Not all Intel devices support Intel ANS. Intel adapters that do not support Intel ANS may still be included in a team. However, they are restricted in the same way non-Intel adapters are. See "Multi-Vendor Teaming" on page 37 for more information.
- You cannot create a team that includes both Intel X710/XL710-based devices and Intel® I350-based devices. These devices are incompatible together in a team and will be blocked during team setup.

- NDIS 6.2 introduced new RSS data structures and interfaces. Because of this, you cannot enable RSS on teams that contain a mix of adapters that support NDIS 6.2 RSS and adapters that do not.
- If a team is bound to a Hyper-V virtual NIC, you cannot change the Primary or Secondary adapter.
- To assure a common feature set, some advanced features, including hardware offloading, are automatically disabled when an adapter that does not support the feature is added to a team.
- Hot Plug operations in a Multi-Vendor Team may cause system instability. We recommended that you restart the system or reload the team after performing Hot Plug operations with a Multi-Vendor Team. When you physically remove an adapter that is part of a team or a VLAN, you must reboot or reload the team/VLAN before using that adapter in the same network. This will prevent Ethernet address conflicts.
- Spanning tree protocol (STP) should be disabled on switch ports connected to teamed adapters in order to prevent data loss when the primary adapter is returned to service (failback). Alternatively, an activation delay may be configured on the adapters to prevent data loss when spanning tree is used.
- Data Center Bridging will be automatically disabled when an adapter is added to a team with non-DCB capable adapters.
- NLB will not work when Receive Load Balancing (RLB) is enabled. This occurs because NLB and iANS both attempt to set the server's multicast MAC address, resulting in an ARP table mismatch.
- Teaming with the Intel® 10 Gigabit AF DA Dual Port Server Adapter is only supported with similar adapter types and models or with switches using a Direct Attach connection.
- If you want to set up VLANs on a team, you must first create the team.
- After adding a VLAN to the team, the Network Connections window shows the team as disabled or network cable unplugged. This is normal. The connection protocols are now bound to the VLAN on the team. You can configure the connection protocols in the Properties for the VLAN.

4.1.1.1 Teaming and VLAN Considerations When Replacing Adapters

After installing an adapter in a specific slot, Windows treats any other adapter of the same type as a new adapter. Also, if you remove the installed adapter and insert it into a different slot, Windows recognizes it as a new adapter. Make sure that you follow the instructions below carefully.

1. If the adapter is part of a team remove the adapter from the team.
2. Shut down the system and unplug the power cable.
3. Disconnect the network cable from the adapter.
4. Open the case and remove the adapter.
5. Insert the replacement adapter. (Use the same slot, otherwise Windows assumes that there is a new adapter.)
6. Reconnect the network cable.
7. Close the case, reattach the power cable, and power-up the server.

4.1.1.2 Microsoft Load Balancing and Failover (LBFO) Teams

Intel ANS teaming and VLANs are not compatible with Microsoft's LBFO teams. Intel PROSet will block a member of an LBFO team from being added to an Intel ANS team or VLAN. You should not add a port that is already part of an Intel ANS team or VLAN to an LBFO team, as this may cause system instability. If you use an Intel ANS team member or VLAN in an LBFO team, perform the following procedure to restore your configuration:

1. Reboot the machine
2. Remove LBFO team. Even though LBFO team creation failed, after a reboot Server Manager will report that LBFO is Enabled, and the LBFO interface is present in the 'NIC Teaming' GUI.
3. Remove the Intel ANS teams and VLANs involved in the LBFO team and recreate them. This is an optional (all bindings are restored when the LBFO team is removed), but strongly recommended step

**NOTES:**

- If you add an Intel AMT enabled port to an LBFO team, do not set the port to Standby in the LBFO team. If you set the port to Standby you may lose AMT functionality.
- DCB is incompatible with Microsoft Server LBFO Teams. Do not create an LBFO team when DCB is installed. Do not install DCB if you use LBFO teaming. Install failures and persistent link loss may occur if DCB and LBFO are used on the same port.

4.1.1.3 Supported Adapters

Teaming options are supported on Intel server adapters. Selected adapters from other manufacturers are also supported. If you are using a Windows-based computer, adapters that appear in Intel PROSet may be included in a team.



NOTE: In order to use adapter teaming, you must have at least one Intel server adapter in your system. Furthermore, all adapters must be linked to the same switch or hub.

Conditions that may prevent you from teaming a device

During team creation or modification, the list of available team types or list of available devices may not include all team types or devices. This may be caused by any of several conditions, including:

- The device does not support the desired team type or does not support teaming at all.
- The operating system does not support the desired team type.
- The devices you want to team together use different driver versions.
- TOE (TCP Offload Engine) enabled devices cannot be added to an Intel ANS team and will not appear in the list of available adapters.
- You can add Intel® Active Management Technology (Intel® AMT) enabled devices to Adapter Fault Tolerance (AFT), Switch Fault Tolerance (SFT), and Adaptive Load Balancing (ALB) teams. All other team types are not supported. The Intel AMT enabled device must be designated as the primary adapter for the team.
- The device's MAC address is overridden by the Locally Administered Address advanced setting.
- The device has "OS Controlled" or "Enabled" selected on the Data Center tab.
- The device has a virtual NIC bound to it.
- The device is part of a Microsoft Load Balancing and Failover (LBFO) team.

4.1.1.4 Phantom Teams and Phantom VLANs

If you physically remove all adapters that are part of a team or VLAN from the system without removing them via the Device Manager first, a phantom team or phantom VLAN will appear in Device Manager.

Preventing the Creation of Phantom Devices

Make sure you perform these steps before physically removing an adapter from the system:

1. Remove the adapter from any teams using the Settings tab on the team properties dialog box.
2. Remove any VLANs from the adapter using the VLANs tab on the adapter properties dialog box.
3. Uninstall the adapter from Device Manager.

You do not need to follow these steps in hot-replace scenarios.

4.1.2 Configuring Teams with Intel PROSet

This section describes how to configure Intel ANS teams using Intel PROSet. Refer to the following subsections for more specific information:

- "Configuring Teams with Intel PROSet for Windows Device Manager" below
- "Configuring Teams with Windows PowerShell" on the next page
- "Configuring Teams with Intel PROSet ACU" on page 30

4.1.2.1 Configuring Teams with Intel PROSet for Windows Device Manager

Creating a Team

1. Launch Windows Device Manager
2. Expand **Network Adapters**.
3. Double-click on one of the adapters that will be a member of the team.
The adapter properties dialog box appears.
4. Click the **Teaming** tab.
5. Click **Team with other adapters**.
6. Click **New Team**.
7. Type a name for the team, then click **Next**.
8. Click the checkbox of any adapter you want to include in the team, then click **Next**.
9. Select a teaming mode, then click **Next**.
10. Click **Finish**.

The Team Properties window appears, showing team properties and settings.

Once a team has been created, it appears in the Network Adapters category in the Computer Management window as a virtual adapter. The team name also precedes the adapter name of any adapter that is a member of the team.

Changing Which Adapters Are In a Team

1. Launch Windows Device Manager.
2. Open the Team Properties dialog box by double-clicking on a team listing in the Computer Management window.
3. Click the **Settings** tab.
4. Click **Modify Team**, then click the **Adapters** tab.

5. Select the adapters that will be members of the team.
 - Click the checkbox of any adapter that you want to add to the team.
 - Clear the checkbox of any adapter that you want to remove from the team.
6. Click **OK**.

Renaming a Team

1. Open the Team Properties dialog box by double-clicking on a team listing in the Computer Management window.
2. Click the **Settings** tab.
3. Click **Modify Team**, then click the **Name** tab.
4. Type a new team name, then click **OK**.



NOTE: If you modify a team name from the team property sheet, it may take several minutes for the name to change in Device Manager. Closing and opening Device Manager will load the new name.

Removing a Team

1. Open the Team Properties dialog box by double-clicking on a team listing in the Computer Management window.
2. Click the **Settings** tab.
3. Select the team you want to remove, then click **Remove Team**.
4. Click **Yes** when prompted.



NOTE: If you defined a VLAN or QoS Prioritization on an adapter joining a team, you may have to redefine it when it is returned to a stand-alone mode.

Specifying a Preferred Primary or Secondary Adapter

You must specify a primary adapter before you can specify a secondary adapter.

1. In the Team Properties dialog box's **Settings** tab, click **Modify Team**.
2. On the **Adapters** tab, select an adapter.
3. Click **Set Primary** or **Set Secondary**.
4. Click **OK**.

The adapter's preferred setting appears in the Priority column on Intel PROSet's **Team Configuration** tab. A "1" indicates a preferred primary adapter, and a "2" indicates a preferred secondary adapter.

4.1.2.2 Configuring Teams with Windows PowerShell

Using non-Intel cmdlets, such as the Set-NetAdapterAdvancedProperty cmdlet provided in Microsoft PowerShell*, to change settings for an ANS-teamed adapter may cause the team to stop using that adapter to pass traffic. You may see this as reduced performance or the adapter being disabled in the PROSet Teaming GUI. You can repair the issue by changing the setting back to its previous state, or by removing the adapter from the ANS team and then adding it back.

Creating a Team

Use the New-IntelNetTeam cmdlet. For example:

```
New-IntelNetTeam -TeamMemberNames "<adapter1_name>", "<adapter2_name>" -TeamMode  
AdapterFaultTolerance -TeamName "<team_name>"
```

Changing Which Adapters Are In a Team

Use the Add-IntelNetTeamMember or Remove-IntelNetTeamMember cmdlet. For example:

```
Add-IntelNetTeamMember -TeamName "<team_name>" -Name "<adapter_name>"
```

Renaming a Team

Use the Set-IntelNetTeam cmdlet. For example

```
Set-IntelNetTeam -TeamName "<team_name>" -NewTeamName "<new_team_name>"
```

Removing a Team

Use the Remove-IntelNetTeam cmdlet. For example

```
Remove-IntelNetTeamMember -Name "<adapter_name>"
```



NOTE: If you defined a VLAN or QoS Prioritization on an adapter joining a team, you may have to redefine it when it is returned to a stand-alone mode.

Specifying a Preferred Primary or Secondary Adapter

Use the Set-IntelNetTeam cmdlet. For example

```
Set-IntelNetTeam -TeamName "Team 1" -PrimaryAdapterName "<adapter1_name>" -  
SecondaryAdapterName "<adapter2_name>"
```

4.1.2.3 Configuring Teams with Intel PROSet ACU

Creating a Team with Intel PROSet ACU

1. Launch the Intel PROSet ACU.
2. Select an adapter to start the team.
3. Click the **Teaming/VLANs** tab.
4. In the Teaming panel, click **Create Team**.
5. Select the adapters to include in the team, then click **Next**.
6. Type a name for the team.
7. Select the teaming mode, then click **Next**.
8. [Optional] Designate Primary and Secondary adapters for the team.
9. Click **Finish**.

Changing Which Adapters Are In a Team

1. Launch the Intel PROSet ACU.
2. Select the team you wish to modify.
3. In the Team Members panel, click **Modify Members**.
4. Select the adapters that will be members of the team
5. Click **Apply Changes**.

Renaming a Team

1. Launch the Intel PROSet ACU.
2. Select the team you wish to modify.
3. In the Team Information panel, type a new team name..
4. Click **Apply Changes**.

Removing a Team

1. Launch the Intel PROSet ACU.
2. Select the team you wish to remove.
3. Click **Remove Team**.



NOTE: If you defined a VLAN or QoS Prioritization on an adapter joining a team, you may have to redefine it when it is returned to a stand-alone mode.

Specifying a Preferred Primary or Secondary Adapter

You must specify a primary adapter before you can specify a secondary adapter.

1. Launch the Intel PROSet ACU.
2. Select the team you wish to modify.
3. Select your preferred Primary Adapter.
4. Select your preferred Secondary Adapter.
5. Click **Apply Changes**.

4.1.3 Teaming Modes

4.1.3.1 Overview

The following table explains the available teaming modes. Follow the links in the left column to view details about that mode.

Mode	Description
Adapter Fault Tolerance (AFT)	Provides automatic redundancy for a server's network connection. If the primary adapter fails, the secondary adapter takes over. Adapter Fault Tolerance supports two to eight adapters per team. This teaming type works with any hub or switch. All team members must be connected to the same subnet.
Switch Fault Tolerance (SFT)	Provides failover between two adapters connected to separate switches. Switch Fault Tolerance supports two adapters per team. Spanning Tree Protocol (STP) must be enabled on the switch when you create an SFT team. When SFT teams are created, the Activation Delay is automatically set to 60 seconds. This teaming type works with any switch or hub. All team members must be connected to the same subnet.
Adaptive Load Balancing (ALB)	Provides load balancing of transmit traffic and adapter fault tolerance. In Microsoft* Windows* operating systems, you can also enable or disable receive load balancing (RLB) in ALB teams (by default, RLB is enabled).
Virtual Machine Load Balancing (VMLB)	Provides transmit and receive traffic load balancing across Virtual Machines bound to the team interface, as well as fault tolerance in the event of switch port, cable, or adapter failure. This teaming type works with any switch.
Static Link Aggregation (SLA)	Provides increased transmission and reception throughput in a team of two to eight adapters. This team type replaces the following team types from prior software releases: Fast EtherChannel*/Link Aggregation (FEC) and Gigabit EtherChannel*/Link Aggregation (GEC). This type also includes adapter fault tolerance and load balancing (only routed protocols). This teaming type requires a switch with Intel Link Aggregation, Cisco* FEC or GEC, or IEEE 802.3ad Static Link Aggregation capability. NOTE: All adapters in a Link Aggregation team running in static mode must run at the same speed and must be connected to a Static Link Aggregation capable switch. If the speed capability of adapters in a Static Link Aggregation team are different, the speed of the team is dependent on the lowest common denominator.
IEEE 802.3ad Dynamic Link Aggregation	Creates one or more teams using Dynamic Link Aggregation with mixed-speed adapters. Like the Static Link Aggregation teams, Dynamic 802.3ad teams increase transmission and reception throughput and provide fault tolerance. This teaming type requires a switch that fully supports the IEEE 802.3ad standard.
Multi-Vendor Teaming (MVT)	Adds the capability to include adapters from selected other vendors in a team. If you are using a Windows-based computer, you can team adapters that appear in the Intel PROSet teaming wizard.

**IMPORTANT:**

- Be sure to use the latest available drivers on all adapters.
- Before creating a team, adding or removing team members, or changing advanced settings of a team member, make sure each team member has been configured similarly. Settings to check include VLANs and QoS Packet Tagging, Jumbo Frames, and the various offloads. These settings are available in Intel PROSet's **Advanced** tab. *Pay particular attention when using different adapter models or adapter versions, as adapter capabilities vary.*
- If team members implement Advanced features differently, failover and team functionality will be affected. To avoid team implementation issues:
 - Create teams that use similar adapter types and models.
 - Reload the team after adding an adapter or changing any Advanced features. One way to reload the team is to select a new preferred primary adapter. Although there will be a temporary loss of network connectivity as the team reconfigures, the team will maintain its network addressing schema.

**NOTES:**

- Hot Plug operations for an adapter that is part of a team are only available in Windows Server.
- For SLA teams, all team members must be connected to the same switch. For AFT, ALB, and RLB teams, all team members must belong to the same subnet. The members of an SFT team must be connected to a different switch.
- Teaming only one adapter port is possible, but provides no benefit.

4.1.3.2 Primary and Secondary Adapters

Teaming modes that do not require a switch with the same capabilities (AFT, SFT, ALB (with RLB)) use a primary adapter. In all of these modes except RLB, the primary is the only adapter that receives traffic. RLB is enabled by default on an ALB team.

If the primary adapter fails, another adapter will take over its duties. If you are using more than two adapters, and you want a specific adapter to take over if the primary fails, you must specify a secondary adapter. If an Intel AMT enabled device is part of a team, it must be designated as the primary adapter for the team.

There are two types of primary and secondary adapters:

- **Default primary adapter:** If you do not specify a preferred primary adapter, the software will choose an adapter of the highest capability (model and speed) to act as the default primary. If a failover occurs, another adapter becomes the primary. Once the problem with the original primary is resolved, the traffic will not automatically restore to the default (original) primary adapter in most modes. The adapter will, however, rejoin the team as a non-primary.
- **Preferred Primary/Secondary adapters:** You can specify a preferred adapter. Under normal conditions, the Primary adapter handles all traffic. The Secondary adapter will receive traffic if the primary fails. If the Preferred Primary adapter fails, but is later restored to an active status, control is automatically switched back to the Preferred Primary adapter. Specifying primary and secondary adapters adds no benefit to SLA and IEEE 802.3ad dynamic teams, but doing so forces the team to use the primary adapter's MAC address.

4.1.3.3 Failover and Failback

When a link fails, either because of port or cable failure, team types that provide fault tolerance will continue to send and receive traffic. Failover is the initial transfer of traffic from the failed link to a good link. Failback occurs when the original adapter regains link. You can use the Activation Delay setting (located on the Advanced tab of the team's properties in Device Manager) to specify how long the failover adapter waits before becoming active. If you don't want your team to failback when the original adapter gets link back, you can set the Allow Failback setting to disabled (located on the Advanced tab of the team's properties in Device Manager).

4.1.3.4 Adapter Fault Tolerance (AFT)

Adapter Fault Tolerance (AFT) provides automatic recovery from a link failure caused from a failure in an adapter, cable, switch, or port by redistributing the traffic load across a backup adapter.

Failures are detected automatically, and traffic rerouting takes place as soon as the failure is detected. The goal of AFT is to ensure that load redistribution takes place fast enough to prevent user sessions from being disconnected. AFT supports two to eight adapters per team. Only one active team member transmits and receives traffic. If this primary connection (cable, adapter, or port) fails, a secondary, or backup, adapter takes over. After a failover, if the connection to the user-specified primary adapter is restored, control passes automatically back to that primary adapter.

AFT is the default mode when a team is created. This mode does not provide load balancing.



NOTES:

- AFT teaming requires that the switch not be set up for teaming and that spanning tree protocol is turned off for the switch port connected to the NIC or LOM on the server.
- All members of an AFT team must be connected to the same subnet.

4.1.3.5 Switch Fault Tolerance (SFT)

Switch Fault Tolerance (SFT) supports only two NICs in a team connected to two different switches. In SFT, one adapter is the primary adapter and one adapter is the secondary adapter. During normal operation, the secondary adapter is in standby mode. In standby, the adapter is inactive and waiting for failover to occur. It does not transmit or receive network traffic. If the primary adapter loses connectivity, the secondary adapter automatically takes over. When SFT teams are created, the Activation Delay is automatically set to 60 seconds.

In SFT mode, the two adapters creating the team can operate at different speeds.



NOTE: SFT teaming requires that the switch not be set up for teaming and that spanning tree protocol is turned on.

Configuration Monitoring

You can set up monitoring between an SFT team and up to five IP addresses. This allows you to detect link failure beyond the switch. You can ensure connection availability for several clients that you consider critical. If the connection between the primary adapter and all of the monitored IP addresses is lost, the team will failover to the secondary adapter.

4.1.3.6 Adaptive/Receive Load Balancing (ALB/RLB)

Adaptive Load Balancing (ALB) is a method for dynamic distribution of data traffic load among multiple physical channels. The purpose of ALB is to improve overall bandwidth and end station performance. In ALB, multiple links are provided from the server to the switch, and the intermediate driver running on the server performs the load balancing function. The ALB architecture utilizes knowledge of Layer 3 information to achieve optimum distribution of the server transmission load.

ALB is implemented by assigning one of the physical channels as Primary and all other physical channels as Secondary. Packets leaving the server can use any one of the physical channels, but incoming packets can only use the Primary Channel. With Receive Load Balancing (RLB) enabled, it balances IP receive traffic. The intermediate driver analyzes the send and transmit loading on each adapter and balances the rate across the adapters based on destination address. Adapter teams configured for ALB and RLB also provide the benefits of fault tolerance.



NOTES:

- ALB teaming requires that the switch not be set up for teaming and that spanning tree protocol is turned off for the switch port connected to the network adapter in the server.
- ALB does not balance traffic when protocols such as NetBEUI and IPX* are used.
- You may create an ALB team with mixed speed adapters. The load is balanced according to the adapter's capabilities and bandwidth of the channel.
- All members of ALB and RLB teams must be connected to the same subnet.
- Virtual NICs cannot be created on a team with Receive Load Balancing enabled. Receive Load Balancing is automatically disabled if you create a virtual NIC on a team.

4.1.3.7 Virtual Machine Load Balancing

Virtual Machine Load Balancing (VMLB) provides transmit and receive traffic load balancing across Virtual Machines bound to the team interface, as well as fault tolerance in the event of switch port, cable, or adapter failure.

The driver analyzes the transmit and receive load on each member adapter and balances the traffic across member adapters. In a VMLB team, each Virtual Machine is associated with one team member for its TX and RX traffic.

If only one virtual NIC is bound to the team, or if Hyper-V is removed, then the VMLB team will act like an AFT team.



NOTES:

- VMLB does not load balance non-routed protocols such as NetBEUI and some IPX* traffic.
- VMLB supports from two to eight adapter ports per team.
- You can create a VMLB team with mixed speed adapters. The load is balanced according to the lowest common denominator of adapter capabilities and the bandwidth of the channel.
- You cannot use and Intel AMT enabled adapter a VMLB team.

4.1.3.8 Static Link Aggregation

Static Link Aggregation (SLA) is very similar to [ALB](#), taking several physical channels and combining them into a single logical channel.

This mode works with:

- Cisco EtherChannel capable switches with channeling mode set to "on"
- Intel switches capable of Link Aggregation
- Other switches capable of static 802.3ad

**NOTES:**

- All adapters in a Static Link Aggregation team must run at the same speed and must be connected to a Static Link Aggregation-capable switch. If the speed capabilities of adapters in a Static Link Aggregation team are different, the speed of the team is dependent on the switch.
- Static Link Aggregation teaming requires that the switch be set up for Static Link Aggregation teaming and that spanning tree protocol is turned off.
- An Intel AMT enabled adapter cannot be used in an SLA team.

4.1.3.9 IEEE 802.3ad: Dynamic Link Aggregation

IEEE 802.3ad is the IEEE standard. Teams can contain two to eight adapters. You must use 802.3ad switches (in dynamic mode, aggregation can go across switches). Adapter teams configured for IEEE 802.3ad also provide the benefits of fault tolerance and load balancing. Under 802.3ad, all protocols can be load balanced.

Dynamic mode supports multiple aggregators. Aggregators are formed by port speed connected to a switch. For example, a team can contain adapters running at 1 Gbps and 10 Gbps, but two aggregators will be formed, one for each speed. Also, if a team contains 1 Gbps ports connected to one switch, and a combination of 1 Gbps and 10 Gbps ports connected to a second switch, three aggregators would be formed. One containing all the ports connected to the first switch, one containing the 1 Gbps ports connected to the second switch, and the third containing the 10Gbps ports connected to the second switch.

**NOTES:**

- IEEE 802.3ad teaming requires that the switch be set up for IEEE 802.3ad (link aggregation) teaming and that spanning tree protocol is turned off.
- Once you choose an aggregator, it remains in force until all adapters in that aggregation team lose link.
- In some switches, copper and fiber adapters cannot belong to the same aggregator in an IEEE 802.3ad configuration. If there are copper and fiber adapters installed in a system, the switch might configure the copper adapters in one aggregator and the fiber-based adapters in another. If you experience this behavior, for best performance you should use either only copper-based or only fiber-based adapters in a system.
- An Intel AMT enabled adapter cannot be used in a DLA team.

Before you begin

- Verify that the switch fully supports the IEEE 802.3ad standard.
- Check your switch documentation for port dependencies. Some switches require pairing to start on a primary port.
- Check your speed and duplex settings to ensure the adapter and switch are running at full duplex, either forced or set to auto-negotiate. Both the adapter and the switch must have the same speed and duplex configuration. The full-duplex requirement is part of the IEEE 802.3ad specification: <http://standards.ieee.org/>. If needed, change your speed or duplex setting before you link the

adapter to the switch. Although you can change speed and duplex settings after the team is created, Intel recommends you disconnect the cables until settings are in effect. In some cases, switches or servers might not appropriately recognize modified speed or duplex settings if settings are changed when there is an active link to the network.

- If you are configuring a VLAN, check your switch documentation for VLAN compatibility notes. Not all switches support simultaneous dynamic 802.3ad teams and VLANs. If you do choose to set up VLANs, configure teaming and VLAN settings on the adapter before you link the adapter to the switch. Setting up VLANs after the switch has created an active aggregator affects VLAN functionality.

4.1.3.10 Multi-Vendor Teaming

Multi-Vendor Teaming (MVT) allows teaming with a combination of Intel and non-Intel adapters.

If you are using a Windows-based computer, adapters that appear in the Intel PROSet teaming wizard can be included in a team.

MVT Design Considerations

- In order to activate MVT, you must have at least one Intel adapter or integrated connection in the team, which must be designated as the primary adapter.
- A multi-vendor team can be created for any team type.
- All members in an MVT must operate on a common feature set (lowest common denominator).
- Manually verify that the frame setting for the non-Intel adapter is the same as the frame settings for the Intel adapters.
- If a non-Intel adapter is added to a team, its RSS settings must match the Intel adapters in the team.

4.2 Adaptive Inter-Frame Spacing

Compensates for excessive Ethernet packet collisions on the network.

The default setting works best for most computers and networks. By enabling this feature, the network adapter dynamically adapts to the network traffic conditions. However, in some rare cases you might obtain better performance by disabling this feature. This setting forces a static gap between packets.

To change this setting in Intel PROSet

Range	• Enabled • Disabled
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Adaptive Inter-Frame Spacing" -DisplayValue "Enabled"
```

4.3 Data Center Bridging (DCB)

Data Center Bridging (DCB) is a collection of standards-based extensions to classical Ethernet. It provides a lossless data center transport layer that enables the convergence of LANs and SANs onto a single unified fabric.

Furthermore, DCB is a configuration Quality of Service implementation in hardware. It uses the VLAN priority tag (802.1p) to filter traffic. That means that there are 8 different priorities that traffic can be filtered into. It also enables priority flow control (802.1Qbb) which can limit or eliminate the number of dropped packets during network stress. Bandwidth can be allocated to each of these priorities, which is enforced at the hardware level (802.1Qaz).

DCB includes the following capabilities:

- Priority-based flow control (PFC; IEEE 802.1Qbb)
- Enhanced transmission selection (ETS; IEEE 802.1Qaz)
- Congestion notification (CN)
- Extensions to the Link Layer Discovery Protocol (LLDP) standard (IEEE 802.1AB) that enable Data Center Bridging Capability Exchange Protocol (DCBX)

Adapter firmware implements LLDP and DCBX protocol agents as per 802.1AB and 802.1Qaz respectively.

There are two supported versions of DCBX.

- CEE Version: The specification can be found as a link within the following document: <http://www.ieee802.org/1/files/public/docs2008/dcb-baseline-contributions-1108-v1.01.pdf>
- IEEE Version: The specification can be found as a link within the following document: <https://standards.ieee.org/findstds/standard/802.1Qaz-2011.html>



NOTE: The OS DCBX stack defaults to the CEE version of DCBX, and if a peer is transmitting IEEE TLVs, it will automatically transition to the IEEE version.

For more information on DCB, including the DCB Capability Exchange Protocol Specification, go to <http://www.ieee802.org/1/pages/dcbbridges.html>

4.3.1 DCB for Windows Configuration

To change this setting in Intel PROSet

This setting is found on the Data Center tab of the device's Device Manager property sheet or in the Data Center panel in Intel PROSet Adapter Configuration Utility.

You can use Intel PROSet to perform the following tasks:

- **Display Status:**

- Enhanced Transmission Selection
- Priority Flow Control

Non-operational status: If the Status indicator shows that DCB is non-operational, there may be a number of possible reasons:

- DCB is not enabled - select the checkbox to enable DCB.
- One or more of the DCB features is in a non-operational state.

A non-operational status is most likely to occur when **Use Switch Settings** is selected or **Using Advanced Settings** is active. This is generally a result of one or more of the DCB features not getting successfully exchanged with the switch. Possible problems include:

- One of the features is not supported by the switch.
- The switch is not advertising the feature.
- The switch or host has disabled the feature (this would be an advanced setting for the host).
- Disable/enable DCB
- Troubleshooting information



NOTES:

- On X710 based devices running Microsoft Windows, DCB is only supported on NVM version 4.52 and newer. Older NVM versions must be updated before the adapter is capable of DCB support in Windows.
- On systems running a Microsoft Windows Server operating system, enabling *QoS/priority flow control will disable link level flow control.
- If *QOS/DCB is not available, it may be for one of the following reasons:
 - The Firmware LLDP (FW-LLDP) agent was disabled from a pre-boot environment (typically UEFI).
 - This device is based on the Intel® Ethernet Controller X710 and the current link speed is 2.5 Gbps or 5 Gbps.

4.3.1.1 Hyper-V (DCB and VMQ)



NOTE: Configuring a device in the VMQ + DCB mode reduces the number of VMQs available for guest OSes.

4.3.2 DCB for Linux

Intel Ethernet drivers support firmware-based or software-based DCBX in Linux, depending on the underlying PF device. The following table summarizes DCBX support by driver.

Linux Driver	Firmware-Based DCBX	Software-Based DCBX
ice	Supported	Supported
i40e	Supported	Supported
ixgbe	Not supported	Supported

In **firmware-based** mode, firmware intercepts all LLDP traffic and handles DCBX negotiation transparently for the user. In this mode, the adapter operates in "willing" DCBX mode, receiving DCB settings from the link partner (typically a switch). The local user can only query the negotiated DCB configuration.

In **software-based** mode, LLDP traffic is forwarded to the network stack and user space, where a software agent can handle it. In this mode, the adapter can operate in either "willing" or "nonwilling" DCBX

mode and DCB configuration can be both queried and set locally. Software-based mode requires the FW-based LLDP Agent to be disabled and kernel `CONFIG_DCB` enabled.

**NOTES:**

- Only one LLDP/DCBX agent can be active on a single interface at a time.
- Software-based and firmware-based DCBX modes are mutually exclusive.
- When the firmware DCBX agent is active, software agents will not be able to receive or transmit LLDP frames. See "Firmware Link Layer Discovery Protocol (FW-LLDP)" on page 42, as well as the Linux driver readme in your installation, for information on enabling or disabling the FW-LLDP agent.
- In software-based DCBX mode, you can configure DCB parameters using software LLDP/DCBX agents that interface with the Linux kernel's DCB Netlink API. We recommend using OpenLLDP as the DCBX agent when running in software mode. For more information, see the OpenLLDP man pages and <https://github.com/intel/openlldp>.
- For information on configuring DCBX parameters on a switch, please consult the switch manufacturer's documentation.

4.3.3 iSCSI Over DCB

Intel® Ethernet adapters support iSCSI software initiators that are native to the underlying operating system. Data Center Bridging is most often configured at the switch. If the switch is not DCB capable, the DCB handshake will fail but the iSCSI connection will not be lost.



NOTE: DCB does not install in a VM. iSCSI over DCB is only supported in the base OS. An iSCSI initiator running in a VM will not benefit from DCB ethernet enhancements.

4.3.3.1 Microsoft Windows Configuration

iSCSI installation includes the installation of the iSCSI DCB Agent (`iscsidcb.exe`) user mode service. The Microsoft iSCSI Software Initiator enables the connection of a Windows host to an external iSCSI storage array using an Intel Ethernet adapter. Please consult your operating system documentation for configuration details.

To change this setting in Intel PROSet

This setting is found on the Data Center tab of the device's Device Manager property sheet or in the Data Center panel in Intel PROSet Adapter Configuration Utility.

This setting provides feedback as to the DCB state, operational or non-operational, as well as providing additional details should it be non-operational.



NOTE: On Microsoft Windows Server operating systems, if you configure Priority using IEEE, the iSCSI policy may not be created automatically. To create the iSCSI policy manually, use Powershell and type:

```
New-NetQosPolicy -Name "UP4" -PriorityValue 8021 Action 4 -iSCSI
```

Using iSCSI over DCB with Intel ANS Teaming

The Intel® iSCSI Agent is responsible for maintaining all packet filters for the purpose of priority tagging iSCSI traffic flowing over DCB-enabled adapters. The iSCSI Agent will create and maintain a traffic filter for an Intel ANS Team if at least one member of the team has an "Operational" DCB status. However, if any adapter on the team does not have an "Operational" DCB status, the iSCSI Agent will log an error in the Windows Event Log for that adapter. These error messages are to notify the administrator of configuration issues that need to be addressed, but do not affect the tagging or flow of iSCSI traffic for that team, unless it explicitly states that the TC Filter has been removed.

4.3.3.2 Linux Configuration

In the case of Open Source distributions, virtually all distributions include support for an Open iSCSI Software Initiator and Intel® Ethernet adapters will support them. Please consult your distribution documentation for additional configuration details on their particular Open iSCSI initiator.

Intel® 82599-based adapters support iSCSI within a Data Center Bridging cloud. Used in conjunction with switches and targets that support the iSCSI/DCB application TLV, this solution can provide guaranteed minimum bandwidth for iSCSI traffic between the host and target. This solution enables storage administrators to segment iSCSI traffic from LAN traffic. Previously, iSCSI traffic within a DCB supported environment was treated as LAN traffic by switch vendors. Please consult your switch and target vendors to ensure that they support the iSCSI/DCB application TLV.

4.4 Direct Memory Access (DMA) Coalescing

DMA (Direct Memory Access) allows the network device to move packet data directly to the system's memory, reducing CPU utilization. However, the frequency and random intervals at which packets arrive do not allow the system to enter a lower power state. DMA Coalescing allows the NIC to collect packets before it initiates a DMA event. This may increase network latency but also increases the chances that the system will consume less energy. Adapters and network devices based on the Intel® Ethernet Controller I350 (and later controllers) support DMA Coalescing.

Higher DMA Coalescing values result in more energy saved but may increase your system's network latency. If you enable DMA Coalescing, you should also set the Interrupt Moderation Rate to 'Minimal'. This minimizes the latency impact imposed by DMA Coalescing and results in better peak network throughput performance. You must enable DMA Coalescing on all active ports in the system. You may not gain any energy savings if it is enabled only on some of the ports in your system. There are also several BIOS, platform, and application settings that will affect your potential energy savings. A white paper containing information on how to best configure your platform is available [on the Intel website](#).

To change this setting in Intel PROSet

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "DMA Coalescing" -  
DisplayValue "Enabled"
```

4.5 Dynamic Device Personalization (DDP)

Adapters based on the Intel® Ethernet 800 Series require a Dynamic Device Personalization (DDP) package file to enable advanced features (such as dynamic tunneling, Intel Ethernet Flow Director, RSS, and ADQ). DDP allows you to change the packet processing pipeline of a device by applying a profile package

to the device at runtime. Profiles can be used to, for example, add support for new protocols, change existing protocols, or change default settings. DDP profiles can also be rolled back without rebooting the system.

The DDP package loads during device initialization or driver runtime, depending on the operating system. The driver checks to see if the DDP package is present and compatible. If this file exists, the driver will load it into the device. If not, the driver will go into Safe Mode where it will use the configuration contained in the device's NVM.

Safe Mode disables advanced and performance features, and supports only basic traffic and minimal functionality, such as updating the NVM or downloading a new driver or DDP package. For more information, see "Safe Mode" on page 114.

A general-purpose, default DDP package is automatically installed with all supported Intel Ethernet 800 Series drivers on supported operating systems. Additional DDP packages are available to address needs for specific market segments or targeted solutions.

Refer to the [Intel® Ethernet Controller E810 Dynamic Device Personalization \(DDP\) Technology Guide](#) for more information on configuring DDP.



NOTES:

- If you are using DPDK, see the DPDK documentation for installation instructions and more information.
- In ESXi:
 - Support for DDP packages for specific market segments requires the following:
 - Driver: icen 1.9.1.x or higher
 - Tool: intnet 1.8.3.x or higher
 - Use esxcli to load and unload DDP packages for specific market segments during driver runtime.
 - A package update is not persistent between device resets or system reboots.

4.6 Firmware Link Layer Discovery Protocol (FW-LLDP)

Devices based on the Intel® Ethernet 800 and 700 Series use a Link Layer Discovery Protocol (LLDP) agent that runs in the firmware. When it is running, it prevents the operating system and applications from receiving LLDP traffic from the network adapter.

- The FW-LLDP setting is per port and persists across reboots.
- The FW-LLDP Agent is required for DCB to function.

Adapters Based on the Intel® Ethernet 800 Series

FW-LLDP is disabled in NVM by default. To enable/disable the FW-LLDP Agent:

- **Linux:** Use ethtool to persistently set or show the fw-lldp-agent private flag.
- **FreeBSD:** Use sysctl to persistently set or show the fw_lldp_agent flag.
- **ESX:** Use the esxcli command to persistently set or get the fw-lldp-agent setting.
- **Microsoft Windows:** The base driver does not persistently change FW-LLDP. Use the LLDP Agent attribute in UEFI HII to persistently change the FW-LLDP setting. If you enable DCB when FW-LLDP is disabled, the base driver temporarily starts the LLDP Agent while DCB functionality is enabled.

Adapters Based on the Intel® Ethernet 700 Series

FW-LLDP is enabled in NVM by default. To enable/disable the FW-LLDP Agent:

- **Linux:** Use ethtool to set or show the disable-fw-lldp private flag.
- **FreeBSD:** Use sysctl to set or show the fw_lldp flag.
- **ESX:** Use the esxcfg-module command to set or get the LLDP module parameter.
- **Microsoft Windows:** Use the LLDP Agent attribute in UEFI HII to change the FW-LLDP setting.
Note: You must enable the UEFI HII "LLDP AGENT" attribute for the FW-LLDP setting to take effect.
If "LLDP AGENT" is set to disabled in UEFI HII, you cannot enable FW-LLDP from the OS.
- You must enable the LLDP Agent from UEFI HII to use DCB.

4.7 Firmware Logs and Advanced Debugging

Intel Ethernet 800 Series devices support the ability to generate firmware logs or other information, to debug issues with Customer Support. Refer to the following for more information:

- "Firmware Logging" on page 104
- "Debug Dump" on page 108
- "Health Status Messages" on page 113

4.8 Forward Error Correction (FEC) Mode

Allows you to set the Forward Error Correction (FEC) mode. FEC improves link stability, but increases latency. Many high quality optics, direct attach cables, and backplane channels provide a stable link without FEC.

The driver allows you to set the following FEC Modes:

- Auto FEC - Sets the FEC Mode based on the capabilities of the attached cable.
- CL108 RS-FEC - Selects only RS-FEC ability and request capabilities.
- CL74 FC-FEC/BASE-R - Selects only BASE-R ability and request capabilities.
- No FEC - Disables FEC.

**NOTES:**

- For devices to benefit from this feature, link partners must have FEC enabled.
- Intel® Ethernet 800 Series devices only enable Forward Error Correction (FEC) configurations that are supported by the connected media and which are expected to yield healthy Bit Error Rate (BER) connections.
 - If you enable the registry keyword AllowNoFECModulesInAuto, Auto FEC negotiation will include 'No FEC' in case your link partner does not have FEC enabled or is not FEC capable.
 - To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -RegistryKeyword AllowNoFECModulesInAuto -RegistryValue 1
```
 - To change this setting in Linux, use ethtool. For example:

```
# ethtool --set-priv-flags <ethX> allow-no-fec-modules-in-auto on
```
- If you are having link issues (including no link) at link speeds faster than 10 Gbps, check your switch configuration and/or specifications. Many optical connections and direct attach cables require RS-FEC for connection speeds faster than 10 Gbps. One of the following may resolve the issue:
 - Configure your switch to use RS-FEC mode.
 - Specify a 10 Gbps, or slower, link speed connection.
 - If you are attempting to connect at 25 Gbps, try using an SFP28 CA-S or CS-N Direct Attach cable. These cables do not require RS-FEC.
 - If your switch does not support RS-FEC mode, check with your switch vendor for the availability of a SW or FW upgrade.

To change this setting in Intel PROSet

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "FEC Mode" -DisplayValue "Auto FEC"
```

4.9 Flow Control

Enables adapters to more effectively regulate traffic. Adapters generate flow control frames when their receive queues reach a pre-defined limit. Generating flow control frames signals the transmitter to slow transmission. Adapters respond to flow control frames by pausing packet transmission for the time specified in the flow control frame.

By enabling adapters to adjust packet transmission, flow control helps prevent dropped packets. You may improve RDMA performance by enabling flow control on all nodes and on the switch they are connected to.

**NOTES:**

- For adapters to benefit from this feature, link partners must support flow control frames.
- On systems running a Microsoft Windows Server operating system, enabling *QoS/priority flow control will disable link level flow control.
- Some devices support Auto Negotiation. Selecting this will cause the device to advertise the value stored in its NVM (usually "Disabled").

To change this setting in Intel PROSet

Range	• Disabled • RX Enabled • TX Enabled • RX & TX Enabled • Auto Negotiation (only available on some adapters)
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Flow Control" -
DisplayValue "Rx Enabled"
```

4.10 Gigabit PHY Mode

Determines whether the adapter or link partner is designated as the primary. The other device is designated as the secondary. By default, the IEEE 802.3ab specification defines how conflicts are handled. Multi-port devices such as switches have higher priority over single port devices and are assigned as the primary. If both devices are multi-port devices, the one with higher seed bits becomes the primary. This default setting is called "Hardware Default."



NOTE: In most scenarios, we recommended the default value of this feature.

Setting this to any value other than "Auto Detect" overrides the hardware default.

To change this setting in Intel PROSet

Range	• Force Primary Mode • Force Secondary Mode • Auto Detect
--------------	---



NOTE: When Gigabit PHY Mode is forced to Primary mode on both the Intel adapter and its link partner, the link speed obtained by the Intel adapter may be lower than expected or link may not be established.

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Gigabit PHY Mode" -  
DisplayValue "Auto Detect"
```

4.11 Interrupt Moderation Rate

Sets the Interrupt Throttle Rate (ITR). This setting moderates the rate at which Transmit and Receive interrupts are generated.

When an event such as packet receiving occurs, the adapter generates an interrupt. The interrupt interrupts the CPU and any application running at the time, and calls on the driver to handle the packet. At greater link speeds, more interrupts are created, and CPU rates also increase. This results in poor system performance. When you use a higher ITR setting, the interrupt rate is lower and the result is better CPU performance.



NOTE: A higher ITR rate also means that the driver has more latency in handling packets. If the adapter is handling many small packets, it is better to lower the ITR so that the driver can be more responsive to incoming and outgoing packets.

Altering this setting may improve traffic throughput for certain network and system configurations, however the default setting is optimal for common network and system configurations. Do not change this setting without verifying that the desired change will have a positive effect on network performance.

To change this setting in Intel PROSet

Range	• Adaptive • Extreme • High • Medium • Low • Minimal • Off
-------	--

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Interrupt Moderation  
Rate" -DisplayValue "Adaptive"
```

4.12 Jumbo Frames

Enables or disables Jumbo Packet capability. The standard Ethernet frame size is about 1514 bytes, while Jumbo Packets are larger than this. Jumbo Packets can increase throughput and decrease CPU utilization. However, additional latency may be introduced.

Enable Jumbo Packets only if ALL devices across the network support them and are configured to use the same frame size. When setting up Jumbo Packets on other network devices, be aware that network devices calculate Jumbo Packet sizes differently. Some devices include the frame size in the header information while others do not. Intel adapters do not include frame size in the header information.

Jumbo Packets can be implemented simultaneously with VLANs and teaming. If a team contains one or more non-Intel adapters, the Jumbo Packets feature for the team is not supported. Before adding a non-Intel adapter to a team, make sure that you disable Jumbo Packets for all non-Intel adapters using the software shipped with the adapter.

Restrictions

- Jumbo frames are not supported in multi-vendor team configurations.
- Supported protocols are limited to IP (TCP, UDP).
- Jumbo frames require compatible switch connections that forward Jumbo Frames. Contact your switch vendor for more information.
- When standard-sized Ethernet frames (64 to 1518 bytes) are used, there is no benefit to configuring Jumbo Frames.
- The Jumbo Packets setting on the switch must be set to at least 8 bytes larger than the adapter setting for Microsoft Windows operating systems, and at least 22 bytes larger for all other operating systems.
- Jumbo Frames are not supported over Intel ANS VLANs under Microsoft Windows 10.

To change this setting in Intel PROSet

Range	• Disabled (1514 bytes) • 4088 Bytes • 9014 Bytes (Set the switch 4 bytes higher for CRC, plus 4 bytes if using VLANs.)
--------------	--



NOTES:

- End-to-end hardware must support this capability; otherwise, packets will be dropped.
- Intel adapters that support Jumbo Packets have a frame size limit of 9238 bytes, with a corresponding MTU size limit of 9216 bytes.

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Jumbo Packet" -
DisplayValue "4088 Bytes"
```

4.13 Link State on Interface Down

Sets if link is enabled or disabled when the interface is brought down. If this is set to **Disabled** and you bring an interface down (using an administrative tool, or in another way), then the port will lose link. This allows an attached switch to detect that the interface is no longer up. However, if Wake on LAN or manageability is enabled on this port, link will remain up.

To change this setting in Intel PROSet

Range	• Enabled • Disabled
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Link State on Interface Down" -DisplayValue "Enabled"
```

4.14 Locally Administered Address

Overrides the initial MAC address with a user-assigned MAC address. To enter a new network address, type a 12-digit hexadecimal number in this box.

To change this setting in Intel PROSet

Range	0000 0000 0001 - FFFF FFFF FFFD Exceptions: • Do not use a multicast address (Least Significant Bit of the high byte = 1). For example, in the address 0Y123456789A, "Y" cannot be an odd number. (Y must be 0, 2, 4, 6, 8, A, C, or E.) • Do not use all zeros or all Fs. If you do not enter an address, the address is the original network address of the adapter. For example, Multicast: 0123 4567 8999 Broadcast: FFFF FFFF FFFF Unicast (legal): 0070 4567 8999
--------------	---



NOTE: In a team, Intel PROSet uses either:

- The primary adapter's permanent MAC address if the team does not have an LAA configured, or
- The team's LAA if the team has an LAA configured.

Intel PROSet does not use an adapter's LAA if the adapter is the primary adapter in a team and the team has an LAA.

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Locally Administered Address" -DisplayValue "<desired address>"
```

4.15 Log Link State Event

This setting is used to enable/disable the logging of link state changes. If enabled, a link up change event or a link down change event generates a message that is displayed in the system event logger. This message contains the link's speed and duplex. Administrators view the event message from the system event log.

The following events are logged.

- The link is up.
- The link is down.
- Mismatch in duplex.
- Spanning Tree Protocol detected.

To change this setting in Intel PROSet

Range	• Enabled • Disabled
--------------	--

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Log Link State Event" -  
DisplayValue "Enabled"
```

4.16 Low Latency Interrupts

LLI enables the network device to bypass the configured interrupt moderation scheme based on the type of data being received. It configures which arriving TCP packets trigger an immediate interrupt, enabling the system to handle the packet more quickly. Reduced data latency enables some applications to gain faster access to network data.



NOTE: When LLI is enabled, system CPU utilization may increase.

LLI can be used for data packets containing a TCP PSH flag in the header or for specified TCP ports.

- **Packets with TCP PSH Flag** - Any incoming packet with the TCP PSH flag will trigger an immediate interrupt. The PSH flag is set by the sending device.
- **TCP Ports** - Every packet received on the specified ports will trigger an immediate interrupt. Up to eight ports may be specified.

To change this setting in Intel PROSet

Range	• Disabled • PSH Flag-Based • Port-Based
--------------	--

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Low Latency Interrupts" -
DisplayValue "Port-Based"
```

4.17 Malicious Driver Detection (MDD) for VFs

Some Intel Ethernet devices use Malicious Driver Detection (MDD) to detect malicious traffic from the VF and disable Tx/Rx queues or drop the offending packet until a VF driver reset occurs. You can view MDD messages in the PF's event log.

- If the device supports automatic VF resets and the driver detects an MDD event on the receive path, the PF will automatically reset the VF and reenables queues. If automatic VF resets are disabled, the PF will not automatically reset the VF when it detects MDD events. See the table below for supported MDD features.
- If the PF driver logs MDD events from the VF, confirm that the correct VF driver is installed.
- To restore functionality, you can manually reload the VF or VM or, if supported by the device, enable automatic VF resets.

The following table shows MDD capabilities by device family.

Feature	Intel Ethernet 800 Series	Intel Ethernet 700 Series	Intel Ethernet 500 Series	Intel I350 Gigabit Network Connection
Automatically resets the VF and reenables queues after MDD events	If enabled	If enabled	Yes	Yes
Can disable automatic VF reset after MDD events	Yes	Yes	No	No

4.17.1 MDD Auto Reset VFs

Automatically resets the virtual machine immediately after the adapter detects a Malicious Driver Detection (MDD) event on the receive path.

To change this setting in Intel PROSet

Range	• Disabled • Enabled
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "MDD Auto Reset VFs" -
DisplayValue "Enabled"
```

4.18 Max Number of RSS Queues Per Vport

Sets the maximum number of Receive Side Scaling (RSS) queue pairs per VF.

To change this setting in Intel PROSet

Range	• 2 Queues • 4 Queues • 8 Queues • 16 Queues
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Max Number of RSS Queues Per Vport" -DisplayValue "4 Queues"
```

4.19 Offloads

In addition to the offloads included this subsection, see the following pages for related information:

- "Priority & VLAN Tagging" on page 63
- "Virtual Machine Queue Offloading" on page 77

4.19.1 IPv4 Checksum Offload

This allows the adapter to compute the IPv4 checksum of incoming and outgoing packets. This feature enhances IPv4 receive and transmit performance and reduces CPU utilization.

With Offloading off, the operating system verifies the IPv4 checksum.

With Offloading on, the adapter completes the verification (on RX) and computation (on TX) for the operating system.

To change this setting in Intel PROSet

Range	• Disabled • RX Enabled • TX Enabled • RX & TX Enabled
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "IPv4 Checksum Offload" -DisplayValue "Tx Enabled"
```

4.19.2 Large Send Offload (IPv4 and IPv6)

Sets the adapter to offload the task of segmenting TCP messages into valid Ethernet frames. The maximum frame size limit for large send offload is set to 64,000 bytes.

Since the adapter hardware is able to complete data segmentation much faster than operating system software, this feature may improve transmission performance. In addition, the adapter uses fewer CPU resources.

To change this setting in Intel PROSet

Range	• Enabled • Disabled
--------------	--

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Large Send Offload V2 (IPv4)" -DisplayValue "Enabled"
```

4.19.3 NVGRE Encapsulated Task Offload

Network Virtualization using Generic Routing Encapsulation (NVGRE) increases the efficient routing of network traffic within a virtualized or cloud environment. Some Intel® Ethernet Network devices perform NVGRE processing, offloading it from the operating system. This reduces CPU utilization.

To change this setting in Intel PROSet

Range	• Enabled • Disabled
--------------	--

This setting is found in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility. On the device's Device Manager property sheet, it is found on the Advanced tab, under the Offloading Options > Encapsulated Task Offload setting.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "NVGRE Encapsulated Task Offload" -DisplayValue "Enabled"
```

4.19.4 QoS Offload

Configures the Quality of Service (QoS) offload setting for the miniport adapter. This feature allows you to set a bandwidth cap and reservation to one or more virtual machines on a physical device, including both software VMs and SR-IOV interfaces.

To change this setting in Intel PROSet

Range	• Disabled • Enabled
--------------	--

This setting is found on the Adapter tab and in the Adapter Settings panel of the Intel® PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "QoS Offload" -
DisplayValue "Enabled"
```

4.19.5 TCP Checksum Offload (IPv4 and IPv6)

Allows the adapter to verify the TCP checksum of incoming packets and compute the TCP checksum of outgoing packets. This feature enhances receive and transmit performance and reduces CPU utilization.

With Offloading off, the operating system verifies the TCP checksum.

With Offloading on, the adapter completes the verification for the operating system.

To change this setting in Intel PROSet

Range	• Disabled • RX Enabled • TX Enabled • RX & TX Enabled
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "TCP Checksum Offload
(IPv4)" -DisplayValue "Tx Enabled"
```

4.19.6 UDP Checksum Offload (IPv4 and IPv6)

Allows the adapter to verify the UDP checksum of incoming packets and compute the UDP checksum of outgoing packets. This feature enhances receive and transmit performance and reduces CPU utilization.

With Offloading off, the operating system verifies the UDP checksum.

With Offloading on, the adapter completes the verification for the operating system.

To change this setting in Intel PROSet

Range	• Disabled • RX Enabled • TX Enabled • RX & TX Enabled
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "UDP Checksum Offload
(IPv4)" -DisplayValue "Tx Enabled"
```

4.19.7 UDP Segmentation Offload (IPv4 and IPv6)

Allows the adapter to segmenting UDP packets with payloads up to 64K into valid Ethernet frames. Because the adapter hardware is able to complete data segmentation much faster than operating system software, this feature may improve transmission performance. In addition, the adapter may use fewer CPU resources.

With Offloading off, the operating system segments UDP packets into valid Ethernet frames.

With Offloading on, the adapter segments UDP packets for the operating system.



NOTE: UDP Segmentation Offload requires:

- Microsoft* Windows Server* 2019, Version 1903, or later
- Linux* kernel 4.18, or later

To change this setting in Intel PROSet

Range	• Disabled • Enabled
-------	--

To change this setting in Windows PowerShell, use the `Set_IntelNetAdapterSetting` cmdlet. For example:

```
Set_IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "UDP Segmentation Offload (IPv4)" -DisplayValue "Enabled"
```

4.19.8 VXLAN Encapsulated Task Offload

Virtual Extensible LAN (VXLAN) allows you to extend an L2 network over an L3 network, which may be useful in a virtualized or cloud environment. Some Intel Ethernet devices perform VXLAN processing, offloading it from the operating system. This reduces CPU utilization.

VXLAN may be useful in multi-tenant environments such as cloud service providers where the number of VLANs exceeds the 4094 limit imposed by the 12-bit VLAN ID used in Ethernet data frames.

To change this setting in Intel PROSet

Range	• Enabled • Disabled
-------	--

This setting is found in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility. On the device's Device Manager property sheet, it is found on the Advanced tab, under the Offloading Options > Encapsulated Task Offload setting.

To change this setting in Windows PowerShell, use the `Set-IntelNetAdapterSetting` cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "VXLAN Encapsulated Task Offload" -DisplayValue "Enabled"
```


4.20 Performance Options

4.20.1 Optimizing Performance

You can configure Intel network adapter advanced settings to help optimize server performance. This section provides tips for:

- "General Optimization" below
- "Optimization for Specific Usage Models" on the next page



NOTES:

- Linux users, see the README file in the Linux driver package for Linux-specific performance enhancement details.
- The recommendations below are guidelines and should be treated as such. Additional factors such as installed applications, bus type, network topology, and operating system also affect system performance.
- These adjustments should be performed by a highly skilled network administrator. They are not guaranteed to improve performance. Not all settings shown here may be available through network driver configuration, operating system or system BIOS.
- When using performance test software, refer to the documentation of the application for optimal results.

4.20.1.1 General Optimization

- Install the adapter in an appropriate slot.



NOTE: Some PCIe x8 slots are actually configured as x4 slots. These slots have insufficient bandwidth for full line rate with some dual port devices. The driver can detect this situation and will write the following message in the system log: "PCI-Express bandwidth available for this card is not sufficient for optimal performance. For optimal performance a x8 PCI-Express slot is required." If this error occurs, moving your adapter to a true x8 slot will resolve the issue.

- For an Intel® Ethernet 700 Series adapter to reach its full potential, you must install it in a PCIe Gen3 x8 slot. Installing it in a shorter slot, or a Gen2 or Gen1 slot, will impact the throughput the adapter can attain.
- Use the proper cabling for your device.
- Increase the number of TCP and Socket resources from the default value. For Windows based systems, we have not identified system parameters other than the TCP Window Size which significantly impact performance.
- Increase the allocation size of Driver Resources (transmit/receive buffers). However, most TCP traffic patterns work best with the transmit buffer set to its default value, and the receive buffer set to its minimum value.

Jumbo Frames

Enabling jumbo frames may increase throughput. You must enable jumbo frames on all of your network components to get any benefit.

RSS Queues

If you have multiple 10 Gbps (or faster) ports installed in a system, the RSS queues of each adapter port can be adjusted to use non-overlapping sets of processors within the adapter's local Non-Uniform Memory Access (NUMA) Node/Socket. Change the RSS Base Processor Number for each adapter port so that the combination of the base processor and the max number of RSS processors settings ensure non-overlapping cores. For Microsoft Windows systems, do the following:

1. Identify the adapter ports to be adjusted and inspect their `RssProcessorArray` using the `Get-NetAdapterRSS` PowerShell cmdlet.
2. Identify the processors with NUMA distance 0. These are the cores in the adapter's local NUMA Node/Socket and will provide the best performance.
3. Adjust the RSS Base processor on each port to use a non-overlapping set of processors within the local set of processors. You can do this manually or using the following PowerShell command:
`Set-NetAdapterAdvancedProperty -Name <Adapter Name> -DisplayName "RSS Base Processor Number" -DisplayValue <RSS Base Proc Value>`
4. Use the `Get-NetAdapterAdvancedproperty` cmdlet to check that the right values have been set:
`Get-NetAdapterAdvancedproperty -Name <Adapter Name>`

For Example: For a 4 port adapter with Local processors 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, and 'Max RSS processor' of 8, set the RSS base processors to 0, 8, 16 and 24.

CPU Affinity

When passing traffic on multiple network ports using an I/O application that runs on most or all of the cores in your system, consider setting the CPU Affinity for that application to fewer cores. This should reduce CPU utilization and in some cases may increase throughput for the device. The cores selected for CPU Affinity must be local to the affected network device's Processor Node/Group. You can use the PowerShell command `Get-NetAdapterRSS` to list the cores that are local to a device. You may need to increase the number of cores assigned to the application to maximize throughput. Refer to your operating system documentation for more details on setting the CPU Affinity.

4.20.1.2 Optimization for Specific Usage Models

The following table provides guidance for additional server usage models.

Optimize For	Useful For	Optimization Tasks
Quick response and low latency	Video, audio, and High Performance Computing Cluster (HPCC) servers	- Minimize or disable interrupt moderation rate - Disable offload TCP segmentation - Disable jumbo packets - Increase transmit descriptors - Increase receive descriptors - Increase RSS queues
Throughput	Data backup/retrieval and file servers	- Enable jumbo packets - Increase transmit descriptors - Increase receive descriptors. - On systems that support NUMA, set the Preferred NUMA Node on each adapter to achieve better scaling across NUMA nodes
CPU utilization	Application, web, mail, and database servers	- Maximize interrupt moderation rate - Keep the default setting for the number of receive descriptors; avoid setting large numbers of receive descriptors - Decrease RSS queues - In Hyper-V environments, decrease the max number of RSS CPUs

4.20.2 Tuning Performance with SR-IOV

When SR-IOV is enabled in Hyper-V, the following steps can help to improve performance between VM to VM and VM to Host.

From host OSes on both Host 1 and Host 2:

1. Enable RSS on the PF and vSwitch.

```
Enable-NetAdapterRss -name "ADAPTER_NAME"
```

2. Enable 4 queues per VF:

```
Set-VMNetworkAdapter -VMName "YOUR_TEST_VM_NAME"
-IovQueuePairsRequested 4
```

```
Get-VMNetworkAdapter -VMName * | where {$_.SwitchName -eq "YOUR_TEST_
SWITCH_NAME"} | Set-VMNetworkAdapter -IovQueuePairsRequested 4
```

3. Ensure the VMs have at least twice as many vCPUs as RSS queues. In this case, set the number of total processors in the VM to 8. To do this:
 - a. Turn off the VM.
 - b. In the VM, click **Settings**.
 - c. Under **Hardware**, select **Processor**.
 - d. Change the value of **Number of virtual processors** to 8.
 - e. Apply the change.

4. For Windows Server 2022, issue the following command while the VM is in the off state:

```
Set-VMProcessor -VMName "YOUR_VM_Name" -HwThreadCountPerCore 1  
-Count 8
```

In both guest OSes VM1 and VM2:

1. Set RSS queues to 4 for all VFs in the guest OSes:

```
Set-NetAdapterRss -InterfaceDescription *adaptive*  
-NumberOfReceiveQueues 4
```

2. Update the number of queues in the guest OS:

```
Set-NetAdapterAdvancedProperty -Name "your_adapter_name_from_guest_os" -  
DisplayName "Maximum Number of RSS Queues" -DisplayValue "8 Queues"
```



NOTE: In the locations where there are settings for the number of queues, that value can be anything from 1 to 16. If you want more total throughput, increase the number of queues. When updating the number of queues, you **must** set `IovQueuePairsRequested` to a value that is equal to or greater than the number of queues you want to use in the VM.

4.20.3 Transmit Balancing

Some Intel® Ethernet 800 Series devices allow you to enable a transmit balancing feature to improve transmit performance under certain conditions. When the feature is enabled, you should experience more consistent transmit performance across queues and/or PFs and VFs.

By default, transmit balancing is disabled in the NVM. To enable this feature, use one of the following to persistently change the setting for the device:

- Use the Ethernet Port Configuration Tool (EPCT) to enable the `tx_balancing` option. Refer to the EPCT readme for more information.
- Enable the Transmit Balancing device setting in UEFI HII.
- Enable transmit balancing via Linux devlink. Refer to the Linux readme inside the driver tarball for more information.

When the driver loads, it reads the transmit balancing setting from the NVM and configures the device accordingly.



NOTE:

- The user selection for transmit balancing in EPCT, HII, or Linux devlink is persistent across reboots. You must reboot the system for the selected setting to take effect.
- This setting is device wide.
- The driver, NVM, and DDP package must all support this functionality to enable the feature.

4.20.4 Performance Profile

Performance Profiles are supported on Intel® 10GbE adapters and allow you to quickly optimize the performance of your Intel® Ethernet Adapter. Selecting a performance profile will automatically adjust some Advanced Settings to their optimum setting for the selected application. For example, a standard

server has optimal performance with only two RSS (Receive-Side Scaling) queues, but a web server requires more RSS queues for better scalability.

To change this setting in Intel PROSet

You must install Intel PROSet to use Performance profiles.

Profiles	• Standard Server – This profile is optimized for typical servers. • Web Server – This profile is optimized for IIS and HTTP-based web servers. • Virtualization Server – This profile is optimized for Microsoft's Hyper-V virtualization environment. • Storage Server – This profile is optimized for Fibre Channel over Ethernet or for iSCSI over DCB performance. Selecting this profile will disable SR-IOV and VMQ. • Storage + Virtualization – This profile is optimized for a combination of storage and virtualization requirements. • Low Latency – This profile is optimized to minimize network latency.
-----------------	--



NOTES:

- Not all options are available on all adapter/operating system combinations.
- If you have selected the Virtualization Server profile or the Storage + Virtualization profile, and you uninstall the Hyper-V role, you should select a new profile.

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Profile" -DisplayValue "Standard Server"
```

Teaming Considerations

When you create a team with all members of the team supporting Performance Profiles, you will be asked which profile to use at the time of team creation. The profile will be synchronized across the team. If there is not a profile that is supported by all team members then the only option will be Use Current Settings. The team will be created normally. Adding an adapter to an existing team works in much the same way.

If you attempt to team an adapter that supports performance profiles with an adapter that doesn't, the profile on the supporting adapter will be set to Custom Settings and the team will be created normally.

This feature is not configurable through Intel PROSet ACU. On Microsoft Windows Server 2019, Microsoft Windows* 10 Version 1809, and later, use Windows PowerShell.

4.21 Power Options

The Power Management tab in the device's Device Manager property sheet or the Adapter Settings panel in Intel PROSet ACU includes several settings that control the device's power consumption. For example, you can set the adapter to reduce its power consumption if the cable is disconnected.

4.21.1 ACPI Power States

Advanced Configuration and Power Interface (ACPI) supports a variety of power states. Each state represents a different level of power, from fully powered up to completely powered down, with partial levels of power in each intermediate state.

The following table describes the ACPI power states.

Power State	Description
S0	On and fully operational
S1	System is in low-power mode (sleep mode). The CPU clock is stopped, but RAM is powered on and being refreshed.
S2	Similar to S1, but power is removed from the CPU.
S3	Suspend to RAM (standby mode). Most components are shut down. RAM remains operational.
S4	Suspend to disk (hibernate mode). The memory contents are swapped to the disk drive and then reloaded into RAM when the system is awakened.
S5	Power off

Microsoft Windows Server is ACPI-capable. It does not support waking from a power-off (S5) state, only from standby (S3) or hibernate (S4). When shutting down the system, these states shut down ACPI devices, including Intel Ethernet adapters. This disarms the adapter's remote wake-up capability. However, in some ACPI-capable computers, the BIOS may have a setting that allows you to override the operating system and wake from an S5 state anyway. If there is no support for wake from S5 state in your BIOS settings, you are limited to Wake From Standby when using these operating systems in ACPI computers.

4.21.2 Wake on LAN (WoL) Options

The ability to remotely wake computers is an important development in computer management. This feature has evolved from a simple remote power-on capability to a complex system interacting with a variety of device and operating system power states.

The Intel PROSet Power Management tab or the Adapter Settings panel in Intel PROSet ACU includes **Wake on Magic Packet** and **Wake on directed packet** settings. These control the type of packets that wake up the system from standby.

For some adapters, the Power Management tab in Intel PROSet or the Adapter Settings panel in Intel PROSet ACU includes a setting called **Wake on Magic Packet from power off state**. Enable this setting to explicitly allow wake-up with a Magic Packet* from shutdown under APM power management mode.



NOTES:

- To use the Wake on Directed Packet feature, WoL must first be enabled in the EEPROM using BootUtil.
- If **Reduce speed during standby** is enabled, then **Wake on Magic Packet** and/or **Wake on directed packet** must be enabled. If both of these options are disabled, power is removed from the adapter during standby.
- **Wake on Magic Packet from power off state** has no effect on this option.

4.21.2.1 WoL Supported Devices

All devices support Wake on LAN on all ports, with the exceptions listed in the following table:

Family	Device	Adapter Port(s) supporting WoL
Intel Ethernet 800 Series	Intel® Ethernet Network Adapter E810-2C-Q2 Intel® Ethernet Network Adapter E810-C-Q2 Intel® Ethernet Network Adapter E810-C-Q2T Intel® Ethernet Network Adapter E810-XXV-4 Intel® Ethernet Network Adapter E810-XXV-4T Intel® Ethernet Network Adapter E810-XXV-2	Do not support WoL
Intel Ethernet 700 Series	Intel® Ethernet Network Adapter I710-T4L for OCP 3.0 Intel® Ethernet Network Adapter I710-T4L Intel® Ethernet Converged Network Adapter X710-2 Intel® Ethernet Converged Network Adapter X710-4 Intel® Ethernet Converged Network Adapter X710-T4 Intel® Ethernet Converged Network Adapter X710 Intel® Ethernet Converged Network Adapter XL710-Q1 Intel® Ethernet Converged Network Adapter XL710-Q2 Intel® Ethernet Network Adapter X710-T2L Intel® Ethernet Network Adapter X710-T4L Intel® Ethernet Network Adapter X710-TL	Do not support WoL
Intel Ethernet 500 Series	Intel® Ethernet Server Adapter X520-2 Intel® Ethernet Server Adapter X520-1 Intel® Ethernet Server Adapter X540-T1 Intel® Ethernet Converged Network Adapter X540-T2 Intel® Ethernet Converged Network Adapter X540-T1	Do not support WoL Note: Most Intel 10GbE Network Adapters do not support Wake on LAN on any port. The following 10GbE Network Adapters <i>do</i> support Wake on LAN on all ports: - Intel® Ethernet Server Adapter X550-T2 for OCP - Intel® Ethernet Server Adapter X550-T1 for OCP
Intel Ethernet 300 Series	Intel® Ethernet Server Adapter I350-T2 Intel® Ethernet Server Adapter I350-T4 Intel® Ethernet Server Adapter I340-T2 Intel® Ethernet Server Adapter I340-T4 Intel® Ethernet Server Adapter I340-F4	Support WoL only on Port A

4.21.2.2 Wake from S0ix on Magic Packet

Enables this device to bring the system out of an S0ix power state when the device receives a Magic Packet.

Range	• Disabled • Enabled
--------------	---

4.21.3 Reduce Power if Cable Disconnected & Reduce Link Speed During Standby

Enables the adapter to reduce power consumption when the LAN cable is disconnected from the adapter and there is no link. When the adapter regains a valid link, adapter power usage returns to its normal state (full power usage).

The Hardware Default option is available on some adapters. If this option is selected, the feature is disabled or enabled based on the system hardware.

Range	The range varies with the operating system and adapter.
--------------	---

4.21.4 Ultra Low Power Mode When Cable is Disconnected

Enabling Ultra Low Power (ULP) mode significantly reduces power consumption when the network cable is disconnected from the device.



NOTE: If you experience link issues when two ULP-capable devices are connected back to back, disable ULP mode on one of the devices.

4.21.5 Selective Suspend

Enables the device to enter a low power state when the network is idle.

Range	• Disabled • Enabled
--------------	---

4.21.6 Selective Suspend Idle Timeout

Sets the length of time that the network is idle before the device enters a low power state. You must enable Selective Suspend for this setting to take effect.

Range	1 - 60 in seconds
--------------	-------------------

4.21.7 Energy Efficient Ethernet

The Energy Efficient Ethernet (EEE) feature allows a capable device to enter Low-Power Idle between bursts of network traffic. Both ends of a link must have EEE enabled for any power to be saved. Both ends of the link will resume full power when data needs to be transmitted. This transition may introduce a small amount of network latency.

**NOTES:**

- Both ends of the IEEE link must automatically negotiate link speed.
- IEEE is not supported on every adapter.

4.22 Priority & VLAN Tagging

Enables the adapter to offload the insertion and removal of priority and VLAN tags for transmit and receive.

To change this setting in Intel PROSet

Range	• Priority & VLAN Disabled • Priority Enabled • VLAN Enabled • Priority & VLAN Enabled
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To set this in Windows Powershell, first disable DCB, then set priority and VLAN tagging. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "DCB" -DisplayValue "Disabled"
```

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Packet Priority & VLAN" -DisplayValue "VLAN Enabled"
```

4.23 Quality of Service

Quality of Service (QoS) allows the adapter to send and receive IEEE 802.3ac tagged frames. 802.3ac tagged frames include 802.1p priority-tagged frames and 802.1Q VLAN-tagged frames. In order to implement QoS, the adapter must be connected to a switch that supports and is configured for QoS. Priority-tagged frames allow programs that deal with real-time events to make the most efficient use of network bandwidth. High priority packets are processed before lower priority packets.

To change this setting in Intel PROSet

Tagging is enabled and disabled using the following fields:

- Windows Server: Use the "QoS Packet Tagging" field in the **Advanced** tab in Intel PROSet or in the **Adapter Settings** panel in Intel PROSet ACU
- Other versions of Windows: Use the "Priority/VLAN Tagging" setting on the **Advanced** tab in Intel PROSet or in the **Adapter Settings** panel in Intel PROSet ACU

To set this in Windows Powershell, first disable DCB, then set QoS using the Priority and VLAN tagging DisplayName in the cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "DCB" -DisplayValue "Disabled"
```

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Packet Priority & VLAN" -DisplayValue "VLAN Enabled"
```

Once QoS is enabled, you can specify levels of priority based on IEEE 802.1p/802.1Q frame tagging.

The supported operating systems, including Windows Server, have a utility for 802.1p packet prioritization. For more information, see the Windows system help and Microsoft's knowledge base.



NOTE: The first generation Intel® PRO/1000 Gigabit Server Adapter (PWLA 8490) does not support QoS frame tagging.

4.24 Receive Buffers

Defines the number of Receive Buffers, which are data segments. They are allocated in the host memory and used to store the received packets. Each received packet requires at least one Receive Buffer, and each buffer uses 2KB of memory.

You might choose to increase the number of Receive Buffers if you notice a significant decrease in the performance of received traffic. If receive performance is not an issue, use the default setting appropriate to the adapter.

To change this setting in Intel PROSet

Range	128-4096, in intervals of 64, for all adapters.
Recommended Value	Teamed adapter: 256 Using IPSec and/or multiple features: 352

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Receive Buffers" -  
DisplayValue "256"
```

4.25 Receive Side Scaling

When Receive Side Scaling (RSS) is enabled, all of the receive data processing for a particular TCP connection is shared across multiple processors or processor cores. Without RSS all of the processing is performed by a single processor, resulting in less efficient system cache utilization.

4.25.1 LAN RSS

LAN RSS applies to a particular TCP connection.



NOTE: This setting has no effect if your system has only one processing unit.

4.25.1.1 LAN RSS Configuration

If your adapter does not support RSS, or if the SNP or SP2 is not installed, the RSS setting will not be displayed. If RSS is supported in your system environment, the following will be displayed:

- **Port NUMA Node.** This is the NUMA node number of a device.
- **Starting RSS CPU.** This setting allows you to set the preferred starting RSS processor. Change this setting if the current processor is dedicated to other processes. The setting range is from 0 to the number of logical CPUs - 1.
- **Max number of RSS CPU.** This setting allows you to set the maximum number of CPUs assigned to an adapter and is primarily used in a Hyper-V environment. By decreasing this setting in a Hyper-V environment, the total number of interrupts is reduced which lowers CPU utilization. The default is 8 for Gigabit adapters and 16 for 10 Gigabit, or faster, adapters.
- **Preferred NUMA Node.** This setting allows you to choose the preferred NUMA (Non-Uniform Memory Access) node to be used for memory allocations made by the network adapter. In addition, the system will attempt to use the CPUs from the preferred NUMA node first for the purposes of RSS. On NUMA platforms, memory access latency is dependent on the memory location. Allocation of memory from the closest node helps improve performance. The Windows Task Manager shows the NUMA Node ID for each processor.

**NOTES:**

- This setting only affects NUMA systems. It will have no effect on non-NUMA systems.
- Choosing a value greater than the number of NUMA nodes present in the system selects the NUMA node closest to the device.
- **Receive Side Scaling Queues.** This setting configures the number of RSS queues, which determine the space to buffer transactions between the network adapter and CPU(s).

To change this setting in Intel PROSet

Range	• 1 queue is used when low CPU utilization is required. • 2 queues are used when good throughput and low CPU utilization are required. • 4 or more queues are used for applications that demand maximum throughput and transactions per second.  NOTES: • Not all settings are available on all adapters. • 8, or more, queues are only available when Intel PROSet for Windows Device Manager or Intel PROSet ACU is installed. If Intel PROSet is not installed, only 4 queues are available. • Using 8 or more queues requires the system to reboot.
--------------	--

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Receive Side Scaling" -
DisplayValue "Enabled"
```

4.25.1.2 LAN RSS and Teaming

- If RSS is not enabled for all adapters in a team, RSS will be disabled for the team.
- If an adapter that does not support RSS is added to a team, RSS will be disabled for the team.
- If you create a multi-vendor team, you must manually verify that the RSS settings for all adapters in the team are the same.

4.26 Remote Direct Memory Access (RDMA)

Remote Direct Memory Access, or RDMA, allows a network device to transfer data directly to and from application memory on another system, increasing throughput and lowering latency in certain networking environments.

- Intel® Ethernet 800 Series devices support both iWARP and RoCEv2.
- Intel® Ethernet X722 Series devices only support iWARP.

The major difference is that iWARP performs RDMA over TCP, while RoCEv2 uses UDP.

On devices with RDMA capabilities, RDMA is supported on the following operating systems (refer to "Supported Operating Systems" on page 2 for currently supported versions):

- Linux
- FreeBSD
- ESXi
- Windows Server

To avoid performance degradation from dropped packets, enable link level flow control or priority flow control on all network interfaces and switches.



NOTES:

- On systems running a Microsoft Windows Server operating system, enabling *QoS/priority flow control will disable link level flow control.
- Devices based on the Intel® Ethernet 800 Series do not support RDMA when operating in multiport mode with more than 4 ports.
- On Linux systems, RDMA and link aggregation (LAG, also known as *bonding*) are not compatible on most devices. If RDMA is enabled, bonding will not be functional.
 - On Intel Ethernet 810 Series devices, RDMA and LAG are compatible if all the following are true:
 - RDMA technology is set to RoCEv2.
 - LAG configuration is active-backup.
 - Bonding is between two ports within the same device.
 - The QoS configuration of the two ports matches prior to the bonding of the devices.

4.26.1 RDMA on Linux or FreeBSD

For Intel Ethernet devices that support RDMA on Linux or FreeBSD, use the drivers shown in the following table.

Device	Linux		FreeBSD		Supported Protocols
	Base Driver	RDMA Driver	Base Driver	RDMA Driver	
Intel® Ethernet 800 Series	ice	irdma	ice	irdma	RoCEv2, iWARP
Intel® Ethernet X722 Series	i40e	irdma	ixl	not supported	iWARP

Basic Installation Instructions

At a high level, installing and configuring RDMA on Linux or FreeBSD consists of the following steps. See the README file inside the appropriate RDMA driver tarball for full details.

1. Install the base driver.
2. Install the RDMA driver.
3. Install and patch any user-mode RDMA libraries. Exact steps will vary by operating system; refer to the RDMA driver readme for details.
4. Enable flow control on your device. Refer to the base driver README for details and supported modes.
5. If you are using RoCE, enable flow control (PFC or LFC) on the device and endpoint your system is connected to. See your switch documentation and, for Linux, the [Intel® Ethernet 800 Series Linux Flow Control Configuration Guide for RDMA Use Cases](#) for details.

4.26.1.1 RDMA for Virtualized Environments in Linux

Devices based on the Intel Ethernet 800 Series support RDMA in a Linux VF on supported Windows or Linux hosts. Refer to the README file inside the Linux RDMA driver tarball for more information on how to load and configure RDMA in a Linux VF.

4.26.2 RDMA on Microsoft Windows

4.26.2.1 RDMA for Network Direct (ND) User-Mode Applications

Network Direct (ND) allows user-mode applications to use RDMA features.



NOTE: User mode applications may have prerequisites such as Microsoft HPC Pack or Intel MPI Library, refer to your application documentation for more details.

RDMA User Mode Installation

The Intel® Ethernet User Mode RDMA Provider is supported on Microsoft Windows Server.

Follow the steps below to install user-mode Network Direct features.

1. Download the software package you want for the release. See "Install Drivers and Software" on page 14 for more information.
 - A. If you are installing via the complete driver pack:
 - i. In the extracted files from the download, navigate to \APPS\PROSETDX and then the Windows subfolder corresponding to your version of Windows (32-bit or 64-bit).
 - ii. Inside the Winx64 or Win32 folder, double-click on DxSetup.exe to launch the install wizard.

- B. If you are installing via the separate webpaks for base drivers and Intel PROSet:
 - i. Download and extract the webpak for Intel PROSet.
 - ii. In the extracted files, double-click on the **.exe** file to launch the install wizard.
2. On the Setup Options screen, select "Intel® Ethernet User Mode RDMA Provider".
3. On the RDMA Configuration Options screen, select "Enable RDMA routing across IP Subnets" if desired. Note that this option is displayed during base driver installation even if user mode RDMA was not selected, as this option is applicable to Network Direct Kernel functionality as well.
4. If Windows Firewall is installed and active, select "Create an Intel® Ethernet RDMA Port Mapping Service rule in Windows Firewall" and the networks to which to apply the rule.



NOTE: If Windows Firewall is disabled or you are using a third party firewall, you will need to add this rule manually.

5. Continue with driver and software installation.

4.26.2.2 RDMA Network Direct Kernel (NDK)

RDMA Network Direct Kernel (NDK) functionality is included in the Intel base networking drivers and requires no additional features to be installed.

RDMA Routing Across IP Subnets

If you want to allow NDK's RDMA functionality across subnets, you will need to select "Enable RDMA routing across IP Subnets" on the RDMA Configuration Options screen during [base driver installation](#).

4.26.2.3 Enabling Priority Flow Control (PFC) on a Microsoft Windows Server Operating System

To avoid performance degradation from dropped packets, enable priority flow control (PFC) or link level flow control on all network interfaces and switches.



NOTE: On systems running a Microsoft Windows Server operating system, enabling *QoS/priority flow control will disable link level flow control.

Use the following PowerShell commands to enable PFC on Microsoft Windows Server:

```
Install-WindowsFeature -Name Data-Center-Bridging -IncludeManagementTools
New-NetQoSPolicy "SMB" -NetDirectPortMatchCondition 445 -PriorityValue8021Action 3
Enable-NetQoSFlowControl -Priority 3
Disable-NetQoSFlowControl -Priority 0,1,2,4,5,6,7
New-NetQoSTrafficClass -Name "SMB" -Priority 3 -BandwidthPercentage 60 -Algorithm ETS
Set-NetQoS DcbxSetting -Willing $FALSE
Enable-NetAdapterQos -Name "Slot1 4 2 Port 1"
```

4.26.2.4 Verifying RDMA Operation with Microsoft PowerShell

You can check that RDMA is enabled on the network interfaces using the following Microsoft PowerShell command:

```
Get-NetAdapterRDMA
```

Use the following PowerShell command to check if the network interfaces are RDMA capable and multichannel is enabled:

```
Get-SmbClientNetworkInterface
```

Use the following PowerShell command to check if Network Direct is enabled in the operating system:

```
Get-NetOffloadGlobalSetting | Select NetworkDirect
```

Use netstat to make sure each RDMA-capable network interface has a listener at port 445 (Windows Client OSs that support RDMA may not post listeners). For example:

```
netstat.exe -xan | ? {$_ -match "445"}
```

4.26.2.5 RDMA for Virtualized Environments in Windows

To enable RDMA functionality on virtual adapter(s) connected to a VMSwitch, you must:

- Enable SR-IOV (Single Root IO Virtualization) and VMQ (Virtual Machine Queues) advanced properties on each port.
- Set the number of VFs to enable with RDMA capabilities. You can enable up to 32 VFs with RDMA capabilities.

Under certain circumstances, you may disable these settings by default. You can manually set these options in the Adapter Settings panel of Intel PROSet ACU, in the Advanced tab of the adapter properties dialog box, or with the following PowerShell commands:

```
Set-NetAdapterAdvancedProperty -Name <nic_name> -RegistryKeyword *SRIOV -RegistryValue 1
Set-NetAdapterAdvancedProperty -Name <nic_name> -RegistryKeyword *VMQ -RegistryValue 1
Set-NetAdapterAdvancedProperty -Name <nic_name> -RegistryKeyword RdmaMaxVfsEnabled -
RegistryValue <1-32>
```

4.26.2.6 Configuring RDMA Guest Support (NDK Mode 3)

NDK Mode 3 allows kernel mode Windows components to use RDMA features inside Hyper-V guest partitions. To enable NDK mode 3 on an Intel Ethernet device, do the following:

1. Enable SR-IOV in your system's BIOS or uEFI.
2. Enable the SR-IOV advanced setting on the device.
3. Enable SR-IOV on the VMSwitch bound to the device by performing the following for all physical functions on the same device:


```
New-VMSwitch -Name <switch_name> -NetAdapterName <device_name>
-EnableIov $true
```
4. Configure the number of RDMA virtual functions (VFs) on the device by setting the "RdmaMaxVfsEnabled" advanced setting. All physical functions must be set to the same value. The value is the maximum number of VFs that can be capable of RDMA at one time for the entire device. Enabling more VFs will restrict RDMA resources from physical functions (PFs) and other VFs.


```
Set-NetAdapterAdvancedProperty -Name <device_name> -RegistryKeyword
RdmaMaxVfsEnabled -RegistryValue <Value: 0 - 32>
```
5. Disable all PF adapters on the host and re-enable them. This is required when the registry keyword "RdmaMaxVfsEnabled" is changed or when creating or destroying a VMSwitch.


```
Get-NetAdapterRdma | Disable-NetAdapter
Get-NetAdapterRdma | Enable-NetAdapter
```
6. Create VM Network Adapters for VMs that require RDMA VF support.


```
Add-VMNetworkAdapter -VMName <vm_name> -VMNetworkAdapterName <device_name> -
SwitchName <switch_name>
```

7. If you plan to use Microsoft Windows 10 Creators Update (RS2) or later on a guest partition, set the RDMA weight on the VM Network Adapter by entering the following command on the host:

```
Set-VMNetworkAdapterRdma -VMName <vm_name> -VMNetworkAdapterName <device_name> -RdmaWeight 100
```
8. Set SR-IOV weight on the VM Network Adapter (Note: SR-IOV weight must be set to 0 before setting the RdmaWeight to 0):

```
Set-VMNetworkAdapter -VMName <vm_name> -VMNetworkAdapterName <device_name> -IovWeight 100
```
9. Install the VF network adapter with the PROSET Installer in the VM.
10. Enable RDMA on the VF driver and Hyper-V Network Adapter using PowerShell in the VM:

```
Set-NetAdapterAdvancedProperty -Name <device_name> -RegistryKeyword RdmaVfEnabled -RegistryValue 1
Get-NetAdapterRdma | Enable-NetAdapterRdma
```

4.26.2.7 RDMA for NDK Features such as SMB Direct (Server Message Block)

NDK allows Windows components (such as SMB Direct storage) to use RDMA features.

Testing NDK: Microsoft Windows SMB Direct with DiskSPD

This section outlines the recommended way to test RDMA for Intel Ethernet functionality and performance on Microsoft Windows operating systems.

Note that since SMB Direct is a storage workload, the performance of the benchmark may be limited to the speed of the storage device rather than the network interface being tested. Intel recommends using the fastest storage possible in order to test the true capabilities of the network device(s) under test.

Test instructions:

1. Set up and connect at least two servers running a supported Microsoft Windows Server operating system, with at least one RDMA-capable Intel® Ethernet device per server.
2. On the system designated as the SMB server, set up an SMB share. Note that the performance of the benchmark may be limited to the speed of the storage device rather than the network interface being tested. Storage setup is outside of the scope of this document. You can use the following PowerShell command:

```
New-SmbShare -Name <SMBsharename> -Path <SMBsharefilepath> -FullAccess <domainname>\Administrator,Everyone
```

For Example:

```
New-SmbShare -Name RAMDISKShare -Path R:\RAMDISK -FullAccess group\Administrator,Everyone
```

3. Download and install the Diskspd Microsoft utility from here:
<https://gallery.technet.microsoft.com/DiskSpd-a-robust-storage-6cd2f223>
4. Using CMD or Powershell, cd to the DiskSpd folder and run tests. (Refer to Diskspd documentation for more details on parameters)

For Example: Set the block size to 4K, run the test for 60 seconds, disable all hardware and software caching, measure and display latency statistics, leverage 16 overlapped IOs and 16 threads per target, random 0% writes and 100% reads and create a 10GB test file at

```
"\\<SMBserverTestIP>\<SMBsharename>\test.dat" :
.\diskspd.exe -b4K -d60 -h -L -o16 -t16 -r -w0 -c10G
\\<SMBserverTestIP>\<SMBsharename>\test.dat
```


5. Verify that RDMA traffic is running using perfmon counters such as "RDMA Activity" and "SMB Direct Connection". Refer to Microsoft documentation for more details.

4.26.2.8 RDMA Windows Performance Monitoring

You can use perfmon, or other performance monitoring tool, to monitor and display RDMA counters and statistics. Refer to Microsoft documentation for more details. Use the Register-IntelEthernetRDMACounterSet cmdlet registers the RDMA statistics counters for the specific device with perfmon. Refer to "Configuring with Windows PowerShell" on page 21 for more information about how to install and use Intel Ethernet cmdlets. You can use the following PowerShell command to register the RDMA statistics for all supported devices:

```
Register-IntelEthernetRDMACounterSet
```

You can use the following PowerShell cmdlet to unregister the RDMA statistics:

```
Unregister-IntelEthernetRDMACounterSet
```

4.26.3 Accessing Remote NVM Express* Drives Using RDMA

RDMA provides a high throughput, low latency means to directly access NVM Express* (NVMe*) drives on a remote server.

Refer to the following for details on supported operating systems and how to set up and configure your server and client systems:

- *NVM Express over TCP for Intel® Ethernet Products Configuration Guide*
- *NVM Express over Fabrics for Intel® Ethernet Products with RDMA Configuration Guide*

Both guides are available on the [Intel Technical Library](#).

4.27 Setting Speed and Duplex

The Link Speed and Duplex setting lets you choose how the adapter sends and receives data packets over the network.

In the default mode, an Intel network adapter using copper connections will attempt to auto-negotiate with its link partner to determine the best setting. If the adapter cannot establish link with the link partner using auto-negotiation, you may need to manually configure the adapter and link partner to the identical setting to establish link and pass packets. This should only be needed when attempting to link with an older switch that does not support auto-negotiation or one that has been forced to a specific speed or duplex mode.

Auto-negotiation is disabled by selecting a discrete speed and duplex mode in the adapter properties sheet. The settings available when auto-negotiation is disabled are dependent on your device. Not all speeds are available on all devices. Your link partner must match the setting you choose.

**NOTES:**

- Only experienced network administrators should force speed and duplex manually.
- Fiber-based adapters operate only in full duplex at their native speed. You cannot change the speed or duplex of Intel adapters that use fiber cabling.
- Some devices may list 10 Mbps and 100 Mbps in full or half duplex as options. These settings are not recommended.
- Link speed information in Intel PROSet may display a blue informational icon with a mouse-over message "This device is not linked at its maximum capable speed". In that case, if your device is set to auto-negotiate, you can adjust the speed of the device's link partner to the device's maximum speed. If the device is not set to auto-negotiate, you can adjust the device's speed manually, but you must ensure the link partner is set at the same speed.
- Auto-negotiation and Auto-Try are not supported on devices based on the Intel® Ethernet Connection X552 and Intel® Ethernet Connection X553.

4.27.1 Manually Configuring Duplex and Speed Settings



CAUTION: The settings at the switch must always match the adapter settings. Adapter performance may suffer, or your adapter might not operate correctly if you configure the adapter differently from your switch.

The default setting is for auto-negotiation to be enabled. Only change this setting to match your link partner's speed and duplex setting if you are having trouble connecting.

To change this setting in Intel PROSet

In Intel PROSet for Windows Device Manager:

1. In Windows Device Manager, double-click the adapter you want to configure.
2. On the **Link Speed** tab, select a speed and duplex option from the **Speed and Duplex** drop-down menu.
3. Click **OK**.

In Intel PROSet ACU, link speed is reported on the Adapter Information panel. Change speed and duplex in the Adapter Settings panel.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Speed & Duplex" -  
DisplayValue "Auto Negotiation"
```

4.28 Thermal Monitoring

Adapters and network controllers based on the Intel® Ethernet Controller I350 (and later controllers) can display temperature data and automatically reduce the link speed if the controller temperature gets too hot.



NOTE: This feature is enabled and configured by the equipment manufacturer. It is not available on all adapters and network controllers. There are no user configurable settings.

4.28.1 Monitoring and Reporting

Temperature information is displayed on the Link tab in Intel PROSet for Windows Device Manager or in the Adapter Information panel in Intel PROSet ACU. There are three possible conditions:

- Temperature: Normal
Indicates normal operation.
- Temperature: Overheated, Link Reduced
Indicates that the device has reduced link speed to lower power consumption and heat.
- Temperature: Overheated, Adapter Stopped
Indicates that the device is too hot and has stopped passing traffic so it is not damaged.

If either of the overheated events occur, the device driver writes a message to the system event log.

4.29 Timestamps

4.29.1 PTP Hardware Timestamp

Allows applications that use PTPv2 (Precision Time Protocol) to use hardware generated timestamps to synchronize clocks throughout your network. If this setting is enabled, it takes precedence over the [Software Timestamp](#) setting.

To change this setting in Intel PROSet

Range	• Enabled • Disabled
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "PTP Hardware Timestamp" -
DisplayValue "Enabled"
```

4.29.2 Software Timestamp

Allows applications that use PTPv2 (Precision Time Protocol) to use software generated timestamps to synchronize clocks throughout your network. If the [PTP Hardware Timestamp](#) setting is enabled, it takes precedence over this setting.

To change this setting in Intel PROSet

Range	• Disabled • RxAll • TxAll • RxAll & TxAll • TaggedTx • RxAll & TaggedTx
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the `Set-IntelNetAdapterSetting` cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Software Timestamp" -  
DisplayValue "RxAll"
```

4.30 Transmit Buffers

Defines the number of Transmit Buffers, which are data segments that enable the adapter to track transmit packets in the system memory. Depending on the size of the packet, each transmit packet requires one or more Transmit Buffers.

You might choose to increase the number of Transmit Buffers if you notice a possible problem with transmit performance. Although increasing the number of Transmit Buffers can enhance transmit performance, Transmit Buffers do consume system memory. If transmit performance is not an issue, use the default setting. This default setting varies with the type of adapter.

To change this setting in Intel PROSet

Range	128-16384, in intervals of 64, for 10 Gigabit Server Adapters. 128-4096, in intervals of 64, for all other adapters.
--------------	---

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the `Set-IntelNetAdapterSetting` cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Transmit Buffers" -  
DisplayValue "128"
```

4.31 Virtualization Support

Virtualization makes it possible for one or more operating systems to run simultaneously on the same physical system as virtual machines. This allows you to consolidate several servers onto one system, even if they are running different operating systems. Intel® Network Adapters work with, and within, virtual machines with their standard drivers and software.



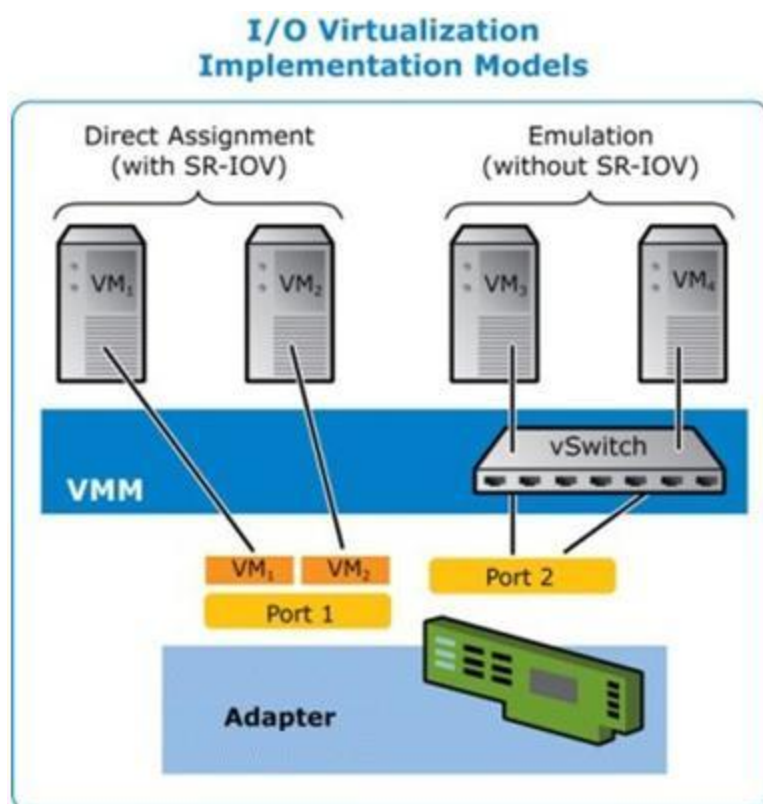
NOTES:

- Some virtualization options are not available on some adapter/operating system combinations.
- The jumbo frame setting inside a virtual machine must be the same, or lower than, the setting on the physical port.
- When you attach a Virtual Machine to a tenant overlay network through the Virtual NIC ports on a Virtual Switch, the encapsulation headers increase the Maximum Transmission Unit (MTU) size on the virtual port. The Encapsulation Overhead feature automatically adjusts the physical port's MTU size to compensate for this increase.

4.31.1 Single Root I/O Virtualization (SR-IOV)

4.31.1.1 SR-IOV Overview

Single Root I/O Virtualization (SR-IOV) is a PCI SIG specification allowing PCI Express devices to appear as multiple separate physical PCI Express devices. SR-IOV allows efficient sharing of PCI devices among Virtual Machines (VMs). It manages and transports data without the use of a hypervisor by providing independent memory space, interrupts, and DMA streams for each virtual machine.



SR-IOV architecture includes two functions:

- Physical Function (PF) is a full featured PCI Express function that can be discovered, managed and configured like any other PCI Express device.
- Virtual Function (VF) is similar to PF but cannot be configured and only has the ability to transfer data in and out. The VF is assigned to a Virtual Machine.

SR-IOV Benefits

SR-IOV has the ability to increase the number of virtual machines supported per physical host, improving I/O device sharing among virtual machines for higher overall performance:

- Provides near native performance due to direct connectivity to each VM through a virtual function
- Preserves VM migration
- Increases VM scalability on a virtualized server
- Provides data protection

4.31.1.2 Configuring SR-IOV

SR-IOV lets a single network port appear to be several virtual functions in a virtualized environment. If you have an SR-IOV capable NIC, each port on that NIC can assign a virtual function to several guest partitions. The virtual functions bypass the Virtual Machine Manager (VMM), allowing packet data to move directly to a guest partition's memory, resulting in higher throughput and lower CPU utilization. SR-IOV also allows you to move packet data directly to a guest partition's memory. See your operating system documentation for system requirements.

For devices that support it, SR-IOV is enabled in the host partition. Some devices may need to have SR-IOV enabled in a preboot environment.



NOTES:

- **Configuring SR-IOV for improved network security:** In a virtualized environment, on Intel® Server Adapters that support SR-IOV or Intel® Scalable I/O Virtualization (Intel® Scalable IOV), the virtual function (VF) may be subject to malicious behavior. Software-generated layer two frames, like IEEE 802.3x (link flow control), IEEE 802.1Qbb (priority based flow-control), and others of this type, are not expected and can throttle traffic between the host and the virtual switch, reducing performance. To resolve this issue, and to ensure isolation from unintended traffic streams, configure all SR-IOV or Intel Scalable IOV enabled ports for VLAN tagging from the administrative interface on the PF. This configuration allows unexpected, and potentially malicious, frames to be dropped.
- SR-IOV must be enabled in the BIOS.
- You must enable VMQ for SR-IOV to function.
- For best performance, on the host use 'Set-VMNetworkAdapter -IovQueuePairsRequested 4' on the VF to allow the virtual network to use 4 queues (maximum supported value) and assign 4 or more virtual CPUs to the connected VM. In the VM, set 'Maximum number of Receive Queues' in the VF's adapter properties to 4.
- Binding more than two virtual functions (VFs) to a virtual machine (VM) is not recommended. Binding more VFs to a VM may cause system instability.
- SR-IOV is not supported with Intel ANS teams.
- VMWare ESXi does not support SR-IOV on 1GbE ports.

To change this setting in Intel PROSet

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "SR-IOV" -DisplayValue "Enabled"
```

4.31.2 Intel® Scalable I/O Virtualization Support

Intel® Scalable I/O Virtualization (Intel® Scalable IOV) allows you to share a physical device across multiple virtual machines and applications. Intel Scalable IOV provides your system the ability to share device resources with different address domains using different abstractions. For example, application processes may access a device using system calls and VMs may access a device through virtual device interfaces.

Intel Scalable IOV and SR-IOV (Single Root I/O Virtualization) are mutually exclusive. If both are enabled on your system, and all of the Intel Scalable IOV requirements are met, the PF driver will use Intel Scalable IOV. If the Intel Scalable IOV requirements are not met, the PF driver will use SR-IOV.

For more information, please refer to the [Intel Scalable I/O Virtualization Technical Specification](#) (login required).

Intel Scalable IOV is not available in the kernel driver. Download and install the current driver to use this feature. Refer to the [Customer Support section](#) for where to download the current driver.

4.31.2.1 Requirements

- Your system platform must support Intel Scalable IOV
- A network device based on an Intel(R) Ethernet 800 Series controller
- The host operating system must be a Linux distro using kernel version 5.12 - 5.15
- The host PF driver must be version 1.9.0, or later
- The guest operating system must be Linux
- The guest iAVF driver must be version 4.5.0, or later

4.31.2.2 Enabling Intel® Scalable IOV

You can use Intel's Ethernet Port Configuration Tool (EPCT) to enable Intel Scalable IOV. If the EPCT tool is not available, you can also enable Intel Scalable IOV through your system's HII interface (if it has one). The recommended method is to use the EPCT tool. To enable or disable Intel Scalable IOV using the EPCT tool, use one of these commands:

```
# epct -nic=1 -set 'siov enable'
# epct -nic=1 -set 'siov disable'
```

Where `-nic=1` specifies the Intel Ethernet device. See the EPCT tool documentation for instructions on how to determine the NIC number of your device.

If the EPCT tool is not available, and your system has an HII interface, you can use the HII interface to enable/disable Intel Scalable IOV. Find the 'Intel Scalable IOV (Scalable IOV)' setting and select your desired value.

4.31.3 Virtual Machine Queue Offloading

Enabling VMQ offloading increases receive and transmit performance, as the adapter hardware is able to perform these tasks faster than the operating system. Offloading also frees up CPU resources. Filtering is based on MAC and/or VLAN filters.

Each Intel® Ethernet Adapter has a pool of virtual ports that are split between the various features, such as VMQ Offloading, SR-IOV, and Data Center Bridging (DCB). Increasing the number of virtual ports used for one feature decreases the number available for other features. On devices that support it, enabling DCB reduces the total pool available for other features to 32.



NOTE: This does not apply to devices based on the Intel® Ethernet X710 or XL710 controllers.

For devices that support it, VMQ offloading is enabled in the host partition in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility or on the Advanced tab of the adapter's Device Manager property sheet, under Virtualization properties. Virtualization properties also displays the number of virtual

ports available for virtual functions, and allows you to set the distribution of available virtual ports between VMQ and SR-IOV.

4.31.3.1 Teaming Considerations

- If VMQ is not enabled for all adapters in a team, VMQ will be disabled for the team.
- If an adapter that does not support VMQ is added to a team, VMQ will be disabled for the team.
- Virtual NICs cannot be created on a team with Receive Load Balancing enabled. Receive Load Balancing is automatically disabled if you create a virtual NIC on a team.
- If a team is bound to a Hyper-V virtual NIC, you cannot change the Primary or Secondary adapter.

4.31.3.2 Virtual Machine Multiple Queues

Virtual Machine Multiple Queues (VMMQ) enables Receive Side Scaling (RSS) for virtual ports attached to a physical port. This allows RSS to be used with SR-IOV and inside a VMQ virtual machine, and offloads the RSS processing to the network adapter. RSS balances receive traffic across multiple CPUs or CPU cores. This setting has no effect if your system has only one processing unit.

4.31.4 Using Intel® Network Adapters in a Microsoft* Hyper-V* Environment

When a Hyper-V Virtual NIC (VNIC) interface is created in the host OS, the VNIC takes on the MAC address of the underlying physical NIC (PF, or physical function). The same is true when a VNIC is created on a team or VLAN. Since the VNIC uses the MAC address of the underlying interface, any operation that changes the MAC address of the interface (for example, setting LAA on the interface), will cause the VNIC to lose connectivity. In order to prevent this loss of connectivity, Intel PROSet will not allow you to change settings that change the MAC address.



NOTES:

- When sent from inside a virtual machine, LLDP and LACP packets may be a security risk. The Intel® Virtual Function driver blocks the transmission of such packets.
- The Virtualization setting on the Advanced tab of the adapter's Device Manager property sheet is not available if the Hyper-V role is not installed.

4.31.4.1 The Virtual Machine Switch

The virtual machine switch is part of the network I/O data path. It sits between the physical NIC and the virtual machine NICs and routes packets to the correct MAC address. Enabling [Virtual Machine Queue \(VMQ\) offloading](#) in Intel PROSet will automatically enable VMQ in the virtual machine switch. For driver-only installations, you must manually enable VMQ in the virtual machine switch.



NOTE: Intel ANS VLANs are not compatible with the Microsoft Hyper-V virtual machine switch. If you want to bind the virtual machine switch to a VLAN, you must create the VLAN from within the Virtual Switch Manager.

4.31.4.2 Using Intel ANS VLANs

If you create Intel ANS VLANs in the host OS, and you then create a Hyper-V Virtual NIC interface on an Intel ANS VLAN, then the Virtual NIC interface **must** have the same VLAN ID as the VLAN. Using a

different VLAN ID or not setting a VLAN ID on the Virtual NIC interface will result in loss of communication on that interface.

Virtual Switches bound to an Intel ANS VLAN will have the same MAC address as the VLAN, which will have the same address as the underlying NIC or team. If you have several VLANs bound to a team and bind a virtual switch to each VLAN, all of the virtual switches will have the same MAC address. Clustering the virtual switches together will cause a network error in Microsoft's cluster validation tool. In some cases, ignoring this error will not impact the performance of the cluster. However, such a cluster is not supported by Microsoft. Using Device Manager to give each of the virtual switches a unique address will resolve the issue. See the Microsoft TechNet article [Configure MAC Address Spoofing for Virtual Network Adapters](#) for more information.

Virtual Machine Queues (VMQ) and SR-IOV cannot be enabled on a Hyper-V Virtual NIC interface bound to a VLAN configured using the VLANs tab in Windows Device Manager.

4.31.4.3 Using an Intel ANS Team or VLAN as a Virtual NIC

If you want to use a team or VLAN as a virtual NIC, you must follow these steps:



NOTES:

- This applies only to virtual NICs created on a team or VLAN. Virtual NICs created on a physical adapter do not require these steps.
- Receive Load Balancing (RLB) is not supported in Hyper-V. Disable RLB when using Hyper-V.

1. Use Intel PROSet to create the team or VLAN.
2. Open the Network Control Panel.
3. Open the team or VLAN.
4. On the General Tab, uncheck all of the protocol bindings and click OK.
5. Create the virtual NIC. (If you check the "Allow management operating system to share the network adapter." box you can do the following step in the host OS.)
6. Open the Network Control Panel for the Virtual NIC.
7. On the General Tab, check the protocol bindings that you desire.



NOTE: This step is not required for the team. When the Virtual NIC is created, its protocols are correctly bound.

4.31.4.4 Command Line for Microsoft Windows Server Core

Microsoft Windows Server Core does not have a GUI interface. If you want to use an Intel ANS Team or VLAN as a Virtual NIC, you must use [Microsoft Windows PowerShell](#) to set up the configuration. Use Windows PowerShell to create the team or VLAN.

The following is an example of how to set up the configuration using Microsoft Windows PowerShell.

1. Get all the adapters on the system and store them into a variable.

```
$a = Get-IntelNetAdapter
```

2. Create a team by referencing the indexes of the stored adapter array.

```
New-IntelNetTeam -TeamMembers $a[1],$a[2] -TeamMode
VirtualMachineLoadBalancing -TeamName "Team1"
```

4.32 Virtual LANs

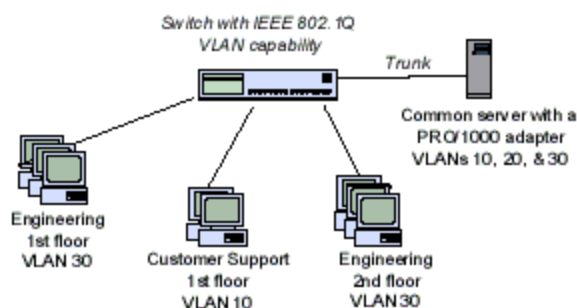
4.32.1 Overview



NOTES:

- For more information on Intel ANS, refer to "Adapter Teaming" on page 25.
 - Intel ANS is not supported on Microsoft Windows Server 2016 and later.
 - Microsoft Windows 10 is the last Windows operating system version that supports Intel ANS. Intel ANS is not supported on Microsoft Windows 11 and later.
 - You must install the latest Microsoft Windows 10 updates before you can create Intel ANS Teams or VLANs on Windows 10 systems. Any Intel ANS Teams or VLANs created with a previous software/driver release on a Windows 10 system will be corrupted and cannot be upgraded. The installer will remove these existing teams and VLANs.
 - If you are running Windows 10 Anniversary edition (RS1) you will need to install Intel LAN software v22.1 or newer.
 - If you are running Windows 10 Creators Update (RS2) you will need to install Intel LAN software v22.3 or newer.
- NOTE:** If you are running Windows 10 Creators Update (RS2) and are using Intel LAN software release v22.1 or v22.2, then Intel ANS will not function until you update to the Intel LAN software v22.3 or newer.
- Intel ANS VLANs are not compatible with Microsoft's Load Balancing and Failover (LBFO) teams. Intel PROSet will block a member of an LBFO team from being added to an Intel ANS VLAN. You should not add a port that is already part of an Intel ANS VLAN to an LBFO team, as this may cause system instability.

The term VLAN (Virtual Local Area Network) refers to a collection of devices that communicate as if they were on the same physical LAN. Any set of ports (including all ports on the switch) can be considered a VLAN. LAN segments are not restricted by the hardware that physically connects them.



VLANs offer the ability to group computers together into logical workgroups. This can simplify network administration when connecting clients to servers that are geographically dispersed across the building, campus, or enterprise network.

Typically, VLANs consist of co-workers within the same department but in different locations, groups of users running the same network protocol, or a cross-functional team working on a joint project.

By using VLANs on your network, you can:

- Improve network performance
- Limit broadcast storms
- Improve LAN configuration updates (adds, moves, and changes)
- Minimize security problems
- Ease your management task

4.32.2 Other Considerations

- **Configuring SR-IOV for improved network security:** In a virtualized environment, on Intel® Server Adapters that support SR-IOV or Intel® Scalable I/O Virtualization (Intel® Scalable IOV), the virtual function (VF) may be subject to malicious behavior. Software-generated layer two frames, like IEEE 802.3x (link flow control), IEEE 802.1Qbb (priority based flow-control), and others of this type, are not expected and can throttle traffic between the host and the virtual switch, reducing performance. To resolve this issue, and to ensure isolation from unintended traffic streams, configure all SR-IOV or Intel Scalable IOV enabled ports for VLAN tagging from the administrative interface on the PF. This configuration allows unexpected, and potentially malicious, frames to be dropped.
- The VF is not aware of the VLAN configuration if you use LBFO to configure VLANs in a Windows guest. VLANs configured using LBFO on a VF driver may result in failure to pass traffic. You must use Windows Hyper-V on the host to configure VLANs on a Windows guest.
- Intel ANS VLANs are not compatible with the Microsoft Hyper-V virtual machine switch. If you want to bind the virtual machine switch to a VLAN, you must create the VLAN from within the Virtual Switch Manager.
- To set up IEEE VLAN membership (multiple VLANs), the adapter must be attached to a switch with IEEE 802.1Q VLAN capability.
- A maximum of 64 VLANs per network port or team are supported by Intel software.
- Intel ANS VLANs can co-exist with Intel ANS teams (if the adapter supports both). If you do this, the team must be defined first, then you can set up your VLAN.
- You can set up only one untagged VLAN per adapter or team. You must have at least one tagged VLAN before you can set up an untagged VLAN.
- Jumbo Frames are not supported over Intel ANS VLANs under Microsoft Windows 10.



CAUTION: When using IEEE 802 VLANs, settings must match between the switch and those adapters using the VLANs.

4.32.3 Configuring VLANs in Microsoft Windows

4.32.3.1 Using Intel PROSet for Windows Device Manager

This setting is found on the VLANs tab of the device's Device Manager property sheet or in the VLANs panel in Intel PROSet Adapter Configuration Utility.



CAUTION: Do not use the Network Connections dialog box to enable or disable VLANs. Otherwise, the VLAN driver may not be correctly enabled or disabled.



NOTES:

- The VLAN ID keyword is supported. The VLAN ID must match the VLAN ID configured on the switch. Adapters with VLANs must be connected to network devices that support IEEE 802.1Q.
- In most environments, a maximum of 64 VLANs per network port or team are supported by Intel ANS.
- Intel ANS VLANs are not supported on adapters and teams that have VMQ enabled. However, VLAN filtering with VMQ is supported via the Microsoft Hyper-V VLAN interface. For more information, see [Using Intel® Network Adapters in a Microsoft* Hyper-V* Environment](#).
- You can have different VLAN tags on a child partition and its parent. Those settings are separate from one another, and can be different or the same. The only instance where the VLAN tag on the parent and child **MUST** be the same is if you want the parent and child partitions to be able to communicate with each other through that VLAN. For more information, see [Using Intel® Network Adapters in a Microsoft* Hyper-V* Environment](#).

4.32.3.2 Using Windows PowerShell

To add a VLAN use the Add-IntelNetVLAN cmdlet. For example

```
Add-IntelNetVLAN -ParentName "Name" -VLANID "1"
```

To remove a VLAN use the Remove-IntelNetVLAN cmdlet. For example:

```
Remove-IntelNetVLAN -ParentName "Name" -VLANID "1"
```

4.32.3.3 Using Intel PROSet ACU

On the Teaming/VLANs tab, use the VLANs panel.

4.33 Wait for Link

Determines whether the driver waits for auto-negotiation to be successful before reporting the link state. If this feature is off, the driver does not wait for auto-negotiation. If the feature is on, the driver does wait for auto-negotiation.

If this feature is on and the speed is not set to auto-negotiation, the driver will wait for a short time for link to be established before reporting the link state.

If the feature is set to **Auto Detect**, this feature is automatically set to **On** or **Off** depending on speed and adapter type when the driver is installed. The setting is:

- Off for copper Intel gigabit adapters with a speed of "Auto"
- On for copper Intel gigabit adapters with a forced speed and duplex
- On for fiber Intel gigabit adapters with a speed of "Auto"

To change this setting in Intel PROSet

Range	• On • Off • Auto Detect
--------------	--

This setting is found on the Advanced tab of the device's Device Manager property sheet or in the Adapter Settings panel in Intel PROSet Adapter Configuration Utility.

To change this setting in Windows PowerShell, use the Set-IntelNetAdapterSetting cmdlet. For example:

```
Set-IntelNetAdapterSetting -Name "<adapter_name>" -DisplayName "Wait for Link" -  
DisplayValue "Off"
```

5. Microsoft* Windows* Driver and Software Installation and Configuration

This chapter explains the following in more detail:

- How to [install device drivers](#) on supported versions of Microsoft Windows
- How to [save and restore](#) a device's configuration settings

Refer to "About Intel PROSet®" on page 15 for an overview of this software, how to install it, and how to use it to configure device features in Microsoft Windows.

5.1 Installing Windows Drivers and Software

There are multiple installation options:

- Install via the complete driver pack. This option will install Windows drivers and [Intel PROSet](#) but is a very large download.
- Install device drivers and Intel PROSet software separately.
- Install device drivers or Intel PROSet via a command line interface.



NOTE: To successfully install or uninstall the drivers or software, you must have administrative privileges on the computer completing installation.

This section describes how to install the base drivers. Refer to "Installing Intel PROSet" on page 17 for additional instructions.



NOTES:

- This will update the drivers for all supported Intel® network adapters in your system.
- The Roll Back Driver feature of Windows Server (available on the Adapter Properties dialog's **Driver** tab) will not work correctly if an adapter team or Intel PROSet are present on the system. Before you use the Roll Back Driver feature, remove any teams. Then remove Intel PROSet using **Programs and Features** from the Control Panel of Windows. See "Installing Intel PROSet" on page 17 for details regarding Intel PROSet.
- Using Microsoft Windows Update to upgrade or downgrade your Ethernet network drivers is not supported. Please download the latest driver package from the [support website](#).

Before installing or updating the drivers, insert your adapter(s) in the computer and plug in the network cable. When Windows discovers the new adapter, it attempts to find an acceptable Windows driver already installed with the operating system.

If found, the driver is installed without any user intervention. If Windows cannot find the driver, the Found New Hardware Wizard window is displayed.

Regardless of whether Windows finds the driver, it is recommended that you follow the procedures below to install the driver. Drivers for all Intel adapters supported by this software release are installed.

5.1.1 Install via the Complete Driver Pack

To download and install via the complete driver pack:

1. Download the latest software package from the [support website](#) and transfer it to the system.
2. Extract the downloaded software package to your hard drive.
3. If the Found New Hardware Wizard screen is displayed, click **Cancel**.
4. Navigate in your extracted files to \APPS\SETUPBD and then the Windows subfolder corresponding to your version of Windows (32-bit or 64-bit).
5. Inside the Winx64 or Win32 folder, double-click on SetupBD.exe.
6. Complete the steps in the installation wizard.
7. If you want to install Intel PROSet, navigate to \APPS\PROSETDX and then the Windows subfolder corresponding to your version of Windows (32-bit or 64-bit).
8. Inside the Winx64 or Win32 folder, double-click on DxSetup.exe.
9. Complete the steps in the installation wizard.

5.1.2 Install Only Windows Drivers

To download and install only Windows drivers:

1. Download and extract the **Wired_driver_XX.X_*.zip** file for your version of Windows, where XX.X is the release number. This file will install the base driver(s) for your system.
 - If you are running a 32-bit operating system, download **Wired_driver_XX.X_32.zip**.
 - If you are running a 64-bit operating system, download **Wired_driver_XX.X_x64.zip**.
2. In the extracted driver files, double-click on the **.exe** file to launch the installation.
3. In the dialog box that opens, click on **OK** to install the drivers.
4. The device driver(s) will install. Click **Close** when prompted.



NOTE: This method does not install Intel PROSet. See "Installing Intel PROSet" on page 17 for additional instructions.

5.1.3 Command Line Options for Installing Base Drivers

SetupBD.exe supports the following command line switches.



NOTE: You must include a space between switches.

Switch	Description
/h	Displays help file for SetupBD
/l <path\filename>	Create a log file with the specified path and filename. If you do not specify the path and filename, SetupBD creates a log file (named SetupBD_<timestamp>.log, for example SetupBD_18-04-2022_14-29-20.log) in the current directory.
/m	Non-interactive install. This still displays the installation GUI, but you cannot interact with it. Use the /s switch to suppress the GUI.
/n	Ignore INF excludes and force scan all .inf files.

Switch	Description
/nr	No reboot (must be used with the /s switch. This switch is ignored if it is included with the /r switch)
/r	Force reboot (must be used with the /s switch)
/s	Silent install

Examples:

Option	Description
SetupBD	Installs and/or updates the driver(s) and displays the GUI.
SetupBD /s	Installs and/or updates the driver(s) silently.
SetupBD /s /l c:\temp\install.log	Installs and/or updates the driver(s) silently and creates a log file in c:\temp
SetupBD /s /r	Installs and/or updates the driver(s) silently and forces a reboot.
SetupBD /s /r /nr	Installs and/or updates the driver(s) silently and forces a reboot (/nr is ignored).

5.2 Saving and Restoring an Adapter's Configuration Settings

The Save and Restore Command Line Tool allows you to copy the current adapter and team settings into a standalone file (such as on a USB drive) as a backup measure. In the event of a hard drive failure, you can reinstate most of your former settings.

The system on which you restore network configuration settings must have the same configuration as the one on which the save was performed. A saved configuration file can be used to restore adapter settings after an operating system upgrade. However, all adapter configuration settings may not be restored depending on the features supported by the new operating system or adapter configuration software.



NOTES:

- You must have Administrator privileges to run scripts. If you do not have Administrator privileges, you will not receive an error, the script just will not run.
- Only adapter settings are saved (these include Intel ANS teaming and VLANs). The adapter's driver is not saved.
- Restore using the script only once. Restoring multiple times may result in unstable configuration.
- Intel PROSet must be installed for the SaveRestore.ps1 script to run.
- For systems running a 64-bit OS, be sure to run the 64-bit version of Windows PowerShell, not the 32-bit (x86) version, when running the SaveRestore.ps1 script.

5.2.1 Command Line Syntax

```
SaveRestore.ps1 -Action save|restore [-ConfigPath] [-BDF]
```

SaveRestore.ps1 has the following command line options:

Option	Description
-Action	Required. Valid values: save restore. The save option saves adapter and team settings that have been changed from the default settings. When you restore with the resulting file, any settings not contained in the file are assumed to be the default. The restore option restores the settings.
-ConfigPath	Optional. Specifies the path and filename of the main configuration save file. If not specified, it is the script path and default filename (saved_config.txt).
-BDF	Optional. Default configuration file names are saved_config.txt and Saved_StaticIP.txt. If you specify -BDF during a restore, the script attempts to restore the configuration based on the PCI Bus:Device:Function:Segment values of the saved configuration. If you removed, added, or moved a NIC to a different slot, this may result in the script applying the saved settings to a different device.  NOTES: • If the restore system is not identical to the saved system, the script may not restore any settings when the -BDF option is specified. • Virtual Function devices do not support the -BDF option.

5.2.2 Examples

Save Example

To save the adapter settings to a file on a removable media device, do the following.

1. Open a Windows PowerShell Prompt.
2. Navigate to the directory where SaveRestore.ps1 is located (generally c:\Program Files\Intel\Wired Networking\PROSET).
3. Type the following:

```
SaveRestore.ps1 -Action Save -ConfigPath e:\settings.txt
```

Restore Example

To restore the adapter settings from a file on removable media, do the following:

1. Open a Windows PowerShell Prompt.
2. Navigate to the directory where SaveRestore.ps1 is located (generally c:\Program Files\Intel\Wired Networking\PROSET).
3. Type the following:

```
SaveRestore.ps1 -Action Restore -ConfigPath e:\settings.txt
```

6. Remote Boot

Remote Boot allows you to boot a system using only an Ethernet adapter. You connect to a server that contains an operating system image and use that to boot your local system.

6.1 Flash Images

"Flash" is a generic term for nonvolatile RAM (NVRAM), firmware, and option ROM (OROM). Depending on the device, it can be on the NIC or on the system board.



NOTE: You cannot update the flash of a device in the "Pending Reboot" state. Reboot your system before attempting to update the device's flash.

6.1.1 Updating the Flash in Microsoft Windows

Intel PROSet for Windows Device Manager can update the flash on an Intel Ethernet network adapter. However, if you need to enable or disable the Boot ROM use BootUtil.

Intel PROSet for Windows Device Manager can only be used to program add-in Intel Ethernet network adapters. LOM (LAN On Motherboard) network connections cannot be programmed with the UEFI network driver option ROM.

6.1.1.1 Using Intel PROSet to flash the UEFI Network Driver Option ROM

Intel PROSet for Windows Device Manager can install the UEFI network driver on an Intel network adapter's option ROM. The UEFI network driver will load automatically during system UEFI boot when installed in the option ROM. UEFI specific *.FLB images are included in the downloaded release media. The "Boot Options" tab in Intel PROSet for Windows Device Manager will allow the UEFI *.FLB image to be installed on the network adapter.

6.1.2 Updating the Flash from Linux

The BootUtil command line utility can update the flash on an Intel Ethernet network adapter. Run BootUtil with the following command line options to update the flash on all supported Intel network adapters. For example, enter the following command line:

```
bootutil64e -up=efi -all
```

BootUtil can only be used to program add-in Intel network adapters. LOM (LAN On Motherboard) network connections cannot be programmed with the UEFI network driver option ROM.

See the bootutil.txt file for details on using BootUtil.

6.1.3 Installing the UEFI Network Driver Option ROM from the UEFI Shell

The BootUtil command line utility can install the UEFI network driver on an Intel network adapter's option ROM. The UEFI network driver will load automatically during system UEFI boot when installed into the option ROM. For example, run BootUtil with the following command line options to install the UEFI network driver on all supported Intel network adapters:

```
FS0:\>bootutil64e -up=efi -all
```

BootUtil can only be used to program add-in Intel Ethernet network adapters. LOM (LAN On Motherboard) network connections cannot be programmed with the UEFI network driver option ROM.

See the bootutil.txt file for details on using BootUtil.

6.2 Enable Remote Boot

If you have an Intel Desktop Adapter installed in your client computer, the flash ROM device is already available in your adapter, and no further installation steps are necessary. For Intel Server Adapters, the flash ROM can be enabled using the BootUtil utility. For example, from the command line type:

```
BOOTUTIL -E
BOOTUTIL -NIC=1 -FLASHENABLE
```

The first line will enumerate the ports available in your system. Choose a port. Then type the second line, selecting the port you wish to enable. For more details, see the bootutil.txt file.

6.3 UEFI Network Device Driver for Intel® Ethernet Network Connections

6.3.1 UEFI Network Stack

As of UEFI 2.1 there are two network stack configurations under UEFI. The most common configuration is the PXE based network stack. The alternate network stack provides IPv4 TCP, UDP, and MTFTP network protocol support. As of UEFI 2.1 the PXE and IP-based network stacks cannot be loaded or operate simultaneously. The following two sections describe each UEFI network stack configuration.

Reference implementations of the PXE and IP based network stack source code are available for download at www.tianocore.org.

6.3.2 Loading the UEFI Network Driver

The network driver can be loaded using the UEFI shell "load" command:

```
load e3040e2.efi
```

6.3.3 Configuring UEFI Network Stack for PXE

The PXE (Preboot eXecution Environment) based UEFI network stack provides support for UEFI network boot loaders downloaded from a WFM compliant PXE server. Services which can be enabled include Windows Deployment Services (WDS), Linux network installation (Elilo), and TFTP file transfers. To enable UEFI PXE services the following network protocol drivers must be loaded with: snp.efi, bc.efi, and pxdhcp4.efi. These drivers can be loaded from the UEFI "load" shell command, but are often included as part of the UEFI system firmware. The UEFI shell command "drivers" can be used to determine if the UEFI PXE drivers are included in the UEFI implementation. The drivers command will output a table listing drivers loaded in the system. The following entries must be present in order to network boot a UEFI system over PXE:

DRV	VERSION	TYPE	CFG	DIAG	#D	#C	DRIVER NAME	IMAGE NAME
F5	00000010	D	-	-	2	-	Simple Network Protocol Driver	SNP
F7	00000010	D	-	-	2	-	PXE Base Code Driver	BC

F9	00000010	D	-	-	2	-	PXE DHCPv4 Driver	PxeDhcp4
FA	03004000	B	X	X	2	2	Intel(R) Network Connection 3.0.00	/e3000e2.efi

A network boot option will appear in the boot options menu when the UEFI PXE network stack and Intel UEFI network driver have been loaded. Selecting this boot option will initiate a PXE network boot.

6.3.4 Configuring UEFI Network Stack for TCP/UDP/MTFTP

An IP-based network stack is available to applications requiring IP-based network protocols such as TCP, UDP, or MTFTP. The following UEFI network drivers must be built into the UEFI platform implementation to enable this stack: SNP (Simple Network Protocol), MNP (Managed Network Protocol), ARP, DHCP4, IPv4, ip4config, TCPv4, UDPv4, and MTFTpv4. These drivers will show up in the UEFI "drivers" command output if they are included in the platform UEFI implementation:

DRV	VERSION	TYPE	CFG	DIAG	#D	#C	DRIVER NAME	IMAGE NAME
F5	00000010	D	-	-	2	-	IP4 CONFIG Network Service Driver	Ip4Config
F7	00000010	D	-	-	2	-	Simple Network Protocol Driver	SNP
F8	00000010	D	-	-	2	-	ARP Network Service Driver	Arp
F9	00000010	D	-	-	2	-	Tcp Network Service Driver	Tcp4
FA	00000010	D	-	-	2	-	IP4 Network Service Driver	Ip4
FB	00000010	D	-	-	2	-	DHCP Protocol Driver	Dhcp4
FC	00000010	D	-	-	6	-	UDP Network Service Driver	Udp4
FD	00000010	D	-	-	2	-	MTFTp4 Network Service	Mtftp4
FE	00000010	B	-	-	2	6	MNP Network Service Driver	/mnp.efi
FF	03099900	B	X	X	2	2	Intel(R) Network Connection 3.0.00	/e3000e2.efi

The ifconfig UEFI shell command must be used to configure each network interface. Running "ifconfig -?" from the UEFI shell will display usage instructions for ifconfig.

6.3.5 Unloading the UEFI Network Driver

To unload a network driver from memory the UEFI "unload" command is used. The syntax for using the unload command is as follows: "unload [driver handle]", where driver handle is the number assigned to the driver in the far left column of the "drivers" output screen.

6.3.6 Force Speed and Duplex

The UEFI network driver supports forced speed and duplex capability. The force speed and duplex menu can be accessed with UEFI shell command "drvcfg":

```
drvcfg -s [driver handle] [control handle]
```

The following speed and duplex configurations can be selected:

- Autonegotiate (recommended)
- 100 Mbps, full duplex
- 100 Mbps, half duplex
- 10 Mbps, full duplex
- 10 Mbps, half duplex

The speed and duplex setting selected must match the speed and duplex setting of the connecting network port. A speed and duplex mismatch between ports will result in dropped packets and poor network performance. It is recommended to set all ports on a network to autonegotiate. Connected ports must be set to autonegotiate in order to establish a 1 gigabit per second connection.

Fiber-optic and 10 gigabit ethernet adapters do not support forced speed and duplex.

6.3.7 Diagnostic Capability

The UEFI network driver features built in hardware diagnostic tests. The diagnostic tests are called with the UEFI shell `drvdiag` command.

```
drvdiag -s -Performs a basic hardware register test.  
drvdiag -e -Performs an internal loopback transmit and receive test.
```

6.3.8 UEFI Known Issues

6.3.8.1 Long Initialization Times

Long initialization times observed with Intel's UEFI driver are caused when the `UNDI.Initialize` command is called with the `PXE_OPFLAGS_INITIALIZE_CABLE_DETECT` flag set. In this case, `UNDI.Initialize` will try to detect the link state.

If the port is connected and link is up, initialize will generally finish in about 3.5 seconds (the time needed to establish link, dependent on link conditions, link speed and controller type) and returns `PXE_STATFLAGS_COMMAND_COMPLETE`. If the port is disconnected (link is down), initialize will complete in about 5 seconds and return `PXE_STATFLAGS_INITIALIZED_NO_MEDIA` (driver initializes hardware then waits for link and timeouts when link is not establish in 5 seconds).

When `UNDI.Initialize` is called with `PXE_OPFLAGS_INITIALIZE_DO_NOT_DETECT_CABLE` the function will not try to detect link status and will take less than 1 second to complete.

The behavior of `UNDI.Initialize` is described in UEFI specs 2.3.1: Initializing the network device will take up to four seconds for most network devices and in some extreme cases (usually poor cables) up to twenty seconds. Control will not be returned to the caller and the `COMMAND_COMPLETE` status flag will not be set until the adapter is ready to transmit.

6.4 Intel® Boot Agent

The Intel® Boot Agent is a software product that allows your networked client computer to boot using a program code image supplied by a remote server. Intel Boot Agent complies with the Pre-boot eXecution Environment (PXE) Version 2.1 Specification. It is compatible with legacy boot agent environments that use BOOTP protocol.

6.4.1 Intel Boot Agent Client Configuration

The Intel Boot Agent software provides configuration options that allow you to customize the behavior of

the Intel Boot Agent software. You can configure the Intel Boot Agent in any of the following environments:

- A Microsoft Windows environment
- A preboot environment (before operating system is loaded)

The Intel Boot Agent supports PXE in preboot and Microsoft Windows environments. In each of these environments, a single user interface allows you to configure PXE protocols on Intel Ethernet Adapters.



CAUTION: If spanning tree protocol is enabled on a switch port through which a port is trying to use PXE, the delay before the port starts forwarding can cause a DHCP timeout. Either disable spanning tree or turn on the feature that allows the port to begin forwarding of packets immediately ('port fast learning' for Cisco switches), rather than wait until the spanning tree discovery is complete.

6.4.1.1 Configuring the Intel® Boot Agent in a Microsoft Windows Environment

If you use the Windows operating system on your client computer, you can use Intel® PROSet for Windows* Device Manager to configure and update the Intel Boot Agent software. Intel PROSet is available through the device manager. Intel PROSet provides a special tab, called the *Boot Options* tab, used for configuring and updating the Intel Boot Agent software.

To access the **Boot Options** tab:

1. Open Intel PROSet for Windows Device Manager by opening the **System** Control Panel. On the **Hardware** tab, click **Device Manager**.
2. Select the appropriate adapter and click the **Boot Options** tab. If the tab does not appear, update your network driver.
3. The **Boot Options** tab shows a list of current configuration parameters and their corresponding values. Corresponding configuration values appear for the selected setting in a drop-down box.
4. Select a setting you want to change from the **Settings** selection box.
5. Select a value for that setting from the **Value** drop-down list.
6. Repeat the preceding two steps to change any additional settings.
7. Once you have completed your changes, click **Apply Changes** to update the adapter with the new values.

6.4.1.2 Configuring the Intel® Boot Agent in a Preboot PXE Environment



NOTE: Intel Boot Agent may be disabled in the BIOS.

You can customize the behavior of the Intel Boot Agent software through a preboot (operating system independent) configuration setup program contained within the adapter's flash ROM. You can access this preboot configuration setup program each time the client computer cycles through the boot process.

When the boot process begins, the screen clears and the computer begins its Power On Self Test (POST) sequence. Shortly after completion of the POST, the Intel Boot Agent software stored in flash ROM executes. The Intel Boot Agent then displays an initialization message, similar to the one below, indicating that it is active:

```
Initializing Intel(R) Boot Agent Version X.X.XX
```

PXE 2.0 Build 083



NOTE: This display may be hidden by the manufacturer's splash screen. Consult your manufacturer's documentation for details.

The configuration setup menu shows a list of configuration settings on the left and their corresponding values on the right. Key descriptions near the bottom of the menu indicate how to change values for the configuration settings. For each selected setting, a brief "mini-Help" description of its function appears just above the key descriptions.

1. Highlight the setting you need to change by using the arrow keys.
2. Once you have accessed the setting you want to change, press the spacebar until the desired value appears.
3. Once you have completed your changes, press **F4** to update the adapter with the new values. Any changed configuration values are applied as the boot process resumes.

The table below provides a list of configuration settings, their possible values, and their detailed descriptions:

Configuration Setting	Possible Values	Description
Network Boot Protocol	PXE (Preboot eXecution Environment)	Select PXE for use with Network management programs, such as LANDesk* Management Suite. NOTE: Depending on the configuration of the Intel Boot Agent, this parameter may not be changeable.
Boot Order	Use BIOS Setup Boot Order Try network first, then local drives Try local drives first, then network Try network only Try local drives only	Sets the boot order in which devices are selected during boot up if the computer does not have its own control method. If your client computer's BIOS supports the BIOS Boot Specification (BBS), or allows PnP-compliant selection of the boot order in the BIOS setup program, then this setting will always be Use BIOS Setup Boot Order and cannot be changed. In this case, refer to the BIOS setup manual specific to your client computer to set up boot options. If your client computer does not have a BBS- or PnP-compliant BIOS, you can select any one of the other possible values listed for this setting except for Use BIOS Setup Boot Order .
Legacy OS Wakeup Support (For 82559-based adapters only)	0 = Disabled (Default Value) 1 = Enabled	If set to 1, the Intel Boot Agent will enable PME in the adapter's PCI configuration space during initialization. This allows remote wakeup under legacy operating systems that don't normally support it. Note that enabling this makes the adapter technically non-compliant with the ACPI specification, which is why the default is disabled.



NOTE: If, during PXE boot, more than one adapter is installed in a computer and you want to boot from the boot ROM located on a specific adapter, you can do so by moving the adapter to the top of the BIOS Boot Order or by disabling the flash on the other adapters.

While the configuration setup menu is displayed, diagnostics information is also displayed in the lower half of the screen. This information can be helpful during interaction with Intel Customer Support personnel or your IT team members. For more information about how to interpret the information displayed, refer to [Diagnostics Information for Preboot PXE Environments](#).

6.4.2 Intel Boot Agent Target/Server Setup

For the Intel Boot Agent software to perform its intended job, there must be a server set up on the same network as the client computer. That server must recognize and respond to the PXE or BOOTP boot protocols that are used by the Intel Boot Agent software.



NOTE: When the Intel Boot Agent software is installed as an upgrade for an earlier version boot ROM, the associated server-side software may not be compatible with the updated Intel Boot Agent. Contact your system administrator to determine if any server updates are necessary.

6.4.2.1 Linux Server Setup

Consult your Linux vendor for information about setting up the Linux Server.

6.4.2.2 Windows Deployment Services

Nothing is needed beyond the standard driver files supplied on the media. Microsoft owns the process and associated instructions for Windows Deployment Services. For more information on Windows Deployment Services perform a search of Microsoft articles at: <http://technet.microsoft.com/en-us/library/default.aspx>

6.4.3 Intel Boot Agent Messages

Message Text	Cause
Invalid PMM function number.	PMM is not installed or is not working correctly. Try updating the BIOS.
PMM allocation error.	PMM could not or did not allocate the requested amount of memory for driver usage.
Option ROM initialization error. 64-bit PCI BAR addresses not supported, AX=	This may be caused by the system BIOS assigning a 64-bit BAR (Base Address Register) to the network port. Running the BootUtil utility with the -64d command line option may resolve this issue.
PXE-E00: This system does not have enough free conventional memory. The Intel Boot Agent cannot con-	System does not have enough free memory to run PXE image. The Intel Boot Agent was unable to find enough free base memory (below 640K) to install the PXE client software. The system cannot boot via PXE in its current configuration. The error returns control to the BIOS and the system does not attempt to remote boot. If this error persists, try updating your system's BIOS to the most-recent version. Contact your system administrator or your computer vendor's customer support to resolve the problem.

Message Text	Cause
tinue.	
PXE-E01: PCI Vendor and Device IDs do not match!	Image vendor and device ID do not match those located on the card. Make sure the correct flash image is installed on the adapter.
PXE-E04: Error reading PCI configuration space. The Intel Boot Agent cannot continue.	PCI configuration space could not be read. Machine is probably not PCI compliant. The Intel Boot Agent was unable to read one or more of the adapter's PCI configuration registers. The adapter may be mis-configured, or the wrong Intel Boot Agent image may be installed on the adapter. The Intel Boot Agent will return control to the BIOS and not attempt to remote boot. Try to update the flash image. If this does not solve the problem, contact your system administrator or Customer Support .
PXE-E05: The LAN adapter's configuration is corrupted or has not been initialized. The Intel Boot Agent cannot continue.	The adapter's EEPROM is corrupted. The Intel Boot Agent determined that the adapter EEPROM checksum is incorrect. The agent will return control to the BIOS and not attempt to remote boot. Try to update the flash image. If this does not solve the problem, contact your system administrator or Customer Support .
PXE-E06: Option ROM requires DDIM support.	The system BIOS does not support DDIM. The BIOS does not support the mapping of the PCI expansion ROMs into upper memory as required by the PCI specification. The Intel Boot Agent cannot function in this system. The Intel Boot Agent returns control to the BIOS and does not attempt to remote boot. You may be able to resolve the problem by updating the BIOS on your system. If updating your system's BIOS does not fix the problem, contact your system administrator or your computer vendor's customer support to resolve the problem.
PXE-E07: PCI BIOS calls not supported.	BIOS-level PCI services not available. Machine is probably not PCI compliant.
PXE-E09: Unexpected UNDI loader error. Status == xx	The UNDI loader returned an unknown error status. xx is the status returned.
PXE-E0C: Firmware recovery mode detected. Initialization failed.	The adapter is in firmware recovery mode. Refer to the "Firmware Recovery Mode" section of this document for details.
PXE-E20: BIOS extended memory copy error.	BIOS could not move the image into extended memory.
PXE-E20: BIOS extended memory copy error. AH == xx	Error occurred while trying to copy the image into extended memory. xx is the BIOS failure code.

Message Text	Cause
PXE-E51: No DHCP or BOOTP offers received.	The Intel Boot Agent did not receive any DHCP or BOOTP responses to its initial request. Please make sure that your DHCP server (and/or proxyDHCP server, if one is in use) is properly configured and has sufficient IP addresses available for lease. If you are using BOOTP instead, make sure that the BOOTP service is running and is properly configured.
PXE-E53: No boot filename received.	The Intel Boot Agent received a DHCP or BOOTP offer, but has not received a valid filename to download. If you are using PXE, please check your PXE and BINL configuration. If using BOOTP, be sure that the service is running and that the specific path and filename are correct.
PXE-E61: Media test failure.	The adapter does not detect link. Please make sure that the cable is good and is attached to a working hub or switch. The link light visible from the back of the adapter should be lit.
PXE-EC1: Base-code ROM ID structure was not found.	No base code could be located. An incorrect flash image is installed or the image has become corrupted. Try to update the flash image.
PXE-EC3: BC ROM ID structure is invalid.	Base code could not be installed. An incorrect flash image is installed or the image has become corrupted. Try to update the flash image.
PXE-EC4: UNDI ID structure was not found.	UNDI ROM ID structure signature is incorrect. An incorrect flash image is installed or the image has become corrupted. Try to update the flash image.
PXE-EC5: UNDI ROM ID structure is invalid.	The structure length is incorrect. An incorrect flash image is installed or the image has become corrupted. Try to update the flash image.
PXE-EC6: UNDI driver image is invalid.	The UNDI driver image signature was invalid. An incorrect flash image is installed or the image has become corrupted. Try to update the flash image.
PXE-EC8: !PXE structure was not found in UNDI driver code segment.	The Intel Boot Agent could not locate the needed !PXE structure resource. An incorrect flash image is installed or the image has become corrupted. Try to update the flash image. This may also be caused by the system BIOS assigning a 64-bit BAR (Base Address Register) to the network port. Running the BootUtil utility with the -64d command line option may resolve this issue.
PXE-EC9: PXENV + structure was not found in UNDI driver code segment.	The Intel Boot Agent could not locate the needed PXENV+ structure. An incorrect flash image is installed or the image has become corrupted. Try to update the flash image.
PXE-M0F: Exiting Intel Boot Agent.	Ending execution of the ROM image.
This option has been locked and cannot be changed.	You attempted to change a configuration setting that has been locked by your system administrator. This message can appear either from within Intel® PROSet's Boot Options tab when operating under Windows* or from the Configuration Setup Menu when operating in a stand-alone environment. If you think you should be able to change the configuration setting, consult your sys-

Message Text	Cause
	tem administrator.
PXE-M0E: Retrying network boot; press ESC to cancel.	The Intel Boot Agent did not successfully complete a network boot due to a network error (such as not receiving a DHCP offer). The Intel Boot Agent will continue to attempt to boot from the network until successful or until canceled by the user. This feature is disabled by default. For information on how to enable this feature, contact Customer Support .

6.4.4 Intel Boot Agent Troubleshooting

6.4.4.1 Common Issues

The following list of problems and associated solutions covers a representative set of problems that you might encounter while using the Intel Boot Agent.

After booting, my computer experiences problems

After the Intel Boot Agent product has finished its sole task (remote booting), it no longer has any effect on the client computer operation. Thus, any issues that arise after the boot process is complete are most likely not related to the Intel Boot Agent product.

If you are having problems with the local (client) or network operating system, contact the operating system manufacturer for assistance. If you are having problems with some application program, contact the application manufacturer for assistance. If you are having problems with any of your computer's hardware or with the BIOS, contact your computer system manufacturer for assistance.

Cannot change boot order

If you are accustomed to redefining your computer's boot order using the motherboard BIOS setup program, the default settings of the Intel Boot Agent setup program can override that setup. To change the boot sequence, you must first override the Intel Boot Agent setup program defaults. A configuration setup menu appears allowing you to set configuration values for the Intel Boot Agent. To change your computer's boot order setting, see [Configuring the Boot Agent in a Pre-boot PXE Environment](#).

My computer does not complete POST

If your computer fails to boot with an adapter installed, but *does* boot when you remove the adapter, try moving the adapter to another computer and using BootUtil to disable the Flash ROM.

If this does not work, the problem may be occurring before the Intel Boot Agent software even begins operating. In this case, there may be a BIOS problem with your computer. Contact your computer manufacturer's customer support group for help in correcting your problem.

There are configuration/operation problems with the boot process

If your PXE client receives a DHCP address, but then fails to boot, you know the PXE client is working correctly. Check your network or PXE server configuration to troubleshoot the problem. Contact [Customer Support](#) if you need further assistance.

PXE option ROM does not follow the PXE specification with respect to the final "discover" cycle

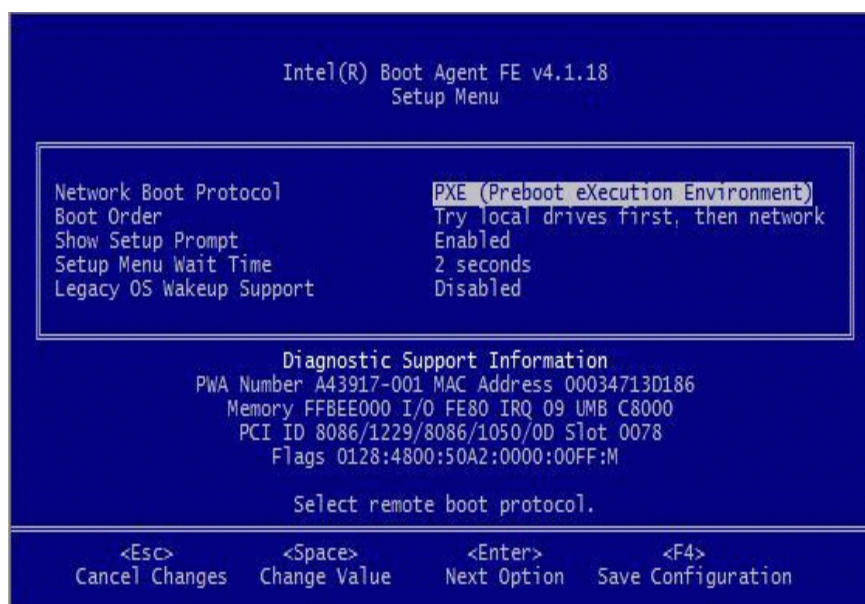
In order to avoid long wait periods, the option ROM no longer includes the final 32-second discover cycle. (If there was no response in the prior 16-second cycle, it is almost certain that there will be none in the final 32-second cycle.)

6.4.4.2 Diagnostics Information for Preboot PXE Environments

Anytime the configuration setup menu is displayed (see [Configuring the Boot Agent in a Preboot PXE Environment](#)), diagnostics information is also displayed on the lower portion of the screen. The information displayed appears similar to that shown in the lower half of the screen image below. This information can be helpful during interaction with [Intel Customer Support](#) personnel or your IT team members.



NOTE: Actual diagnostics information may vary, depending upon the adapter(s) installed in your computer.



Diagnostics information may include the following items:

Item	Description
PWA Number	The Printed Wire Assembly number identifies the adapter's model and version.
MAC Address	The unique Ethernet address assigned to the device.
Memory	The memory address assigned by the BIOS for memory-mapped adapter access.
I/O	The I/O port address assigned by the BIOS for I/O-mapped adapter access.

Item	Description
IRQ	The hardware interrupt assigned by the system BIOS.
UNB	The address in upper memory where the Boot Agent is installed by the BIOS.
PCI ID	The set of PCI identification values from the adapter in the form: VendorID/DeviceID/SubvendorID/SubdeviceID/Revision
Slot	The PCI bus address (slot number) reported by the BIOS. NOTE: The number displayed is the BIOS version of the PCI slot number. Therefore, actual positions of NICs within physical slots may not be displayed as expected. Slots are not always enumerated in an obvious manner, and this will only report what is indicated by the BIOS.
Flags	A set of miscellaneous data either read from the adapter EEPROM or calculated by the Boot Agent initialization code. This information varies from one adapter to the next and is only intended for use by Intel customer support.

6.4.4.3 Known Issues

Incorrect port numbering in the Boot Options Menu

On certain platforms, some device entries in the legacy PXE option ROM Boot Option Menu are pre-pended with identical port number information (first part of the string that comes from BIOS). This is not an option ROM issue. The first device option ROM to be initialized on a platform exposes all boot options for the device. This is misinterpreted by BIOS. The second part of the string from the option ROM indicates the correct slot (port) numbers.

7. Firmware

Firmware is a layer of software that is programmed into a device's memory. It provides low level functionality for the device. In most cases you will not notice the firmware on your device at all. Firmware error states usually occur because of an unsuccessful update.

7.1 Firmware Security

Intel or your equipment manufacturer will occasionally release a firmware security patch. We recommend that you update your firmware to the latest version available for your device to take advantage of these security patches. Firmware updates for Intel Ethernet devices will have a Security Revision number (SRev).

7.1.1 Minimum Security Revision Enforcement

Firmware security updates can be undone if you install a previous version of the firmware onto your device. Intel firmware releases include a Minimum Security Revision (MinSRev) enforcement feature. This means you can block someone from installing a lower revision of the firmware onto your device. This will limit the rollback capabilities of your device. The firmware update process will block the update if the supplied firmware has a lower security revision (SRev) than the MinSRev value of the firmware currently loaded on the device. Only update the MinSRev value if you are certain you will not need to roll the firmware back to an earlier version.

You can update the MinSRev value during the firmware update process, locking the current security version in as the new MinSRev baseline, by using the `-optinminsrev` command line option.



CAUTION: The MinSRev value on a device can never be decreased. Once the MinSRev is increased, NVM downgrades attempting to install a lower Security revision (SRev) than the current MinSRev will be rejected by the device. Users who want to downgrade firmware without regard to security revisions should not use this feature.

7.1.2 SRev and MinSRev Examples

7.1.2.1 View your device's current SRev and MinSRev

You can use the `nvmupdate` tool's inventory mode to view your device's current SRev and MinSRev values as follows:

Windows: `nvmupdatew64e -i -l update.log -o results.xml -c nvmupdate.cfg -optinminsrev`

Linux: `nvmupdate64e -i -l update.log -o results.xml -c nvmupdate.cfg`

Where:

`-i` -- Sets `nvmupdate` to inventory mode.

`-l update.log` -- Specifies the name of the log file.

`-o results.xml` -- Specifies the name of the results file. This is an XML file that contains the inventory/update results.

-c nvupdate.cfg -- Specifies the name of the configuration file. This is a text file that contains descriptions of networking devices and firmware versions for those devices.

-optinminsrev -- Specifies that the MinSRev and SRev values are included in the results.xml file.

Examine the results.xml file for the SRev and MinSRev values.



NOTE: Make sure you specify -i for inventory mode. If you specify -u, the tool will update the MinSRev value, rather than simply disclose it. You can achieve the same results by specifying MINSREV:TRUE in the configuration file.

7.1.2.2 Update your device's MinSRev

Download and extract the NVM Update Package for your device. Use the command line to update your device's MinSRev:

Windows: nvupdatew64e -u -optinminsrev -l update.log -o results.xml -c nvupdate.cfg

Linux: nvupdate64e -u -optinminsrev -l update.log -o results.xml -c nvupdate.cfg

Where:

-u -- Sets nvupdate to update mode.

-optinminsrev -- Tells the tool to update the MinSRev value.

-l update.log -- Specifies the name of the log file.

-o results.xml -- Specifies the name of the results file. This is an XML file that contains the inventory/update results.

-c nvupdate.cfg -- Specifies the name of the configuration file. This is a text file that contains descriptions of networking devices and firmware versions for those devices.

7.2 Firmware Rollback Mode

When a port is in firmware rollback mode it may have reduced functionality. Usually a device enters firmware rollback mode when a firmware update does not complete correctly. Rebooting or power cycling the system may allow the port to use the previous firmware. You may need to reapply the firmware update to regain full functionality on the device. Use the appropriate NVM Update Package to update the device's firmware. Download the latest NVM Update Package from your vendor's support website and follow the instructions in it. After restoring the NVM image, you may need to perform an A/C power cycle of the system.

7.3 Firmware Recovery Mode

A device will enter Firmware Recovery mode if it detects a problem that requires the firmware to be reprogrammed. When a device is in Firmware Recovery mode it will not pass traffic or allow any configuration; you can only attempt to recover the device's firmware.

7.3.1 Recovery Mode Detection

During initialization, a device can enter recovery mode if the device firmware detects a problem with the LAN device, mandating NVM reprogramming to restore normal operation. After thorough internal testing of the NVM (typically less than 10 minutes, but in some cases longer), the NIC enters Recovery Mode.

7.3.2 Firmware Recovery Mode Errors and Messages

When a device is in Firmware Recovery mode, the device drivers, preboot software, and utilities may log or display messages such as the following:

- **Firmware recovery mode detected. Limiting functionality. Refer to the Intel® Ethernet Adapters and Devices User Guide for details on firmware recovery mode.**
- **Firmware recovery mode detected. The underlying hardware has been deactivated. Refer to the Intel® Ethernet Adapters and Devices User Guide for details on firmware recovery mode.**
- **Firmware recovery mode detected. Initialization failed.**
- **Firmware recovery mode detected. Limiting functionality.**
- **Initialization failure due to repeated FW resets.** This message is usually an indication that the device is about to enter Recovery Mode. The device may be able to return to normal functionality without intervention. This may take several minutes. No action is required unless the device does enter Recovery Mode.

7.3.3 Resolving Firmware Recovery Mode Issues

If your device is in Firmware Recovery mode, you can restore it to factory defaults using the latest NVM Update Package. Download the latest NVM Update Package from your vendor's support website and follow the instructions in it.

The process for resolution of Firmware Recovery Mode Issues is outlined in the sub-sections below.

7.3.3.1 NVM Self Check

The process begins after power-on or reboot. At this time, the firmware will perform tests to assess whether there is damage or corruption of the device NVM image.

Actions:

- If NVM image damage or corruption **is not** detected, the device will initialize and operate normally. No further action is required.
- If NVM image damage or corruption **is** detected, the device will not initialize. Proceed with the additional recovery steps listed under Recovery Mode below.

7.3.3.2 Recovery Mode

The device NVM image has exhibited damage or corruption.

Actions:

1. Wait 10 minutes for the NVM self-check process to complete. If during this period normal operation is achieved, the device will initialize and operate normally. No further action is required.
2. If after 10 minutes normal operation is *not* achieved:
 - a. Check the System Event log for Windows OSs or driver message and kernel logs for Linux and ESXi based distributions. Recovery Mode is confirmed by presence of message/log entries as listed in the Firmware Recovery Mode Errors and Messages section above.
 - b. Reboot the system and proceed with the additional recovery steps listed under NVM Image Restoration below.

**NOTES:**

- While in Recovery Mode, for Windows OSs, clicking on the adapter in device manager may present a dialog box indicating that Firmware Recovery Mode is active.
 - Once the dialog is dismissed, while the device appears to be functioning normally, it is in fact limited to only enable NVM image recovery.
- If the system is rebooted (versus power cycled), the driver status may not show a Code 10/yellow bang status as expected. Refer to events logged in System Event log for Windows OSs or driver message and kernel logs for Linux and ESXi based distributions to accurately assess the adapter status.
- When the adapter is in recovery mode, the link LED will not be lit and the adapter will not appear in the following locations:
 - F2 System Setup > Device Settings
 - System BIOS as a NIC for PXE Boot in UEFI boot mode

7.3.3.3 NVM Image Restoration

At this point, the device is in Firmware Recovery mode and its functionality is limited to only supporting restoration of the NVM image.

Actions:

1. Before initiating device recovery, the integrity of the host operating system, device drivers and firmware utilities must be verified and reinstalled if necessary. Fully functional operating system, device drivers and tools are required for device recovery. Please consult your operating system specific instructions on how to scan and repair potentially damaged system files.
2. If your device is in Firmware Recovery mode, you can restore it to factory defaults using the latest NVM Update Package. Download the latest NVM Update Package from your vendor's support website and follow the instructions in it.
3. After restoring the NVM image, perform an A/C power cycle of the system. Details for this are in the **Other General Notes** section below.

**NOTES:**

- User configured settings (i.e. iSCSI target information, user defined port/alternate MAC addresses) will not be restored to pre-recovery mode values.

7.3.3.4 Other General Notes

**NOTES:**

- To perform an AC power cycle, do the following:
 - Shut down the system if its is powered up.
 - Unplug all AC power cords from the system.
 - Leave the AC power cords unplugged for 15 seconds to allow the system power supply to discharge completely.
 - Plug in AC power cords to the system.

7.4 Using Devlink to Update a Device's NVM

On a Linux system, when you update the NVM on some devices, the update may use the devlink interface, rather than the ethtool interface. This will happen if the following are true:

- You are updating an Intel Ethernet 800 Series device.
- Your system is running a distro that supports the "devlink dev flash" command.
- The firmware currently installed on the device supports it.
- The new NVM conforms to the correct PLDM format.

Most of the functionality and commands are the same with the following exceptions:

- You cannot update a device in Recovery Mode. (To update a device in recovery mode, you must download and install the Intel Ethernet driver set.)
- You cannot update the OROM or Netlist as a separate update, only as part of a full NVM update.
- If you specified a preservation level of PRESERVE_ALL, the system will immediately perform an EMPR reset after the NVM update.

On devices that support it, you can also use the devlink command line directly to update the device NVM. However, we recommend that you use NVMUpdate.

```
# devlink dev flash pci/0000:3b:00.0 file filename.bin
```

Where :

- `pci/0000:3b:00.0` – The device you wish to update. You can get a list of devices with the "devlink dev info" command.
- `filename.bin` – The file that contains the new NVM image.

7.5 Firmware Logging

Intel® Ethernet 800 Series devices allow you to generate firmware logs for supported categories of events, to help debug complex issues with [Customer Support](#). Firmware logging is enabled by default.

**NOTE:**

- Both the device and the driver need to support firmware logging for the functionality to work. If you are not able to set the configuration and the problem persists, reinstall the driver.
- You must have the latest base driver and NVM installed.
- Firmware logging events and levels are device-wide settings. Changing the log configuration on one port will apply it to all ports on a device.

7.5.1 Capturing a Firmware Log

To capture a firmware log, you must do the following:

1. Set the configuration for the firmware log. See the following for more information:
 - "Configuring Settings for Firmware Logs" below
 - "Tips for Firmware Logs" on the next page
 - "OS-Specific Information" on page 107
2. Perform the necessary steps to generate the issue you're trying to debug.
3. Capture the firmware log. (Exact steps will vary by operating system.)
4. Stop capturing the firmware log.
5. Reset your firmware log settings as needed.
6. Work with Customer Support to debug your issue.



NOTE: Firmware logs are generated in a binary format and must be decoded by Customer Support. Information collected is related only to firmware and hardware for debug purposes.

7.5.2 Configuring Settings for Firmware Logs

Firmware logs capture information about different categories of events (called "modules"). A module corresponds to a general category of functionality, such as link topology detection or manageability.

The device's NVM sets default verbosity levels for each module. You can change the verbosity level per module; refer to "OS-Specific Information" on page 107 for more details. You can set only one log level per module, and each level includes the verbosity levels lower than it. Available verbosity levels are:

- 0 = none
- 1 = error
- 2 = warning
- 3 = normal
- 4 = verbose

If you see errors or suspect the issue could fall into the below categories, setting the firmware logs to capture more verbosity for the corresponding module(s) in the right column will provide more information in the firmware log.

Category of Event	Corresponding Module
Initialization	Control
NVM	NVM Authentication VPD
I/O	I2C SDP MDIO
Link Management	Link Management

Category of Event	Corresponding Module
	Link Control Technology Link Topology Detection
Rx	Parser Switch ACL Post
Tx	Scheduler Tx Queue Management
AQ Interface	Admin Queue HDMA
Manageability	Manageability
Protocols	LLDP DCBx
Infrastructure	Watchdog Task Dispatcher General IOSF PF Registration Module Versions
XLR	XLR
QoS	DCB
Diagnostics	SyncE Health
TimeSync	Time Sync

7.5.3 Tips for Firmware Logs

- Firmware logs are for the hardest issues to debug. If you are experiencing issues, refer to the following sections for preliminary methods to diagnose problems:
 - "Firmware" on page 100
 - "Troubleshooting" on page 111
 - "Health Status Messages" on page 113
- We generally do not recommend to capture firmware logs at all times. If you suspect an issue, set the module(s) for the suspected event to a higher verbosity level, capture the firmware log, and then stop the log.
- Collecting firmware logs should not materially impact performance or CPU utilization.

- In general, set the logging level to Verbose only for the configuration group(s) or module(s) you need to debug. Setting too many modules to Verbose can overrun the buffer.
- You can try writing logs to a remote location or an external storage device, if your disk is full or your system does not have sufficient storage.

7.5.4 OS-Specific Information

Linux and FreeBSD

Refer to the README in the driver tarball for more information on configuring firmware logs.



NOTE: In FreeBSD, the driver can register/unregister to receive events per PF.

Windows

In Windows, you use PowerShell and Intel Ethernet cmdlets to configure firmware logging and capture firmware logs. At a high level, do the following to capture a firmware log in Windows:

1. Set the configuration for the firmware log, using the `Set-IntelEthernetLogConfig` cmdlet in PowerShell.
2. Perform the necessary steps to generate the issue you're trying to debug.
3. Start capturing the firmware log, using the `Start-IntelEthernetLog` cmdlet.
4. Stop capturing the firmware log, using the `Stop-IntelEthernetLog` cmdlet.
5. Work with Customer Support to decode your firmware log file and debug the issue.



NOTE: Firmware logs will be captured in the file you designated with `Start-IntelEthernetLog`.



NOTE: To disable firmware logging, use the `Disable-IntelEthernetLogConfig` cmdlet. To verify that firmware logging is disabled, run the `Get-IntelEthernetLogConfig` cmdlet; its results should say "Disabled."

Refer to the following for more information:

- "About Intel® Ethernet Cmdlets" on page 15
- The cmdlet help for Intel Ethernet cmdlets (see "Help Information for PowerShell Cmdlets" on page 22)
- The readme file inside the Intel Ethernet cmdlet zip file

ESXi

In ESXi, use `esxcfg-module` to set the configuration for firmware logs. Firmware logs are printed to kernel logs, with the tag `FWLOG`; use `dmesg` or read the file at `/var/log/vmkernel.log`.

At a high level, do the following to capture a firmware log in ESXi:



NOTE: Refer to the table after these steps for all commands and parameters.

1. Set the configuration for the firmware log, using `esxcfg-module`. The ESXi driver uses the following module parameters for firmware logging:
 - `FWLogEnable`: Enables firmware logging functionality on the designated PF (0 = Disable, 1 = Enable). Use commas to separate the values for each PF; the first value is for PF0, second for PF1, and so on.
 - `FWLogEvents`: Designates the firmware events to log, using a bitmask. Binary math is required to set.
 - `FWLogLevel`: Sets the verbosity level for the firmware event's log.
2. Redirect the kernel log or `dmesg` to a separate file for capturing the firmware log.
3. Reboot the system for changes to take effect.
4. After the system has rebooted, perform the necessary steps to generate the issue you're trying to debug.
5. Work with Customer Support to decode your firmware log file and debug the issue.

 **NOTE:** Firmware logs will be captured in the file you designated in step 2.

Use the following commands in ESXi for tasks related to firmware logging:

Task	Example Code
Enable firmware logging and set the verbosity level for your desired events	<pre># esxcfg-module icen -s 'FWLogEnable=<values> FWLogEvents=<bitmask> FWLogLevel=<value>'</pre> For example, to enable firmware logging on PF0 and set all events to log warning messages, use: <pre># esxcfg-module icen -s 'FWLogEnable=1,0,0,0,0,0,0 FWLogEvents=255 FWLogLevel=2'</pre>
Show the current configuration of the firmware log parameters	<pre># esxcfg-module -g <driver name></pre> NOTE: If firmware logging is disabled, the <code>FWLogEnable</code> parameter should say "0" (disabled).
Show a description of module parameters for firmware logging	<pre># esxcfg-module -i <driver name></pre> NOTE: Look for the parameters that begin with <code>FWLog</code>.
Redirect the firmware log to a file	<pre># tail -f /var/log/vmkernel.log > filename.log</pre>
Disable firmware logging	<pre># esxcfg-module icen -s 'FWLogEnable=0 FWLogEvents=0 FWLogLevel=0'</pre>

7.6 Debug Dump

Intel Ethernet 810 Series devices support debug dump, which allows you to obtain runtime register values from the firmware for "clusters" of events and then write the results to a single dump file, for debugging complicated issues in the field.

This debug dump contains a snapshot of the device and its existing hardware configuration, such as switch tables, transmit scheduler tables, and other information. Debug dump captures the current state of the specified cluster(s) and is a stateless snapshot of the whole device.

**NOTE:**

- Like with [firmware logs](#), the contents of the debug dump are not human-readable. You must work with Customer Support to decode the file.
- Debug dump is per device, not per PF.
- Debug dump writes all information to a single file.
- This feature is not currently supported on Linux.

Exact steps will vary by OS, but do the following to generate a debug dump log file:

1. Using the method appropriate for your OS (see "OS-Specific Information" below), specify one or more clusters that you want to dump the hardware configuration for.
 - **NOTE:** Firmware will return an error if you call the command without specifying at least one cluster. Available clusters include:
 - Switch
 - ACL
 - Tx Scheduler
 - Profile Configuration
 - Link
 - DCB
 - L2P
2. Specify the path and filename for the dump file to be written to (optional depending on your OS).
3. Execute the command to write the debug dump file.
4. After the log file is written, work with Customer Support to decode the dump file.

7.6.1 OS-Specific Information

Use the following tools or commands to write the debug dump results to a dump file:

OS	Method to Generate Debug Dump File
Windows Server Azure Stack HCI	Use either of the following: • <code>Write-IntelEthernetDebugDump</code> Ethernet cmdlet in PowerShell (see the cmdlet help for more information) • Intel® Ethernet Inspector
Windows	Not supported
Linux	Not supported
ESXi	Use <code>esxcli</code> (see below)
FreeBSD	Use <code>sysctl</code> (see the FreeBSD base driver README for more information)

ESXi



NOTE: For this functionality to work, you must have installed version 1.10.x or higher of the `intnet` tool, which is a plugin to the `esxcli` tool. You can download the latest version from the Intel Download Center [here](#).

In `esxcli`, use the following command to generate the debug dump file for your specified cluster(s):

```
# esxcli intnet debug fw dump <Cmd options>
```

Where `<Cmd options>` include:

- `-n|--vmnic <string>`: Specifies the vmnic name to operate on. **NOTE:** This field is required.
- `-c|--clusters <string>`: Specifies the clusters to dump. You must specify at least one cluster.
 - To specify multiple clusters, enclose a single string in quotes, separated by commas with no spaces. For example:
esxcli intnet debug fw dump -n vmnic0 --clusters "ACL,L2P"
- `-l|--list`: Displays the complete list of valid clusters on the screen.

To show the complete list of valid clusters, use the following:

```
# esxcli intnet debug fw dump -n <vmnicX> -l
```

`esxcli` will output the debug dump results to a single file in the `/scratch/core` directory. The file naming convention is `vmnicX-<time-stamp>-dump.bin`, where `vmnicX` is the VMware device alias of the affected device.

8. Troubleshooting

8.1 Common Problems and Solutions

There are many simple, easy-to-fix problems related to network problems. Review each one of these before going further.

- Check for recent changes to hardware, software, or the network that may have disrupted communications.
- Check the driver software.
 - Make sure you are using the latest appropriate drivers for your adapter from the [Intel support website](#).
 - Disable (or unload), then re-enable (reload) the driver or adapter.
 - Check for conflicting settings. Disable advanced settings such as teaming or VLANs to see if it corrects the problem.
 - Re-install the drivers.
- Check the cable. Use the best available cabling for the intended data rate.
 - Check that the cable is securely attached at both points.
 - Make sure the cable length does not exceed specifications.
 - Perform a cable test.
 - Replace the cable.
- Check the link partner (switch, hub, etc.).
 - Make sure the link partner is active and can send and receive traffic.
 - Make sure the adapter and link partner settings match one another, or are set to auto-negotiate.
 - Make sure the port is enabled.
 - Re-connect to another available port or another link partner.
- Look for adapter hardware problems.
 - Re-seat the adapter.
 - Insert the adapter in another slot.
 - Check for conflicting or incompatible hardware devices and settings.
 - Replace the adapter.
- Check the [Intel support website](#) for possible documented issues.
 - Select your adapter from the adapter family list.
 - Check the Frequently Asked questions section.
 - Check the Knowledge Base.
- Check your process monitor and other system monitors.
 - Check to see that there is sufficient processor and memory capacity to perform networking activity.
 - Look for any unusual activity (or lack of activity).
 - Use network testing programs to check for basic connectivity.

- Check your BIOS version and settings.
 - Use the latest appropriate BIOS for your computer.
 - Make sure the settings are appropriate for your computer.

The following troubleshooting table assumes that you have already reviewed the common problems and solutions.

Problem	Solution
Your computer cannot find the adapter	Make sure your adapter slots are compatible for the type of adapter you are using.
Diagnostics pass but the connection fails	Make sure the cable is securely attached, is the proper type and does not exceed the recommended lengths. Make sure the duplex mode and speed setting on the adapter matches the setting on the switch.
Adapter unable to connect to switch at correct speed. Gigabit adapter connects at 100 Mbps and 10 gigabit adapter connects at 1000 Mbps.	<i>This is applicable only to copper-based connections.</i> Make sure the adapter and the link partner are set to auto-negotiate. Verify that you are running the latest operating system revision for your switch and that the switch is compliant with the proper IEEE standard: • IEEE 802.3ad-compliant (gigabit over copper) • IEEE 802.3an-compliant (10 gigabit over copper)
The device does not connect at the expected speed.	When Gigabit PHY Mode is forced to Primary mode on both the Intel adapter and its link partner, the link speed obtained by the Intel adapter may be lower than expected or link may not be established.
The adapter stops working without apparent cause	Run the adapter and network tests described in "Diagnostics in Intel PROSet" on page 115.
The Link indicator light is off	Run the adapter and network tests described in "Diagnostics in Intel PROSet" on page 115. Make sure the proper (and latest) driver is loaded. Make sure that the link partner is configured to auto-negotiate (or forced to match adapter) Verify that the switch is IEEE 802.3ad-compliant.
The link light is on, but communications are not properly established	Make sure the proper (and latest) driver is loaded. Both the adapter and its link partner must be set to either auto-detect or manually set to the same speed and duplex settings.  NOTE: The adapter's link indicator light may be on even if communications between the adapter and its link partner have not been properly established. Technically, the link indicator light represents the presence of a carrier signal but not necessarily the ability to properly communicate with a link partner. This is expected behavior and is consistent with IEEE's specification for physical layer operation.
RX or TX light is off	Network may be idle; try creating traffic while monitoring the lights.
The diagnostic utility reports the adapter is	The PCI BIOS isn't configuring the adapter correctly. See "PCI / PCI-X /

Problem	Solution
"Not enabled by BIOS"	PCI Express Configuration" later in this table.
The computer hangs when the drivers are loaded	Try changing the PCI BIOS interrupt settings. See "PCI / PCI-X / PCI Express Configuration" later in this table.
The Fan Fail LED of the 10 Gigabit AT Server Adapter is on (red)	The fan cooling solution is not functioning properly. Contact customer support for further instructions.
PCI / PCI-X / PCI Express Configuration	If the adapter is not recognized by your OS or if it does not work you may need to change some BIOS settings. Try the following only if you are having problems with the adapter and are familiar with BIOS settings. • Check to see that the "Plug-and-Play" setting is compatible with the operating system you are using. • Make sure the slot is enabled. • Configure interrupts for level-triggering, as opposed to edge-triggering. • Reserve interrupts and/or memory addresses. This prevents multiple buses or bus slots from using the same interrupts. Check the BIOS for IRQ options for PCI / PCI-X / PCIE.
Driver message: "Rx/Tx is disabled on this device because an unsupported SFP+ module type was detected."	You installed an unsupported module in the device. See "Supported SFP+, SFP28, QSFP+, and QSFP28 Modules" on page 8 for a list of supported modules.

8.2 Multiple Adapters

When configuring a multi-adapter environment, you must upgrade all Intel adapters in the computer to the latest software.

If the computer has trouble detecting all adapters, consider the following:

- If you enable Wake on LAN* (WoL) on more than two adapters, the Wake on LAN feature may overdraw your system's auxiliary power supply, resulting in the inability to boot the system and other unpredictable problems. For multiple desktop/management adapters, it is recommended that you install one adapter at a time and use the IBAUtil utility (ibautil.exe in \APPS\BOOTAGNT) to disable the WoL feature on adapters that do not require WoL capabilities. On server adapters, the WoL feature is disabled by default.
- Adapters with Intel Boot Agent enabled will require a portion of the limited start up memory for each adapter enabled. Disable the service on adapters that do not need to boot Pre-Boot Execution Environment (PXE).

8.3 Health Status Messages

Intel® Ethernet 800 Series devices support asynchronous health status messages, which help you to debug system-level issues and diagnostics in the field. This feature is enabled by default and cannot be shut off.

When the firmware detects an abnormal event during initialization, it will push health status information to the base driver's system event log, such as dmesg or the Windows Event Log. Health status messages could encompass issues related to:

- Unsupported modules
- The NVM or option ROM
- Invalid link configuration
- Port speed
- Link partner
- Other issues

The system log will identify the device experiencing the issue, list information about the problem, and suggest a possible solution, such as updating to the latest NVM image or checking the cable or module.

See your system log for more information, if you are experiencing issues on Intel Ethernet 800 Series devices.

8.4 Safe Mode

Adapters based on the Intel® Ethernet 800 Series require a [Dynamic Device Personalization \(DDP\)](#) package file to enable advanced and performance features. If the driver detects a missing or incompatible DDP package file, the driver will go into Safe Mode. Safe Mode supports only basic traffic and minimal functionality, such as updating the NVM or downloading a new driver or DDP package.



NOTES:

- Safe Mode only applies to the affected physical function and does not impact any other PFs.
- [Firmware Recovery Mode](#) takes precedence over Safe Mode.

8.4.1 Safe Mode Errors and Messages

When the driver is in Safe Mode, the device drivers and utilities may log or display messages to help with troubleshooting. The following conditions may cause the driver to enter Safe Mode:

- The DDP package file was not found or couldn't be read.
- The DDP package file's version number, signature, or other metadata aren't valid or aren't supported by the driver.
- An unknown error occurred when loading the DDP package.
- The driver couldn't load the DDP package file because a compatible DDP package is already present on the device.
- The device has a DDP package that isn't supported by the driver.

8.4.2 Resolving Safe Mode Issues

The device drivers and utilities may display the action to take to get out of Safe Mode, depending on the underlying cause. Possible actions could include the following:

- Wait for the device to reset.
- Install the latest driver.
- Download a new DDP package.
- Restart the adapter. If the problem persists, install the latest driver.
- Reboot the system. If the problem persists, update the NVM.

You can download the latest drivers and DDP packages from the [Intel support website](#).

8.5 PF Message Queue Overflow

The device driver can detect some types of anomalous behavior. When it does, it will log the VF MAC address and associated PF MAC address. Using this information, you can check the virtual machine (VM) that is using the VF MAC address to ensure that the VM is operating correctly.

8.6 Possible Misconfiguration of the Ethernet Port

You may see an informational message stating that a potential misconfiguration of the Ethernet port was detected. This is to alert you that your device is being underutilized. If this was intentional, you may ignore this message. For example, setting your Intel® Ethernet Network Adapter E810-C-Q2 adapter to 2x2x25 is valid, but it does not use the full capabilities of the device. If you see this message, and the configuration was not intentional, you may use the Ethernet Port Configuration Tool (EPCT) to correct the configuration.

8.7 Other Performance Issues

Attaining the best speed requires that many components are operating at peak efficiency. Among them are the following:

- **Cable quality and length** - Do not exceed the maximum recommended length for your cable type. Shorter lengths often provide better results. Check for loose or damaged connectors. Check the cable for kinked or damaged sections.
- **Bus speed and traffic** - The PCI bus speed accommodates the slowest PCI card installed. Check to see if you have a card that is slowing down your system.
- **Processor and Memory** - Check your performance monitoring programs to see if traffic is being affected by your processor speed, available memory or other processes.
- **Transmission frame size** - Your network performance may be enhanced by adjusting or maximizing the transmission frame size. Operating systems, switches and adapters will impose varying limits on maximum frame size. See the discussion on Jumbo Frames for your OS.
- **Operating System** - Networking feature implementation will vary by operating system version, such as offloading and multiprocessor threading.

8.8 Diagnostics

Multiple utilities are available to help troubleshoot and diagnose issues with your Intel Ethernet devices.

8.8.1 Linux Diagnostics

Intel Ethernet drivers use the ethtool interface for driver configuration and diagnostics, as well as displaying statistical information. The latest ethtool version is required for this functionality. Download it at <https://kernel.org/pub/software/network/ethtool/>.

8.8.2 Diagnostics in Intel PROSet

Intel's diagnostic software lets you test the adapter to see if there are problems with the adapter hardware, the cabling, or the network connection. Refer to "About Intel PROSet®" on page 15 for an overview of this software.

Intel PROSet allows you to run the following types of diagnostic tests on supported Windows operating systems.

Type of Test	Description
Connection Test	Verifies network connectivity by pinging the DHCP server, WINS server, and gateway.
Cable Tests	Provides information about cable properties. ¹
Hardware Tests	Determines if the adapter is functioning properly. ²
Note: The Cable Test is not supported on all adapters and will not run on Direct Attached Cables (DAC) or Fiber. The Cable Test will only be available on adapters that support it.	

To access these tests, select the adapter in Windows Device Manager, click the **Link** tab, and click **Diagnostics**. A Diagnostics window displays tabs for each type of test. Click the appropriate tab and run the test.

In Intel PROSet ACU, use the Diagnostics panel.

The availability of these tests is dependent on the adapter and operating system. Tests may be disabled if:

- The port is used as a manageability port.
- The tests are being run from a virtual machine.



NOTE: At this time, Windows diagnostics are not supported on ports based on an Intel Ethernet Controller I225 and will fail.

8.8.2.1 Testing from Windows PowerShell

Intel provides two [PowerShell cmdlets](#) for testing your device.

- Test-IntelNetDiagnostics runs the specified test suite on the specified device. See the Test-IntelNetDiagnostics help inside PowerShell plus the following table for more information.
- Test-IntelNetIdentifyAdapter blinks the LED on the specified device.

The following table describes the possible result codes from the Test-IntelNetDiagnostics cmdlet (where <X> below indicates a value returned in the message).

Result Code	Description
00	Successfully pinged gateway address <X>.
01	Successfully pinged DHCP address <X>.
02	Successfully pinged DNS address <X>.
03	Successfully pinged WINS address <X>.
04	An instance of this test is already running. You can only have one test running at a time.
05	TCP/IP protocol is not configured. To run this test, configure this connection to use the TCP/IP protocol.
07	The IP address for this connection is invalid. Possible cause: The system may be waiting for a response from a DHCP server.

Result Code	Description
09	The IP address for this connection is invalid.
18	You cannot run this test while the device is included in a team or VLAN.
19	Auto-negotiation is not enabled on the device. The device has been configured to force a lower speed.
20	Auto-negotiation is not complete on this device. Please wait and try again later.
21	A Category 5 (or better) cable is required to run at 1 Gbps. The cable connected to the device either is not Category 5 (or better) or has faulty wires.
22	Link speed: <X> Mbps. The link partner is not capable of higher speeds.
23	The link partner is not advertising a compatible speed. Please check that the link partner supports 1 Gbps.
24	Link speed has been reduced because a Power Saver option is enabled. Disable power saving in your OS settings and run the test again.
25	The device is configured to force a lower speed.
26	No cable problems detected.
27	Could not run the test at this time. Please try again later.
33	The test detected a bad connection. Distance to problem: <X> meters.
34	Passed
35	Failed
36	Cable quality is unknown.
37	Passed
38	Failed
39	Cable quality is unknown.
40	Cable polarity is normal.
41	Cable polarity is reversed.
42	Cable length: <X> meters.
43	This device is running at full speed.
44	Cable quality is poor or no cable is connected. Possible causes: Faulty cable, faulty connector, or a speed/duplex mismatch. Verify that the speed/duplex setting on the switch/hub is configured for auto-negotiation.
45	Cable quality is poor or no cable is connected. Possible causes: Faulty cable, faulty connector, or a speed/duplex mismatch.
46	Cable quality is adequate.
47	Cable quality is good.

Result Code	Description
48	Cable quality is excellent.
49	Cable quality is unknown.
50	The test detected a frequency response that does not meet IEEE specifications.
51	This device does not have link. Make sure the cable is connected and the speed and duplex settings are configured correctly on the device and link partner.
52	Passed
53	Passed
54	Passed
55	Passed
56	Passed
57	Passed
58	Failed
59	Failed
60	Failed
61	Failed
62	Failed
63	Failed
64	Passed
65	Failed
66	This device requires a restart.
67	Could not run the test at this time. The device may be connected to a remote target. Disconnecting the cable will enable the test.
68	Could not run the test at this time. This device is used as a manageability port. Disconnecting the cable will enable the test.
69	The device does not support this test.
70	This test relies on a response from a gateway, DNS, DHCP, or WINS server and no such response was received. Any such server for this connection may be unavailable or misconfigured.
71	Cable integrity is unknown.
72	This test relies on a response from a gateway, DNS, DHCP, or WINS server and no such response was received. Any such server for this connection may be unavailable or misconfigured. This device is configured to automatically obtain an IP address but no DHCP server is present on the network.

Result Code	Description
	Windows selected an IP address using alternate private IP addressing.
73	Temperature is normal.
74	<i>Possible values:</i> The device overheated and was stopped. The device overheated. Link speed was reduced.

9. Known Issues

Known issues are no longer included in this user guide. See the [Release Notes](#) for this release for all known issues and fixed issues.

10. Regulatory Compliance Statements

10.1 FCC Class A Products

- Intel® Ethernet Network Adapter E810-2C-Q2
- Intel® Ethernet Network Adapter E810-C-Q1
- Intel® Ethernet Network Adapter E810-C-Q1 for OCP
- Intel® Ethernet Network Adapter E810-C-Q1 for OCP 3.0
- Intel® Ethernet Network Adapter E810-C-Q2 for OCP 3.0
- Intel® Ethernet Network Adapter E810-C-Q2T
- Intel® Ethernet Network Adapter E810-L-Q2 for OCP 3.0
- Intel® Ethernet Network Adapter E810-XXV-2 for OCP 3.0
- Intel® Ethernet Network Adapter E810-XXV-4 for OCP 3.0
- Intel® Ethernet Network Adapter E810-XXV-4T
- Intel® Ethernet Network Adapter I710-T4L for OCP 3.0
- Intel® Ethernet Network Adapter X710-T2L for OCP 3.0
- Intel® Ethernet Network Adapter X710-T4L for OCP 3.0
- Intel® Ethernet Network Adapter XXV710-DA2 for OCP 3.0
- Intel® Ethernet Network Adapter XXV710
- Intel® Ethernet Network Adapter XXV710-1
- Intel® Ethernet Network Adapter XXV710-2
- Intel® Ethernet Network Adapter X722-2
- Intel® Ethernet Network Adapter X722-4
- Intel® Ethernet Server Adapter XL710-Q1OCP
- Intel® Ethernet Server Adapter XL710-Q2OCP
- Intel® Ethernet Network Adapter X710-2 for OCP NIC 3.0
- Intel® Ethernet Network Adapter X710-4 for OCP NIC 3.0
- Intel® Ethernet Converged Network Adapter X710
- Intel® Ethernet I/O Module XL710-Q1
- Intel® Ethernet I/O Module XL710-Q2
- Intel® Ethernet Server Adapter X550-T2 for OCP
- Intel® Ethernet Server Adapter X550-T1 for OCP
- Intel® Ethernet Server Bypass Adapter X540-T2
- Intel® Ethernet Converged Network Adapter X540-T2
- Intel® Ethernet Converged Network Adapter X540-T1
- Intel® Ethernet OCP Server Adapter X520-1
- Intel® Ethernet OCP Server Adapter X520-2
- Intel® Ethernet Server Bypass Adapter X520-SR2
- Intel® Ethernet Server Adapter X520-T2

- Intel® Ethernet X520 10GbE Dual Port KX4 Mezz
- Intel® 10 Gigabit AT2 Server Adapter
- Intel® 10 Gigabit SR Dual Port Express Module
- Intel® 10 Gigabit AT Server Adapter
- Intel® Ethernet Network Adapter I350-T4 for OCP NIC 3.0
- Intel® PRO/1000 MT Quad Port Server Adapter

10.2 FCC Class B Products

- Intel® Ethernet Network Adapter E810-C-Q2
- Intel® Ethernet Network Adapter E810-XXV-4
- Intel® Ethernet Network Adapter E810-XXV-2
- Intel® Ethernet Network Adapter I710-T4L
- Intel® Ethernet Network Adapter X710-T2L
- Intel® Ethernet Network Adapter X710-T4L
- Intel® Ethernet Network Adapter X710-TL
- Intel® Ethernet Converged Network Adapter X710-2
- Intel® Ethernet Converged Network Adapter X710-4
- Intel® Ethernet Converged Network Adapter X710-T4
- Intel® Ethernet Converged Network Adapter XL710-Q1
- Intel® Ethernet Converged Network Adapter XL710-Q2
- Intel® Ethernet Converged Network Adapter X550-T1
- Intel® Ethernet Converged Network Adapter X550-T2
- Intel® Ethernet Server Adapter X520-1
- Intel® Ethernet Server Adapter X520-2
- Intel® Ethernet SFP+ LR Optics RMN FTLX1471
- Intel® Ethernet Converged Network Adapter X520-4
- Intel® Ethernet Converged Network Adapter X520-Q1
- Intel® 10 Gigabit AF DA Dual Port Server Adapter
- Intel® 10 Gigabit CX4 Dual Port Server Adapter
- Intel® 10 Gigabit XF SR Dual Port Server Adapter
- Intel® 10 Gigabit XF SR Server Adapter
- Intel® 10 Gigabit XF LR Server Adapter
- Intel® Ethernet Network Adapter I225-T1
- Intel® Ethernet Server Adapter I340-T2
- Intel® Ethernet Server Adapter I340-T4
- Intel® Ethernet Server Adapter I350-T2
- Intel® Ethernet Server Adapter I350-T4
- Intel® Ethernet Server Adapter I210-T1
- Intel® Ethernet Server Adapter I340-F4
- Intel® PRO/1000 MT Server Adapter

- Intel® PRO/1000 MT Dual Port Server Adapter
- Intel® PRO/1000 GT Dual Port Server Adapter
- Intel® PRO/1000 PT Server Adapter
- Intel® PRO/1000 PT Dual Port Server Adapter
- Intel® PRO/1000 GT Quad Port Server Adapter
- Intel® PRO/1000 PT Quad Port Server Adapter
- Intel® PRO/1000 PT Quad Port LP Server Adapter
- Intel® PRO/1000 GT Desktop Adapter
- Intel® PRO/1000 PT Desktop Adapter
- Intel® PRO/1000 MF Server Adapter
- Intel® PRO/1000 MF Dual Port Server Adapter
- Intel® PRO/1000 PF Server Adapter
- Intel® PRO/1000 PF Dual Port Server Adapter
- Intel® PRO/1000 PF Quad Port Server Adapter

10.3 Safety Compliance

The following safety standards apply to all products listed above:

- UL 60950-1, 2nd Edition, 2011-12-19 (Information Technology Equipment - Safety - Part 1: General Requirements)
- UL 62368-1 2nd Edition (Information Technology Equipment - Safety requirements)
- CSA C22.2 No. 60950-1-07, 2nd Edition, 2011-12 (Information Technology Equipment - Safety - Part 1: General Requirements)
- CAN/CSA C22.2 European Group Differences and National Differences according to 62368-1-14 - Audio/video, information and communication technology equipment - Part 1: Safety requirements
- EN 60950-1:2006/A11:2009/A1:2010/A12:2011 (European Union)
- IEC 60950-1:2005 (2nd Edition); Am 1:2009 (International)
- EU LVD Directive 2006/95/EC

10.4 EMC Compliance

The following standards may apply.

10.4.1 Class A Products

- FCC Part 15 – Radiated & Conducted Emissions (USA)
- CAN ICES-3(A)/NMB-3(A) – Radiated & Conducted Emissions (Canada)
- CISPR 22 – Radiated & Conducted Emissions (International)
- EN55022: 2010 – Radiated & Conducted Emissions (European Union)
- EN55024: 2010 +A1:2001+A2:2003 – Immunity (European Union)
- EN55032: 2015 Class A Radiated and Conducted Emissions requirements (European Union)
- EMC Directive 2004/108/EC (European Union)
- VCCI (Class A)– Radiated & Conducted Emissions (Japan)
- CNS13438 – Radiated & Conducted Emissions (Taiwan)

- AS/NZS CISPR 22:2009 + A1:2010 Class A and CISPR 32:2015 for Radiated and Conducted Emissions requirements (Australia/New Zealand)
- NRRA No. 2012-13 (2012.06.28), NRRA Notice No. 2012-14 (2012.06.28) (Korea)

10.4.2 Class B Products

- FCC Part 15 (Class B) – Radiated & Conducted Emissions (USA)
- CAN ICES-3(B)/NMB-3(B) – Radiated & Conducted Emissions (Canada)
- CISPR 22 – Radiated & Conducted Emissions (International)
- EN55022: 2010 – Radiated & Conducted Emissions (European Union)
- EN55024: 2010 – Immunity (European Union)
- EN55032: 2015 Class B Radiated and Conducted Emissions requirements (European Union)
- EMC Directive 2004/108/EC (European Union)
- VCCI (Class B)– Radiated & Conducted Emissions (Japan) (excluding optics)
- CNS13438 (Class B)-2006 – Radiated & Conducted Emissions (Taiwan) (excluding optics)
- AS/NZS CISPR 22:2009 + A1:2010 Class B and CISPR 32:2015 for Radiated and Conducted Emissions requirements (Australia/New Zealand)
- KN22; KN24 – Korean emissions and immunity
- NRRA No. 2012-13 (2012.06.28), NRRA Notice No. 2012-14 (2012.06.28) (Korea)

10.5 Hazardous Substances Compliance

The following standards may apply:

- EU REACH directive
- EU WEEE directive
- EU RoHS directive
- China RoHS directive
- BSMI CNS15663: Taiwan RoHS

10.6 Regulatory Compliance Markings

When required, these products are provided with the following Product Certification Markings:

- UL Recognition Mark for USA and Canada
- CE Mark
- EU WEEE Logo
- FCC markings
- VCCI marking
- Australian C-Tick Mark
- Korea MSIP mark
- Taiwan BSMI mark
- People's Republic of China "EFUP" mark

10.7 FCC Class A User Information

The Class A products listed above comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.



NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION: If the device is changed or modified without permission from Intel, the user may void his or her authority to operate the equipment.

10.7.1 Canadian Compliance (Industry Canada)

CAN ICES-3(A)/NMB-3(A)

10.7.2 VCCI Class A Statement

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

VCCI-A

10.7.3 BSMI Class A Statement

警告使用者:

此為甲類資訊技術設備，於居住環境中使用時，可能會造成射頻擾動，在此種情況下，使用者會被要求採取某些適當的對策。

10.7.4 KCC Notice Class A (Republic of Korea Only)

A급 기기 (업무용 방송통신기기) CLASS A device (commercial broadcasting and communication equipment)	이 기기는 업무용(A급)으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다. This device has been approved by EMC registration. Distributors or users pay attention to this point. This device is usually aimed to be used in other area except at home.
--	--

10.7.5 BSMI Class A Notice (Taiwan)

警告使用者:

此為甲類資訊技術設備，於居住環境中使用時，可能會造成射頻擾動，在此種情況下，使用者會被要求採取某些適當的對策。

10.8 FCC Class B User Information

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



CAUTION: If the device is changed or modified without permission from Intel, the user may void his or her authority to operate the equipment.



NOTE: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

10.8.1 Electromagnetic Compatibility Notices

10.8.1.1 FCC Declaration of Conformity Statement

The following products have been tested to Comply with FCC Standards for Home or Office Use:

PRO/1000 PT, PRO/1000 GT, Gigabit PT, I210-T1, I340-T2/T4, and I350-T2/T4.

10.8.1.2 Canadian Compliance (Industry Canada)

CAN ICES-3 (B)/NMB-3 (B)

10.8.2 VCCI Class B Statement (Japan)

この装置は、クラスB 情報技術装置です。この装置は、家庭環境で使用することを目的としています。この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。

取扱説明書に従って正しい取り扱いをして下さい。

V C C I - B

10.8.3 KCC Notice Class B (Republic of Korea Only)

B급 기기 (가정용 방송통신기기) CLASS B device residential broadcasting and communication equipment	이 기기는 가정용(B급)으로 전자파적합등록을 한 기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다. This device has been approved by EMC Registration and is usually aimed to be used in a residential area so that it can be used in all other location as well as at home.
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10.9 EU WEEE Logo



10.10 Manufacturer Declaration European Community



10.10.1 Manufacturer Declaration

Intel Corporation declares that the equipment described in this document is in conformance with the requirements of the European Council Directive listed below:

- Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- RoHS Directive 2011/65/EU

These products follow the provisions of the European Directive 1999/5/EC.

Dette produkt er i overensstemmelse med det europæiske direktiv 1999/5/EC.

Dit product is in navolging van de bepalingen van Europees Directief 1999/5/EC.

Tämä tuote noudattaa EU-direktiivin 1999/5/EC määräyksiä.

Ce produit est conforme aux exigences de la Directive Européenne 1999/5/EC.

Dieses Produkt entspricht den Bestimmungen der Europäischen Richtlinie 1999/5/EC.

Þessi vara stenst reglugerð Evrópska Efnahags Bandalagsins númer 1999/5/EC.

Questo prodotto è conforme alla Direttiva Europea 1999/5/EC.

Dette produktet er i henhold til bestemmelsene i det europeiske direktivet 1999/5/EC.

Este produto cumpre com as normas da Diretiva Europeia 1999/5/EC.

Este producto cumple con las normas del Directivo Europeo 1999/5/EC.

Denna produkt har tillverkats i enlighet med EG-direktiv 1999/5/EC.

This declaration is based upon compliance of the Class A products listed above to the following standards:

EN 55022:2010 (CISPR 22 Class A) RF Emissions Control.

EN 55024:2010 (CISPR 24) Immunity to Electromagnetic Disturbance.

EN 60950-1:2006/A11:2009/A1:2010/A12:2011 Information Technology Equipment- Safety-Part 1: General Requirements.

EN 50581:2012 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

This declaration is based upon compliance of the Class B products listed above to the following standards:

EN 55022:2010 (CISPR 22 Class B) RF Emissions Control.

EN 55024:2010 (CISPR 24) Immunity to Electromagnetic Disturbance.

EN 60950-1:2006/A11:2009/A1:2010/A12:2011 Information Technology Equipment- Safety-Part 1:

General Requirements.

EN 50581:2012 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.



WARNING: In a domestic environment, Class A products may cause radio interference, in which case the user may be required to take adequate measures.

Responsible Party

Intel Corporation, Mailstop JF3-446
5200 N.E. Elam Young Parkway
Hillsboro, OR 97124-6497
Phone 1-800-628-8686

10.11 China RoHS Declaration

关于符合中国《电子信息产品污染控制管理办法》的声明
**Management Methods on Control of Pollution From
Electronic Information Products
(China RoHS declaration)**

产品中有毒有害物质的名称及含量

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷板组件	X	○	○	○	○	○
○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T 11363-2006 标准规定的限量要求以下。 X：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T 11363-2006 标准规定的限量要求。						

10.12 Class 1 Laser Products

Server adapters listed above may contain laser devices for communication use. These devices are compliant with the requirements for Class 1 Laser Products and are safe in the intended use. In normal operation the output of these laser devices does not exceed the exposure limit of the eye and cannot cause harm.

For continued safe operation in case of an abnormal circumstance, always have the provided laser connector cover in place or a compatible fiber optics cable properly connected when power is available to the product.

The Laser device must be factory serviced ONLY by the responsible manufacturer! NO adjustments, service or maintenance is to be performed otherwise.



CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

These Class 1 Laser devices:

Comply with FDA/CDRH per CFR21, subchapter J.

Comply with IEC 60825-1:2007

10.13 End-of-Life / Product Recycling

Product recycling and end-of-life take-back systems and requirements vary by country.

Contact the retailer or distributor of this product for information about product recycling and/or take-back.



11. Specifications

11.1 Indicator Lights

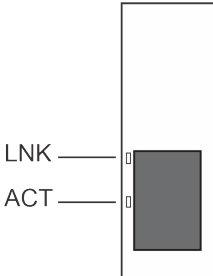
Intel Ethernet adapters feature indicator lights on the adapter backplate that serve to indicate activity and the status of the adapter board. The following tables define the meaning for the possible states of the indicator lights for each adapter board.

Subsections are organized by number of ports and types of connections.

All drawings are representational.

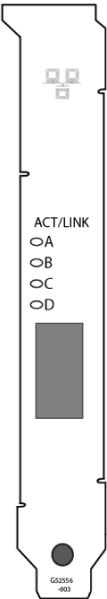
11.1.1 Single Port QSFP28 Adapters

Drawing	Label	Indication	Meaning
	ACT/LNK	Green	Linked at maximum port speed
		Yellow	Linked at less than maximum port speed
		Blinking On/Off	Actively transmitting or receiving data
		Off	No link
These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-C-Q1			

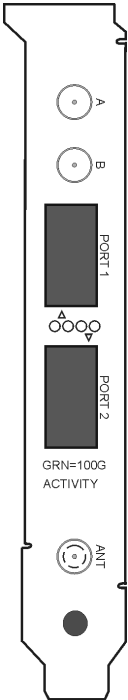
Drawing	Label	Indication	Meaning
	LNK	Green	Operating at maximum port speed
		Yellow	Linked at less than maximum port speed
	ACT	Green Flashing	Data activity
		Off	No activity
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-C-Q1 for OCP Intel® Ethernet Network Adapter E810-C-Q1 for OCP 3.0		

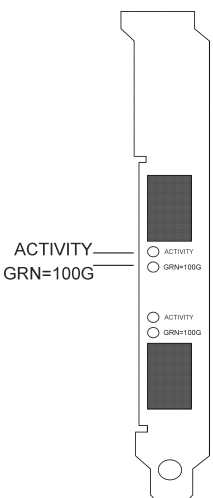
11.1.2 Single Port QSFP+ Adapters

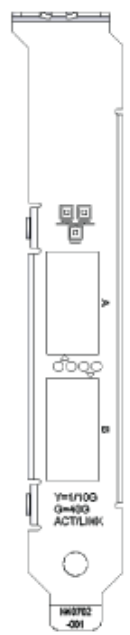
Drawing	Label	Indication	Meaning
	ACT/LNK	Green	Linked at 40 Gb
		Yellow	Linked at 1/10 Gb
		Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter XL710-Q1		

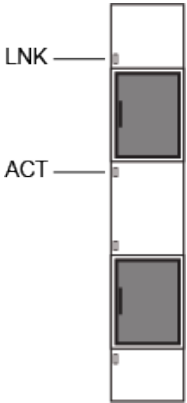
Drawing	Label	Indication	Meaning
 ACT/LNK ○A ○B ○C ○D Q5254 -001	ACT/LNK	Green	Linked at 10 Gb
		Yellow	Linked at 1 Gb
		Blinking On/Off	Actively transmitting or receiving data
		Off	No link
These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter X520-Q1			

11.1.3 Dual Port QSFP28 Adapters

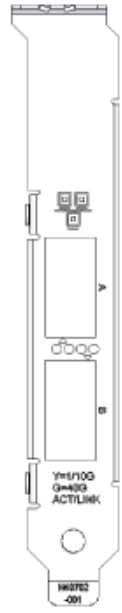
Drawing	Label	Indication	Meaning
 A B PORT 1 A B PORT 2 GRN=100G ACTIVITY ANT	Link	Green	Operating at maximum port speed
		Yellow	Operating at less than maximum port speed
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-C-Q2T			

Drawing	Label	Indication	Meaning
 ACTIVITY GRN=100G ○ ACTIVITY ○ GRN=100G ○ ACTIVITY ○ GRN=100G	GRN 100G	Green	Linked at maximum port speed
		Yellow	Linked at less than maximum port speed
	ACTIVITY	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-2C-Q2		

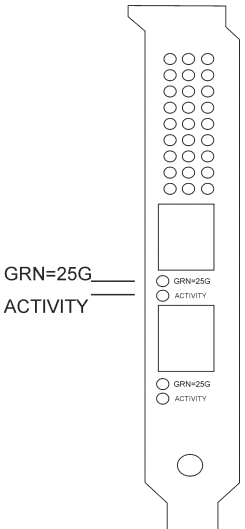
Drawing	Label	Indication	Meaning
 100G Q=400G ACT/LNK 100G Q=400G ACT/LNK	ACT/LNK	Green	Linked at maximum port speed
		Yellow	Linked at less than maximum port speed
		Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-C-Q2		

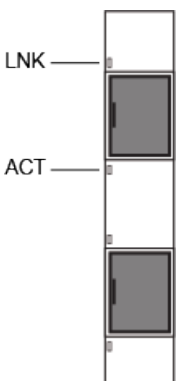
Drawing	Label	Indication	Meaning
	LNK	Green	Operating at maximum port speed
		Yellow	Linked at less than maximum port speed
	ACT	Green flashing	Data activity
		Off	No activity
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-C-Q2 for OCP 3.0 Intel® Ethernet Network Adapter E810-L-Q2 for OCP 3.0		

11.1.4 Dual Port QSFP+ Adapters

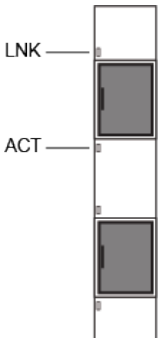
Drawing	Label	Indication	Meaning
	ACT/LNK	Green	Linked at 40 Gb
		Yellow	Linked at 1/10 Gb
		Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter XL710-Q2		

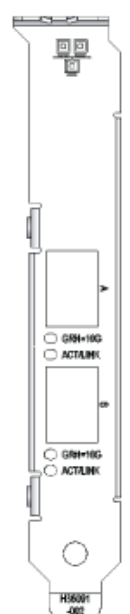
11.1.5 Dual Port SFP28 Adapters

Drawing	Label	Indication	Meaning
	GRN 25G	Green	Linked at maximum port speed
		Yellow	Linked at less than maximum port speed
	ACTIVITY	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-XXV-2		

Drawing	Label	Indication	Meaning
	LNK	Green	Operating at maximum port speed
		Yellow	Linked at less than maximum port speed
	ACT	Green flashing	Data activity
		Off	No activity
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-XXV-2 for OCP 3.0 Intel® Ethernet Network Adapter XXV710-DA2 for OCP 3.0		

11.1.6 Dual Port SFP/SFP+ Adapters

Drawing	Label	Indication	Meaning
	LNK	Green	Operating at maximum port speed
		Yellow	Linked at less than maximum port speed
	ACT	Green flashing	Data activity
		Off	No activity
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter X710-2 for OCP NIC 3.0		

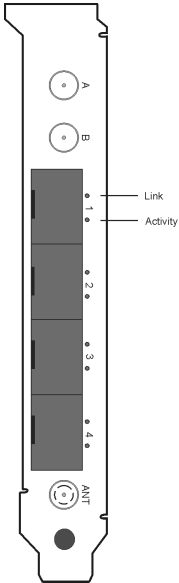
Drawing	Label	Indication	Meaning
	LNK	Green	Linked at 10 Gb
		Yellow	Linked at 1 Gb
	ACT	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter X710-2		

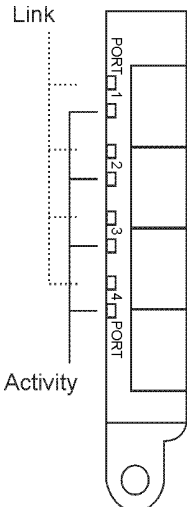


Drawing	Label	Indication	Meaning
	GRN 10G (A or B): Green	On	Linked to the LAN
		Off	Not linked to the LAN
	ACT/LNK (A or B): Green	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® 10 Gigabit AF DA Dual Port Server Adapter Intel® Ethernet Server Adapter X520 series of adapters Intel® Ethernet Network Adapter X722-2		

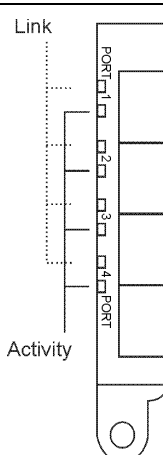
11.1.7 Quad Port SFP28 Adapters

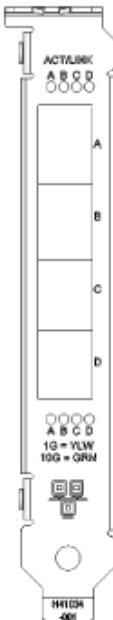
Drawing	Label	Indication	Meaning
	GRN 25G	Green	Linked at 25 Gb
		Yellow	Linked at 10 Gb or 1 Gb
	ACTIVITY	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-XXV-4		

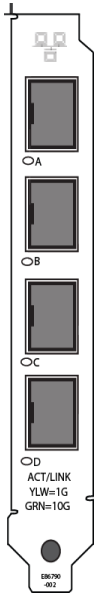
Drawing	Label	Indication	Meaning
	Link	Green	Operating at maximum port speed
		Yellow	Operating at less than maximum port speed
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-XXV-4T		

Drawing	Label	Indication	Meaning
	Link	Green	Linked at maximum port speed
		Yellow	Linked at less than maximum port speed
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter E810-XXV-4 for OCP 3.0		

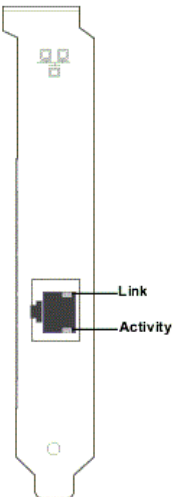
11.1.8 Quad Port SFP/SFP+ Adapters

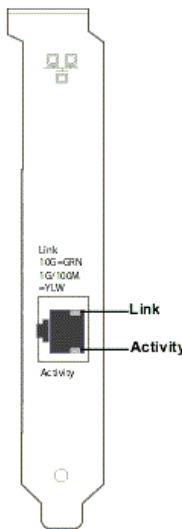
Drawing	Label	Indication	Meaning
	Link	Green	Linked at maximum port speed
		Yellow	Linked at less than maximum port speed
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
These indicator lights apply to the following devices:			
Intel® Ethernet Network Adapter X710-4 for OCP NIC 3.0			

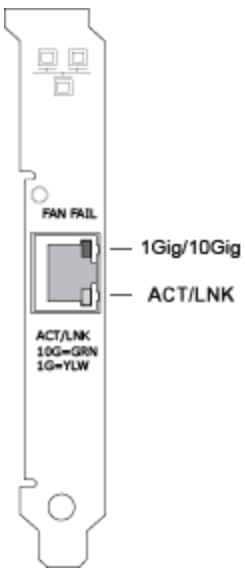
Drawing	Label	Indication	Meaning
	LNK	Green	Linked at 10 Gb
		Yellow	Linked at 1 Gb
	ACT	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter X710-4		

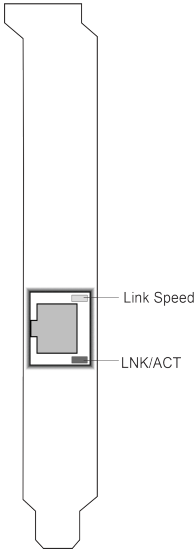
Drawing	Label	Indication	Meaning
 ○A ○B ○C ○D ACT/LNK YLW=1G GRN=10G	ACT/LNK	Green	Linked at 10 Gb
		Yellow	Linked at 1 Gb
		Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter X520-4 Intel® Ethernet Network Adapter X722-4		

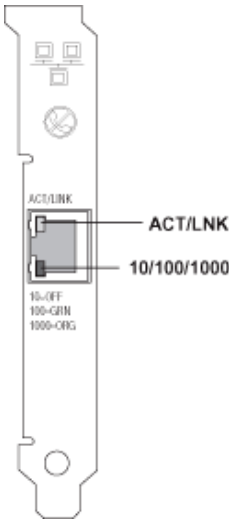
11.1.9 Single Port Copper Adapters

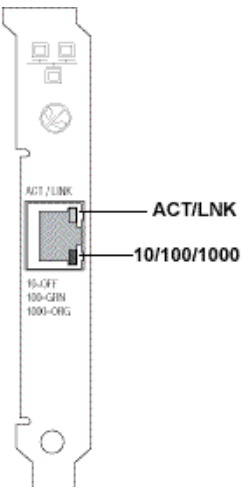
Drawing	Label	Indication	Meaning
 Link Activity	Link	Green	Linked at 10 Gb
		Yellow	Linked at 1 Gb
		Off	Linked at 100 Mbps
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter X550-T1		

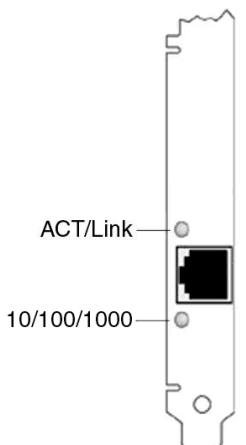
Drawing	Label	Indication	Meaning
	Link	Green	Linked at 10 Gb
		Yellow	Linked at 1 Gb
		Off	No link
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter X540-T1			

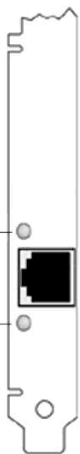
Drawing	Label	Indication	Meaning
	ACT/LNK	Green on	The adapter is connected to a valid link partner
		Green blinking	Data activity
		Off	No link
		Green blinking	Identity. Use the "Identify Adapter" button in Intel PROSet or the BLINK command in IBAUtil to control blinking. See Intel PROSet Help for more information.
	1Gig/10Gig	Green	10 Gbps
		Yellow	1 Gbps
		Off	No link
	FAN FAIL	Red	Over temperature event occurred. The adapter will be shut down to avoid damage.
These indicator lights apply to the following devices: Intel® 10 Gigabit AT Server Adapter			

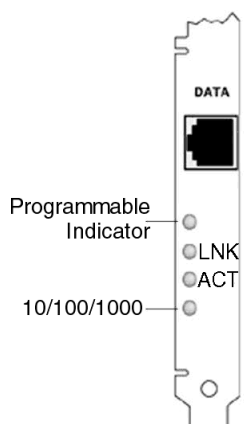
Drawing	Label	Indication	Meaning
	Link Speed	Green	Linked at 2.5 Gbps
		Amber	Linked at 1 Gbps
		Off	Linked at 100 Mbps or 10 Mbps
	Activity	Green	Linked
		Green flashing	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter I225-T1		

Drawing	Label	Indication	Meaning
	ACT/LNK	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
	10=OFF 100=GRN 1000=ORG	Off	10 Mbps
		Green	100 Mbps
		Orange	1000 Mbps
		Orange flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
	These indicator lights apply to the following devices: Intel® PRO/1000 PT Server Adapter		

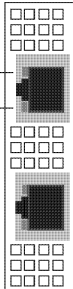
Drawing	Label	Indication	Meaning
	ACT/LNK	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
		Yellow flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
	10=OFF 100=GRN 1000=ORG	Off	10 Mbps
		Green	100 Mbps
		Orange	1000 Mbps
These indicator lights apply to the following devices:			
Intel® PRO/1000 MT Server Adapter			

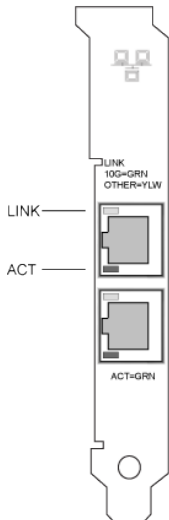
Drawing	Label	Indication	Meaning
	ACT/LNK	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
		Yellow flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
	10/100/1000	Off	10 Mbps
		Green	100 Mbps
		Orange	1000 Mbps
These indicator lights apply to the following devices: PRO/1000 T, and PRO/1000 MT Desktop Adapters			

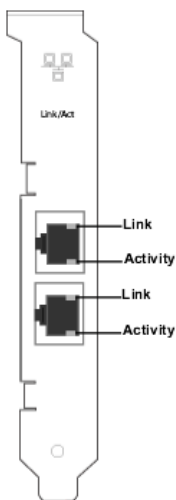
Drawing	Label	Indication	Meaning
 ACT/Link 10/100/1000	ACT/LNK	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
		Yellow flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
	10/100/1000	Off	10 Mbps
		Green	100 Mbps
		Yellow	1000 Mbps
These indicator lights apply to the following devices:			
Intel® PRO/1000 XT Server Adapter			

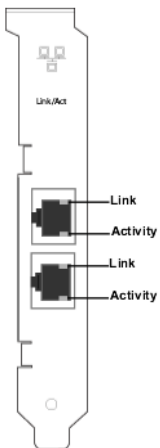
Drawing	Label	Indication	Meaning
 DATA Programmmable Indicator LNK ACT 10/100/1000	<i>not labeled</i>	Flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
	LNK	On	The adapter is connected to a valid link partner
		Off	No link
	ACT	On	Data is being transmitted or received
		Off	No data activity
	10/100/1000	Off	10 Mbps
		Green	100 Mbps
		Yellow	1000 Mbps
	These indicator lights apply to the following devices:		
Intel® PRO/1000 T Server Adapter			

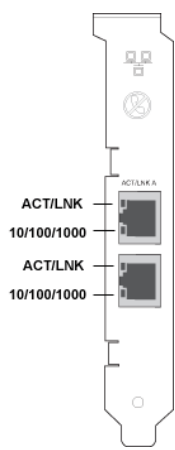
11.1.10 Dual Port Copper Adapters

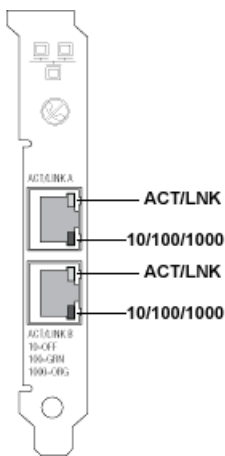
Drawing	Label	Indication	Meaning
 ACT LNK	Link	Green	Linked at 10 Gbps
		Yellow	Linked at slower than 10 Gbps
		Off	No link
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices:		
Intel® Ethernet Network Adapter X710-T2L for OCP 3.0			

Drawing	Label	Indication	Meaning
	Link	Green	Linked at 10 Gbps
		Yellow	Linked at slower than 10 Gbps
		Off	No link
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
These indicator lights apply to the following devices:			
Intel® Ethernet Network Adapter X710-T2L			

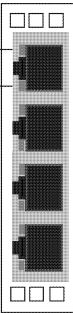
Drawing	Label	Indication	Meaning
	Link	Green	Linked at 10 Gbps
		Yellow	Linked at slower than 10 Gbps
		Off	No link
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Converged Network Adapter X550-T2		

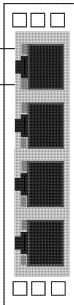
Drawing	Label	Indication	Meaning
	Link	Green	Linked at 10 Gb
		Yellow	Linked at slower than 10 Gb
		Off	No link
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Server Adapter X520-T2		

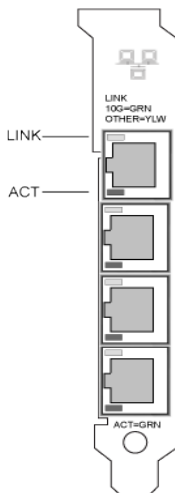
Drawing	Label	Indication	Meaning
	ACT/LNK	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
	10/100/1000	Off	10 Mbps
		Green	100 Mbps
		Yellow	1000 Mbps
		Orange flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
	These indicator lights apply to the following devices: Intel® Ethernet Server Adapter I350-T2, I340-T2, PRO/1000 P, and PT Dual Port Server Adapters		

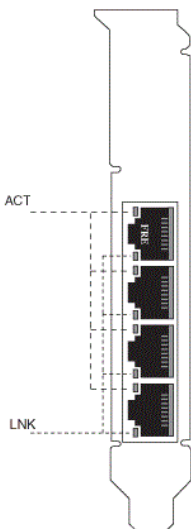
Drawing	Label	Indication	Meaning
	ACT/LNK	Green on	The port is connected to a valid link partner
		Green flashing	Data activity
		Yellow flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
		Off	No link
	10=OFF 100=GRN 1000=ORG	Orange	1000 Mbps
		Green	100 Mbps
		Off	10 Mbps
	These indicator lights apply to the following devices: Intel® PRO/1000 MT and GT Dual Port Server Adapters		

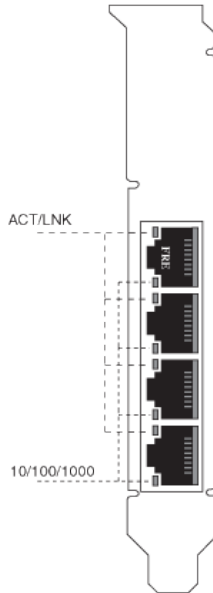
11.1.11 Quad Port Copper Adapters

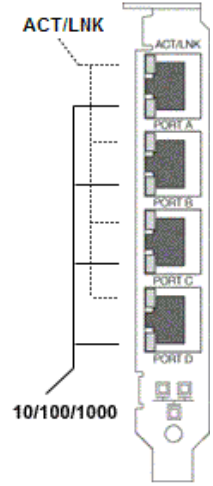
Drawing	Label	Indication	Meaning
	Link	Green	Linked at 1 Gbps
		Yellow	Linked at slower than 1 Gbps
		Off	No link
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
These indicator lights apply to the following devices:			
Intel® Ethernet Network Adapter I350-T4 for OCP NIC 3.0			

Drawing	Label	Indication	Meaning
	Link	Green	Linked at 10 Gbps
		Yellow	Linked at slower than 1 Gbps
		Off	No link
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Network Adapter X710-T4L for OCP 3.0 Intel® Ethernet Network Adapter I710-T4L for OCP 3.0		

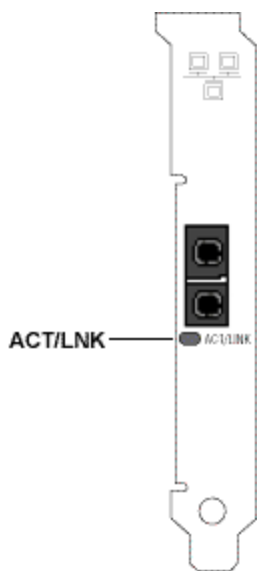
Drawing	Label	Indication	Meaning
	Link	Green	Linked at 10 Gbps
		Yellow	Linked at slower than 10 Gbps
		Off	No link
	Activity	Blinking On/Off	Actively transmitting or receiving data
		Off	No link
These indicator lights apply to the following devices: Intel® Ethernet Network Adapter X710-T4L Intel® Ethernet Network Adapter I710-T4L			

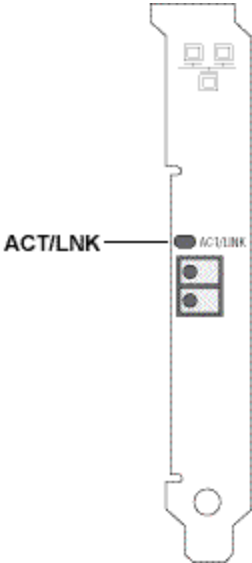
Drawing	Label	Indication	Meaning
	ACT	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
	LNK	Green	10 Gbps
		Yellow	1 Gbps
		Off	100 Mbps
These indicator lights apply to the following devices:			
Intel® Ethernet Converged Network Adapter X710-T4			

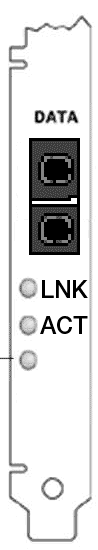
Drawing	Label	Indication	Meaning
	ACT/LNK	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
	10/100/1000	Green	100 Mbps
		Yellow	1000 Mbps
		Orange flashing	Identity. Use the "Identify Adapter" button in Intel® PROSet to control blinking. See Intel PROSet Help for more information.
		Off	10 Mbps
	These indicator lights apply to the following devices: Intel® Ethernet Server Adapter I350-T4, I340-T4, and PRO/1000 PT Quad Port LP Server Adapters		

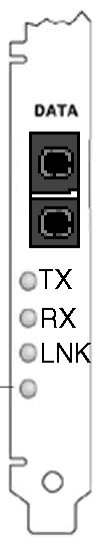
Drawing	Label	Indication	Meaning
	Top LED ACT/LNK	Green on	The port is connected to a valid link partner
		Green flashing	Data activity
		Orange flashing	Identity. Use the "Identify Adapter" button in Intel® PROSet to control blinking. See Intel PROSet Help for more information
		Off	No link
	Bottom LED 10/100/1000	Orange	1000 Mbps
		Green	100 Mbps
		Off	10 Mbps
	These indicator lights apply to the following devices: Intel® PRO/1000 MT, GT and PT Quad Port Server Adapters		

11.1.12 Single Port Fiber Adapters

Drawing	Label	Indication	Meaning
	ACT/LNK	On	The adapter is connected to a valid link partner
		Blinking	Adapter is actively passing traffic. Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
		Off	No link
These indicator lights apply to the following devices: Intel® 10 Gigabit XF SR and LR Server Adapters			

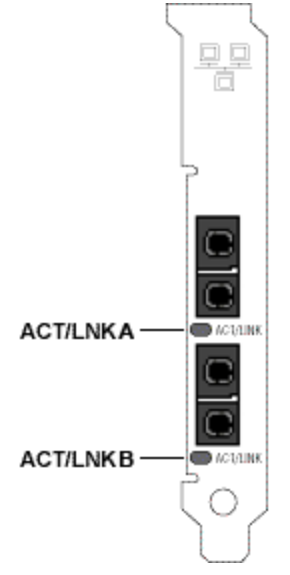
Drawing	Label	Indication	Meaning
	ACT/LNK	On	The adapter is connected to a valid link partner
		Blinking	Adapter is actively passing traffic. Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
		Off	No link
	These indicator lights apply to the following devices: Intel® PRO/1000 MF and PF Server Adapters		

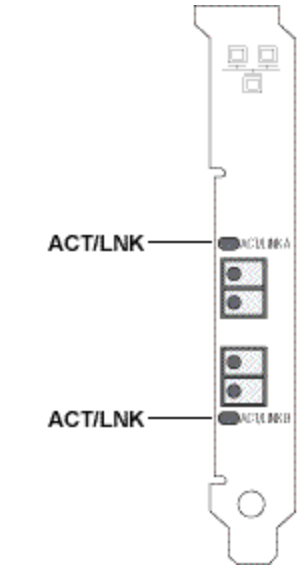
Drawing	Label	Indication	Meaning
 Programmable Indicator	LNK	On	The adapter is connected to a valid link partner
		Off	No link
	ACT	On	Data is being transmitted or received
		Off	No data activity
	<i>not labeled</i>	Flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
These indicator lights apply to the following devices: Intel® PRO/1000 XF Server Adapter			

Drawing	Label	Indication	Meaning
 Programmable Indicator	TX	On	The adapter is sending data
	RX	On	The adapter is receiving data
	LNK	On	The adapter is connected to a valid link partner and is receiving link pulses
		Off	No link
	<i>not labeled</i>	Flashing	Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
These indicator lights apply to the following devices: Intel® PRO/1000F Server Adapter			

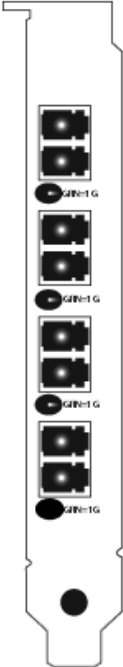


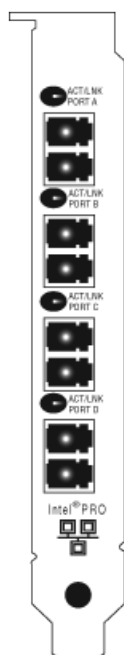
11.1.13 Dual Port Fiber Adapters

Drawing	Label	Indication	Meaning
	ACT/LNK	On	The adapter is connected to a valid link partner
		Blinking	Adapter is actively passing traffic. Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
		Off	No link
	These indicator lights apply to the following devices: Intel® 10 Gigabit XF SR Dual Port Server Adapters		

Drawing	Label	Indication	Meaning
	ACT/LNK	On	The adapter is connected to a valid link partner
		Blinking	Adapter is actively passing traffic. Identity. Use the "Identify Adapter" button in Intel PROSet to control blinking. See Intel PROSet Help for more information.
		Off	No link
	These indicator lights apply to the following devices: Intel® PRO/1000 MF, and PF Dual Port Server Adapters		

11.1.14 Quad Port Fiber Adapters

Drawing	Label	Indication	Meaning
	GRN=1G	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
	These indicator lights apply to the following devices: Intel® Ethernet Server Adapter I340-F4		

Drawing	Label	Indication	Meaning
	ACT/LNK	Green on	The adapter is connected to a valid link partner
		Green flashing	Data activity
		Off	No link
	These indicator lights apply to the following devices: Intel® PRO/1000 PF Quad Port Server Adapter		

12. Discontinued Support

The following table lists features, devices, or operating systems that were discontinued in a particular release. Subsequent releases will not support the discontinued feature.

Release	What Was Discontinued
Release 28.3	End of support for: • Microsoft Windows Server 2012 and Windows Server 2012 R2 • Intel® I354 Gigabit Ethernet Controller and the e1s driver • Autorun.exe and its associated files Release 28.2.3 is the last release that includes drivers for these OSs and devices.
Release 28.1	End of support for RSS on Microsoft Windows operating systems for the following devices: • Intel® Ethernet Connection I217-LM • Intel® Ethernet Connection I218-LM • Intel® Ethernet Connection (2) I218-LM • Intel® Ethernet Connection (3) I218-LM • Intel® Ethernet Connection I218-LM • Intel® Ethernet Connection I218-V • Intel® Ethernet Connection (2) I218-V • Intel® Ethernet Connection (3) I218-V • Intel® Ethernet Connection I218-V • Intel® Ethernet Connection I217-V • Intel® Ethernet Network Adapter I226-T1 • Intel® Ethernet Network Adapter I226-T1 • Intel® Ethernet Network Adapter I225-T1 • Intel® Ethernet Network Adapter I225-T1 • Intel® Ethernet Controller (2) I225-IT • Intel® Killer(TM) E3100X 2.5 Gigabit Ethernet Controller • Intel® Ethernet Controller (2) I225-LM • Intel® Ethernet Controller (2) I225-LMvP • Intel® Ethernet Controller (2) I225-V • Intel® Ethernet Controller (3) I225-IT • Intel® Killer(TM) E3100X 2.5 Gigabit Ethernet Controller • Intel® Ethernet Controller (3) I225-LM • Intel® Ethernet Controller (3) I225-LMvP • Intel® Ethernet Controller (3) I225-V • Intel® Ethernet Controller I226-IT • Intel® Killer(TM) E3100X 2.5 Gigabit Ethernet Controller (3) • Intel® Ethernet Controller I226-LM • Intel® Ethernet Controller I226-LMvP • Intel® Ethernet Controller I226-V • Intel® Ethernet Controller I225-LM • Intel® Ethernet Controller I225-V • Intel® Ethernet Connection (2) I219-LM • Intel® Ethernet Connection (2) I219-V • Intel® Ethernet Connection (3) I219-LM • Intel® Ethernet Connection (4) I219-LM • Intel® Ethernet Connection (4) I219-V

Release	What Was Discontinued
	• Intel® Ethernet Connection (5) I219-LM • Intel® Ethernet Connection (5) I219-V • Intel® Ethernet Connection I219-LM • Intel® Ethernet Connection (10) I219-LM • Intel® Ethernet Connection (11) I219-LM • Intel® Ethernet Connection (12) I219-LM • Intel® Ethernet Connection (13) I219-LM • Intel® Ethernet Connection (14) I219-LM • Intel® Ethernet Connection (15) I219-LM • Intel® Ethernet Connection (16) I219-LM • Intel® Ethernet Connection (17) I219-LM • Intel® Ethernet Connection (18) I219-LM • Intel® Ethernet Connection (19) I219-LM • Intel® Ethernet Connection (20) I219-LM • Intel® Ethernet Connection (22) I219-LM • Intel® Ethernet Connection (23) I219-LM • Intel® Ethernet Connection (24) I219-LM • Intel® Ethernet Connection (25) I219-LM • Intel® Ethernet Connection (26) I219-LM • Intel® Ethernet Connection (27) I219-LM • Intel® Ethernet Connection (6) I219-LM • Intel® Ethernet Connection (7) I219-LM • Intel® Ethernet Connection (8) I219-LM • Intel® Ethernet Connection (9) I219-LM • Intel® Ethernet Connection I219-V • Intel® Ethernet Connection (10) I219-V • Intel® Ethernet Connection (11) I219-V • Intel® Ethernet Connection (12) I219-V • Intel® Ethernet Connection (13) I219-V • Intel® Ethernet Connection (14) I219-V • Intel® Ethernet Connection (16) I219-V • Intel® Ethernet Connection (17) I219-V • Intel® Ethernet Connection (18) I219-V • Intel® Ethernet Connection (19) I219-V • Intel® Ethernet Connection (20) I219-V • Intel® Ethernet Connection (22) I219-V • Intel® Ethernet Connection (23) I219-V • Intel® Ethernet Connection (24) I219-V • Intel® Ethernet Connection (25) I219-V • Intel® Ethernet Connection (26) I219-V • Intel® Ethernet Connection (27) I219-V • Intel® Ethernet Connection (6) I219-V • Intel® Ethernet Connection (7) I219-V

Release	What Was Discontinued
	- Intel® Ethernet Connection (8) I219-V - Intel® Ethernet Connection (9) I219-V - Intel® Ethernet Connection (3) I218-LM - Intel® Ethernet Connection (3) I218-V
Release 27.9	Release 27.9 is the last release that supports the following: - Microsoft Windows 8.1 - Microsoft Windows 10 Version 20H2 (build 19042) - Microsoft Windows 10 Version 21H1 (build 19043) - VMWare ESXi 6.5 - VMWare ESXi 6.7 - iw_ixl FreeBSD driver
Release 27.5	Release 27.5 is the last release that includes the Microsoft e1q driver in your download package. Release 27.6 removed the e1q driver from the installation package. This affects the following devices: - Intel® 82575EB Gigabit Network Connection - Intel® 82575EB Gigabit Backplane Connection - Intel® Gigabit VT Quad Port Server Adapter - Intel® 82575EB Multi-Function Network Device - Intel® 82574L Gigabit Network Connection - Intel® 82583V Gigabit Network Connection - Intel® Gigabit CT Desktop Adapter - Intel® Gigabit CT2 Desktop Adapter - Intel® 82576 Gigabit Dual Port Network Connection - Intel® Gigabit ET Dual Port Server Adapter - Intel® 82576NS Gigabit Ethernet Controller - Intel® 82576NS Gigabit Network Connection - Intel® 82576NS SerDes Gigabit Ethernet Controller - Intel® Gigabit EF Dual Port Server Adapter - Intel® 82576 Gigabit Dual Port Server Network Connection - Intel® Gigabit ET Quad Port Server Adapter - Intel® Gigabit ET2 Quad Port Server Adapter - Intel® 82576 Gigabit Dual Port Network Connection - Intel® Gigabit ET Quad Port Mezzanine Card
Release 27.0	Release 27.0 is the last release that supports the Microsoft Windows v1q driver. This driver will no longer be tested or updated. The driver may still be provided in your download package or on your install media for your convenience.
Release 26.7	Release 26.7 is the last release that supports Intel® Ethernet Network Adapter E810-XXV-2 for OCP 2.0.
Release 26.4	Release 26.4 is the last release that supports the following: - SUSE Linux Enterprise Server 11. - Canonical Ubuntu 16.04 - The Microsoft Windows e1q driver and devices. These drivers will no longer be tested or updated. This affects devices based on the following:

Release	What Was Discontinued
	• Intel® 82574L Gigabit Network Connection • Intel® Gigabit ET2 Quad Port Server Adapter • Intel® 82575EB Gigabit Backplane Connection • Intel® 82575EB Gigabit Network Connection • Intel® 82576 Gigabit Dual Port Network Connection • Intel® 82576 Gigabit Dual Port Server Network Connection • Intel® 82576NS Gigabit Ethernet Controller • Intel® 82576NS SerDes Gigabit Ethernet Controller • Intel® 82583V Gigabit Network Connection • Intel® Gigabit CT Desktop Adapter • Intel® Gigabit CT2 Desktop Adapter • Intel® Gigabit EF Dual Port Server Adapter • Intel® Gigabit ET Dual Port Network Connection • Intel® Gigabit ET Dual Port Server Adapter • Intel® Gigabit ET Quad Port Mezzanine Card • Intel® Gigabit ET Quad Port Server Adapter • Intel® Gigabit VT Quad Port Server Adapter • Starting with Release 26.4, the following adapters and devices will no longer be tested or updated. The drivers may still be provided in your download package or on your install media for your convenience. • Intel® Ethernet Controller X540-AT2 • Intel® Ethernet Controller X540-AT1 • Intel® Ethernet Converged Network Adapter X540-T2 • Intel® Ethernet Converged Network Adapter X540-T1 • Intel® X540 Virtual Function
Release 26.3	Release 26.3 is the last release that supports the following: • Microsoft Windows 10, Version 1803 • Microsoft Windows 10, Version 1903 • Red Hat® Enterprise Linux® (RHEL) 6.x • The FreeBSD em driver. Maintenance for this driver will be continued by the community.
Release 25.2	Release 25.2 is the last release that supports the following: • DOS tools and diagnostics. • The 32-bit Microsoft Windows 10 e1d driver. 64-bit Microsoft Windows 10 is still supported. This affects devices based on the following controllers: • Intel® Ethernet Connection I217-LM • Intel® Ethernet Connection I217-V • Intel® Ethernet Connection I218-LM • Intel® Ethernet Connection I218-V • Intel® Ethernet Connection I219-LM • Intel® Ethernet Connection I219-V • The Linux e1000e driver. Maintenance for this driver will be continued by the community.
Release 25.0	Release 25.0 is the last release to support: • Microsoft® Windows® 7

Release	What Was Discontinued
	• Microsoft* Windows Server* 2008 R2 • Intel® QSP+ Configuration Utility (QCU) • IOUtil
Release 24.4	Release 24.4 removed the following from the installation package: • Support for PRO/100 devices • DOS drivers • UEFI driver support for PCI/PCI-X devices • Support for WinCE • Microsoft* Windows* 10 RS3 (NDIS65) Universal Drivers. Please use the NDIS68 drivers. • Support for FCoE
Release 23.5	Starting with Release 23.5, the drivers for the following adapters and devices will no longer be tested or updated. The drivers may still be provided in your download package or on your install media for your convenience. • Intel® 82566MM Gigabit Network Connection • Intel® PRO/1000 PB Dual Port Server Connection • Intel® PRO/1000 EB Network Connection with I/O Acceleration • Intel® PRO/1000 EB1 Network Connection with I/O Acceleration • Intel® PRO/1000 EB Backplane Connection with I/O Acceleration • Intel® 82567V-3 Gigabit Network Connection • Intel® 82567V-4 Gigabit Network Connection • Intel® 82567LM-4 Gigabit Network Connection • Intel® 82567LF Gigabit Network Connection • Intel® 82567V Gigabit Network Connection • Intel® 82567LM-2 Gigabit Network Connection • Intel® 82567LF-2 Gigabit Network Connection • Intel® 82567V-2 Gigabit Network Connection • Intel® 82567LM-3 Gigabit Network Connection • Intel® 82567LF-3 Gigabit Network Connection • Intel® 82577LM Gigabit Network Connection • Intel® 82577LC Gigabit Network Connection • Intel® 82578DM Gigabit Network Connection • Intel® 82578DC Gigabit Network Connection • Intel® 82567LM Gigabit Network Connection • Intel® 82566DM Gigabit Network Connection • Intel® 82566DC Gigabit Network Connection • Intel® 82566MC Gigabit Network Connection • Intel® PRO/1000 PT Dual Port Network Connection • Intel® PRO/1000 PT Dual Port Server Adapter • Intel® PRO/1000 PT Dual Port Server Connection • Intel® PRO/1000 PF Dual Port Server Adapter • Intel® PRO/1000 PT Network Connection • Intel® PRO/1000 PT Server Adapter • Intel® PRO/1000 PF Network Connection

Release	What Was Discontinued
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(https://www.gov.br/mcom)						
	 DGS-3130-30PS					

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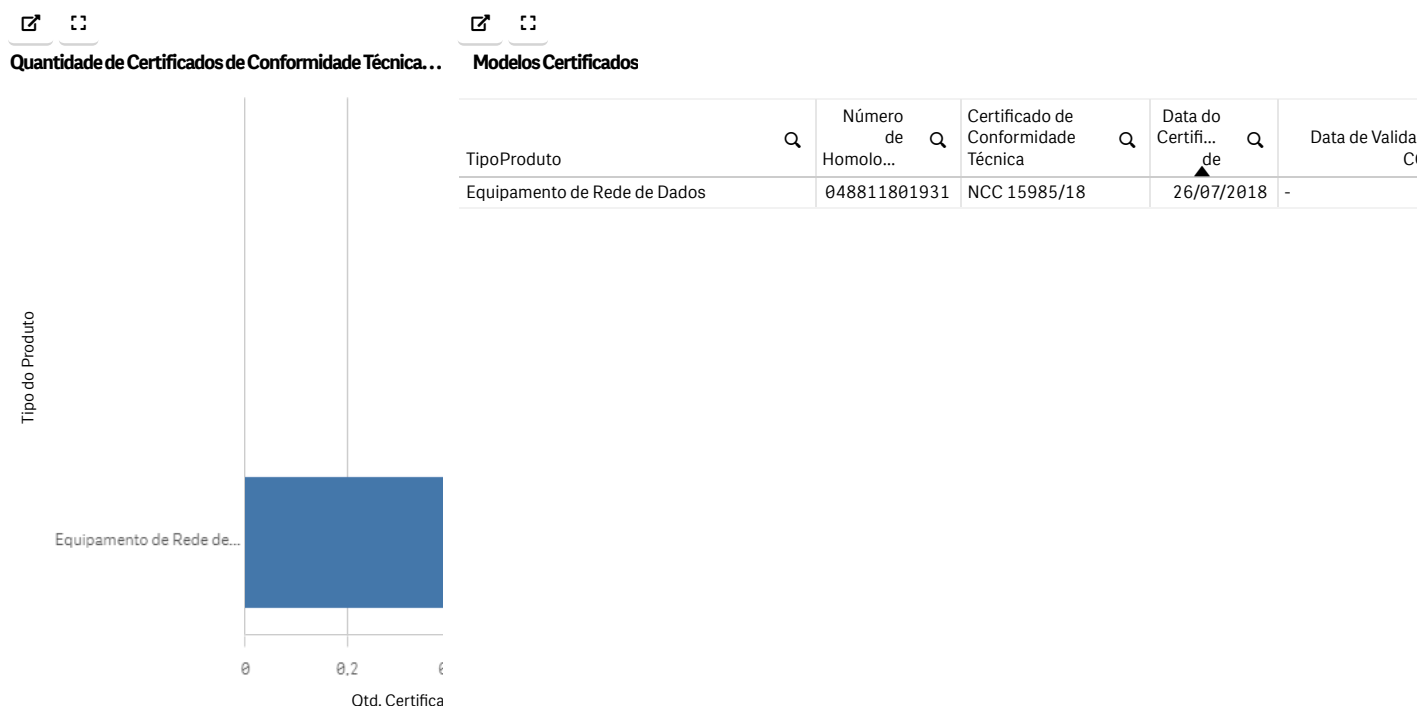
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XPS 8960 Setup and Specifications

Video port resolution

The following table lists the video port resolution for your XPS 8960.

Table 1. Video port resolution

GRAPHICS CARD	VIDEO PORTS	MAXIMUM SUPPORTED RESOLUTION
AMD Radeon RX 6500 XT	- One DisplayPort 1.4a¹ - One HDMI 2.1 port	- DisplayPort - 8K at 120 Hz (DSC) - HDMI - 8K at 60 Hz (DSC)
AMD Radeon RX 6600 XT	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	- DisplayPort - 8K at 120 Hz (DSC) - HDMI - 8K at 60 Hz (DSC)
AMD Radeon RX 6700 XT	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	- DisplayPort - 8K at 120 Hz (DSC) - HDMI - 8K at 60 Hz (DSC)
AMD Radeon RX 6800 XT	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	- DisplayPort - 8K at 120 Hz (DSC) - HDMI - 8K at 60 Hz (DSC)

GRAPHICS CARD	VIDEO PORTS	MAXIMUM SUPPORTED RESOLUTION
AMD Radeon RX 6900 XT	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	- DisplayPort - 8K at 120 Hz (DSC) - HDMI - 8K at 60 Hz (DSC)
NVIDIA GeForce RTX 3050	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	- Maximum pixel clock²: Up to 2660 megapixels per second - Maximum raw bandwidth³: 32.40 Gbps DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz

GRAPHICS CARD	VIDEO PORTS	MAXIMUM SUPPORTED RESOLUTION
NVIDIA GeForce RTX 3060	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz
NVIDIA GeForce RTX 3060 Ti	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz

GRAPHICS CARD	VIDEO PORTS	MAXIMUM SUPPORTED RESOLUTION
NVIDIA GeForce RTX 3070	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz
NVIDIA GeForce RTX 3070 Ti	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz

GRAPHICS CARD	VIDEO PORTS	MAXIMUM SUPPORTED RESOLUTION
NVIDIA GeForce RTX 3080	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz
NVIDIA GeForce RTX 3080 Ti	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz

GRAPHICS CARD	VIDEO PORTS	MAXIMUM SUPPORTED RESOLUTION
NVIDIA GeForce RTX 3090	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz
NVIDIA GeForce RTX 3090 Ti	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz

GRAPHICS CARD	VIDEO PORTS	MAXIMUM SUPPORTED RESOLUTION
NVIDIA GeForce RTX 4070 Ti	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz
NVIDIA GeForce RTX 4080	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz

GRAPHICS CARD	VIDEO PORTS	MAXIMUM SUPPORTED RESOLUTION
NVIDIA GeForce RTX 4090	- Three DisplayPort 1.4a¹ - One HDMI 2.1 port	DisplayPort: 7680 x 4320 at 120 Hz⁴ 7680 x 4320 at 60 Hz⁵ 7680 x 4320 at 60 Hz⁶ 5120 x 3200 at 60 Hz⁷ 5120 x 2880 at 60 Hz⁷ HDMI: 7680 x 4320 at 60 Hz 3840 x 2160 at 120 Hz 4096 x 2160 at 120 Hz
¹ DisplayPort 1.2 certifies, DisplayPort 1.3/1.4 ready ² Depending on GPU resources applied to the port ³ Maximum raw bandwidth represents the raw bandwidth of four lanes of HBR3 ⁴ Requires two DisplayPort 1.4a links and DSC compression ⁵ Requires either a single DisplayPort 1.4a link with DSC compression or two DP links with no compression ⁶ Using DSC compression ⁷ Uncompressed		



GPU Database [GeForce RTX 3070 Specs](#)

NVIDIA GeForce RTX 3070

GA104 GRAPHICS PROCESSOR	5888 CORES	184 TMUS	96 ROPS	8 GB MEMORY SIZE	GDDR6 MEMORY TYPE	256 bit BUS WIDTH
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Recommended Gaming Resolutions:
☐ 1920x1080 ☐ 2560x1440 ☐ 3840x2160

The GeForce RTX 3070 is a high-end graphics card by NVIDIA, launched on September 1st, 2020. Built on the 8 nm process, and based on the GA104 graphics processor, in its GA104-300-A1 variant, the card supports DirectX 12 Ultimate. This ensures that all modern games will run on GeForce RTX 3070. Additionally, the DirectX 12 Ultimate capability guarantees support for hardware-raytracing, variable-rate shading and more, in upcoming video games. The GA104 graphics processor is a large chip with a die area of 392 mm² and 17,400 million transistors. Unlike the fully unlocked GeForce RTX 3070 Ti, which uses the same GPU but has all 6144 shaders enabled, NVIDIA has disabled some shading units on the GeForce RTX 3070 to reach the product's target shader count. It features 5888 shading units, 184 texture mapping units, and 96 ROPs. Also included are 184 tensor cores which help improve the speed of machine learning applications. The card also has 46 raytracing acceleration cores. NVIDIA has paired 8 GB GDDR6 memory with the GeForce RTX 3070, which are connected using a 256-bit memory interface. The GPU is operating at a frequency of 1500 MHz, which can be boosted up to 1725 MHz, memory is running at 1750 MHz (14 Gbps effective). Being a dual-slot card, the NVIDIA GeForce RTX 3070 draws power from 1x 12-pin power connector, with power draw rated at 220 W maximum. Display outputs include: 1x HDMI 2.1 3x DisplayPort 1.4a. GeForce RTX 3070 is connected to the rest of the system using a PCI-Express 4.0 x16 interface. The

Graphics Processor			Graphics Card		Relative Performance	
GPU Name:	GA104		Release Date:	Sep 1st, 2020	GeForce 210	
GPU Variant:	GA104-300-A1		Availability:	Oct 29th, 2020	GeForce 9400 GT	
Architecture:	Ampere		Generation:	GeForce 30	Radeon HD 4550	
Foundry:	Samsung		Predecessor:	GeForce 20	Radeon HD 5450	
Process Size:	8 nm		Successor:	GeForce 40	Radeon HD 6450	
Transistors:	17,400 million		Production:	Active	GeForce GT 520	
Density:	44.4M / mm²		Launch Price:	499 USD	GeForce GT 220	
Die Size:	392 mm²		Current Price:	Amazon / Newegg	GeForce GT 430	
Chip Package:	BGA-2713		Bus Interface:	PCIe 4.0 x16	Radeon HD 5570	
			Reviews:	79 in our database	Radeon HD 4670	
					GeForce RTX 3070	
					Based on TPU review data: "Performance Summary" at 1920x1080, 4K for 2080 Ti and faster.	
Render Config		Theoretical Performance		Clock Speeds		Memory
Shading Units:	5888			Base Clock:	1500 MHz	Memory Size: 8 GB

TMUs: 184	Pixel Rate: 165.6 GPixel/s	Boost Clock: 1725 MHz	Memory Type: GDDR6
ROPs: 96	Texture Rate: 317.4 GTexel/s	Memory Clock: 1750 MHz 14 Gbps effective	Memory Bus: 256 bit
SM Count: 46	FP16 (half): 20.31 TFLOPS (1:1)	Board Design	Bandwidth: 448.0 GB/s
Tensor Cores: 184	FP32 (float): 20.31 TFLOPS		Graphics Features
RT Cores: 46	FP64 (double): 317.4 GFLOPS (1:64)		
L1 Cache: 128 KB (per SM)			
L2 Cache: 4 MB			
		Slot Width: Dual-slot	DirectX: 12 Ultimate
		Length: 242 mm 9.5 inches	OpenGL: 4.6
		Width: 112 mm 4.4 inches	OpenCL: 3.0
		TDP: 220 W	Vulkan: 1.3
		Suggested PSU: 550 W	CUDA: 8.6
		Outputs: 1x HDMI 2.1 3x DisplayPort 1.4a	Shader Model: 6.7
		Power Connectors: 1x 12-pin	
		Board Number: PG142 SKU 10	

GA104 GPU Notes

Ray Tracing Cores: 2nd Gen Tensor Cores: 3rd Gen NVENC: 7th Gen NVDEC: 5th Gen PureVideo HD: VP11 VDPAU: Feature Set K

Retail boards based on this design (234)

				
▼ Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
Acer RTX 3070 OEM	1500 MHz	1725 MHz	1750 MHz	
AFOX RTX 3070	1500 MHz	1725 MHz	1750 MHz	
AFOX RTX 3070	1500 MHz	1725 MHz	1750 MHz	
AFOX RTX 3070	1500 MHz	1725 MHz	1750 MHz	252 mm/9.9 inches, Triple-slot
AFOX RTX 3070 V3	1500 MHz	1725 MHz	1750 MHz	Triple-slot
ASL RTX 3070 Ares	1500 MHz	1725 MHz	1750 MHz	252 mm/9.9 inches, Triple-slot
ASUS ATS RTX 3070 GAMING MEGALODON OC	1500 MHz	1770 MHz	1750 MHz	317 mm/12.5 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ATS RTX 3070 GAMING MEGALODON OC LHR	1500 MHz	1770 MHz	1750 MHz	317 mm/12.5 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS DUAL RTX 3070	1500 MHz	1725 MHz	1750 MHz	267 mm/10.5 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS DUAL RTX 3070 OC	1500 MHz	1770 MHz	1750 MHz	267 mm/10.5 inches, Triple-slot, 2x HDMI 3x DisplayPort, 240 W
ASUS DUAL RTX 3070 SI	1500 MHz	1725 MHz	1750 MHz	229 mm/9 inches
ASUS DUAL RTX 3070 V2	1500 MHz	1725 MHz	1750 MHz	267 mm/10.5 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS DUAL RTX 3070 V2 OC	1500 MHz	1770 MHz	1750 MHz	267 mm/10.5 inches, Triple-slot, 2x HDMI 3x DisplayPort, 240 W
ASUS KO RTX 3070 GAMING	1500 MHz	1725 MHz	1750 MHz	275 mm/10.8 inches, Triple-slot, 2x HDMI 3x DisplayPort

▼ Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
ASUS KO RTX 3070 GAMING LHR	1500 MHz	1725 MHz	1750 MHz	275 mm/10.8 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS KO RTX 3070 GAMING OC	1500 MHz	1815 MHz	1750 MHz	275 mm/10.8 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS KO RTX 3070 V2 GAMING	1500 MHz	1725 MHz	1750 MHz	275 mm/10.8 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS KO RTX 3070 V2 GAMING OC	1500 MHz	1815 MHz	1750 MHz	275 mm/10.8 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 GAMING	1500 MHz	1725 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 GAMING OC	1500 MHz	1905 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 GAMING WHITE	1500 MHz	1725 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 GAMING WHITE OC	1500 MHz	1905 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 V2 GAMING	1500 MHz	1725 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 V2 GAMING	1500 MHz	1725 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 V2 GAMING OC	1500 MHz	1905 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 V2 GAMING WHITE	1500 MHz	1725 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS ROG STRIX RTX 3070 V2 GAMING WHITE OC	1500 MHz	1905 MHz	1750 MHz	319 mm/12.6 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS RTX 3070 EKWB	1500 MHz	1725 MHz	1750 MHz	216 mm/8.5 inches, Single-slot
ASUS RTX 3070 Noctua LHR	1500 MHz	1725 MHz	1750 MHz	310 mm/12.2 inches, Quad-slot, 2x HDMI 3x DisplayPort
ASUS RTX 3070 Noctua OC LHR	1500 MHz	1815 MHz	1750 MHz	310 mm/12.2 inches, Quad-slot, 2x HDMI 3x DisplayPort
ASUS TUF RTX 3070 GAMING	1500 MHz	1725 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS TUF RTX 3070 GAMING OC	1500 MHz	1815 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS TUF RTX 3070 V2 GAMING	1500 MHz	1725 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS TUF RTX 3070 V2 GAMING OC	1500 MHz	1815 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot, 2x HDMI 3x DisplayPort
ASUS TURBO RTX 3070	1500 MHz	1725 MHz	1750 MHz	268 mm/10.6 inches
ASUS TURBO RTX 3070 V2	1500 MHz	1725 MHz	1750 MHz	268 mm/10.6 inches
BIOSTAR RTX 3070	1500 MHz	1725 MHz	1750 MHz	
Colorful iGame RTX 3070 Advanced	1500 MHz	1725 MHz	1750 MHz	316 mm/12.4 inches, Triple-slot
Colorful iGame RTX 3070 Advanced LHR	1500 MHz	1725 MHz	1750 MHz	316 mm/12.4 inches, Triple-slot
Colorful iGame RTX 3070 Advanced OC	1500 MHz	1815 MHz	1750 MHz	316 mm/12.4 inches, Triple-slot
Colorful iGame RTX 3070 Advanced OC LHR	1500 MHz	1815 MHz	1750 MHz	316 mm/12.4 inches, Triple-slot
Colorful iGame RTX 3070 Bilibili E-Sports Edition OC LHR	1500 MHz	1785 MHz	1750 MHz	300 mm/11.8 inches
Colorful iGame RTX 3070 Custom OC LHR	1500 MHz	1785 MHz	1750 MHz	300 mm/11.8 inches
Colorful iGame RTX 3070 Neptune	1500 MHz	1725 MHz	1750 MHz	295 mm/11.6 inches
Colorful iGame RTX 3070 Neptune LHR	1500 MHz	1725 MHz	1750 MHz	295 mm/11.6 inches

▼ Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
Colorful iGame RTX 3070 Neptune OC	1500 MHz	1845 MHz	1750 MHz	295 mm/11.6 inches
Colorful iGame RTX 3070 Neptune OC LHR	1500 MHz	1845 MHz	1750 MHz	295 mm/11.6 inches
Colorful iGame RTX 3070 Ultra	1500 MHz	1725 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful iGame RTX 3070 Ultra LHR	1500 MHz	1725 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful iGame RTX 3070 Ultra OC	1500 MHz	1770 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful iGame RTX 3070 Ultra OC LHR	1500 MHz	1770 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful iGame RTX 3070 Ultra W	1500 MHz	1725 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful iGame RTX 3070 Ultra W LHR	1500 MHz	1725 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful iGame RTX 3070 Ultra W OC	1500 MHz	1770 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful iGame RTX 3070 Ultra W OC LHR	1500 MHz	1770 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful iGame RTX 3070 Vulcan	1500 MHz	1725 MHz	1750 MHz	323 mm/12.7 inches, Triple-slot
Colorful iGame RTX 3070 Vulcan LHR	1500 MHz	1725 MHz	1750 MHz	323 mm/12.7 inches, Triple-slot
Colorful iGame RTX 3070 Vulcan OC	1500 MHz	1875 MHz	1750 MHz	323 mm/12.7 inches, Triple-slot
Colorful iGame RTX 3070 Vulcan OC LHR	1500 MHz	1875 MHz	1750 MHz	323 mm/12.7 inches, Triple-slot
Colorful Tomahawk RTX 3070	1500 MHz	1725 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful Tomahawk RTX 3070 LHR	1500 MHz	1725 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Colorful Tomahawk RTX 3070 V2 LHR	1500 MHz	1725 MHz	1750 MHz	310 mm/12.2 inches, Triple-slot
Dell RTX 3070 LHR OEM	1500 MHz	1725 MHz	1750 MHz	189 mm/7.4 inches
Dell RTX 3070 OEM	1500 MHz	1725 MHz	1750 MHz	189 mm/7.4 inches
ELSA RTX 3070 ERAZOR X	1500 MHz	1785 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
EMTEK HV RTX 3070 BLACK MONSTER COD OC	1500 MHz	1815 MHz	1750 MHz	304 mm/12 inches, Triple-slot, 270 W
EMTEK RTX 3070 MIRACLE	1500 MHz	1725 MHz	1750 MHz	245 mm/9.6 inches, Triple-slot
EVGA RTX 3070 FTW3	1500 MHz	1725 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
EVGA RTX 3070 FTW3 ULTRA	1500 MHz	1815 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
EVGA RTX 3070 FTW3 ULTRA LHR	1500 MHz	1815 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
EVGA RTX 3070 FTW3 ULTRA LHR	1500 MHz	1815 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
EVGA RTX 3070 XC3	1500 MHz	1725 MHz	1750 MHz	285 mm/11.2 inches
EVGA RTX 3070 XC3 BLACK	1500 MHz	1725 MHz	1750 MHz	285 mm/11.2 inches
EVGA RTX 3070 XC3 BLACK LAUNCH EDITION	1500 MHz	1725 MHz	1750 MHz	285 mm/11.2 inches
EVGA RTX 3070 XC3 BLACK LHR	1500 MHz	1725 MHz	1750 MHz	285 mm/11.2 inches

▼ Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
EVGA RTX 3070 XC3 ULTRA	1500 MHz	1770 MHz	1750 MHz	285 mm/11.2 inches
EVGA RTX 3070 XC3 ULTRA LHR	1500 MHz	1770 MHz	1750 MHz	285 mm/11.2 inches
EVGA RTX 3070 XC3 ULTRA LHR	1500 MHz	1770 MHz	1750 MHz	285 mm/11.2 inches
Gainward RTX 3070 Blue Star	1500 MHz	1725 MHz	1750 MHz	330 mm/13 inches, Triple-slot
Gainward RTX 3070 Blue Star G	1500 MHz	1725 MHz	1750 MHz	330 mm/13 inches, Triple-slot
Gainward RTX 3070 Blue Star OC	1500 MHz	1755 MHz	1750 MHz	330 mm/13 inches, Triple-slot
Gainward RTX 3070 Blue Star OCG	1500 MHz	1755 MHz	1750 MHz	330 mm/13 inches, Triple-slot
Gainward RTX 3070 Chasing Wind	1500 MHz	1725 MHz	1750 MHz	
Gainward RTX 3070 Chasing Wind G	1500 MHz	1725 MHz	1750 MHz	
Gainward RTX 3070 Glare	1500 MHz	1725 MHz	1750 MHz	333 mm/13.1 inches, Triple-slot
Gainward RTX 3070 Glare G	1500 MHz	1725 MHz	1750 MHz	333 mm/13.1 inches, Triple-slot
Gainward RTX 3070 Glare OC	1500 MHz	1785 MHz	1750 MHz	333 mm/13.1 inches, Triple-slot
Gainward RTX 3070 Glare OCG	1500 MHz	1785 MHz	1750 MHz	333 mm/13.1 inches, Triple-slot
Gainward RTX 3070 Phantom	1500 MHz	1725 MHz	1750 MHz	304 mm/12 inches
Gainward RTX 3070 Phantom GS	1500 MHz	1815 MHz	1750 MHz	304 mm/12 inches
Gainward RTX 3070 Phantom GS V1	1500 MHz	1815 MHz	1750 MHz	304 mm/12 inches
Gainward RTX 3070 Phantom V1	1500 MHz	1725 MHz	1750 MHz	304 mm/12 inches
Gainward RTX 3070 Phantom+	1500 MHz	1725 MHz	1750 MHz	304 mm/12 inches, Triple-slot
Gainward RTX 3070 Phantom+ GS	1500 MHz	1815 MHz	1750 MHz	304 mm/12 inches, Triple-slot
Gainward RTX 3070 Phoenix	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches
Gainward RTX 3070 Phoenix GS	1500 MHz	1770 MHz	1750 MHz	294 mm/11.6 inches
Gainward RTX 3070 Phoenix GS V1	1500 MHz	1770 MHz	1750 MHz	294 mm/11.6 inches
Gainward RTX 3070 Phoenix V1	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches
Gainward RTX 3070 Red Star	1500 MHz	1725 MHz	1750 MHz	330 mm/13 inches, Triple-slot
Gainward RTX 3070 Red Star G	1500 MHz	1725 MHz	1750 MHz	330 mm/13 inches, Triple-slot
Gainward RTX 3070 Red Star OC	1500 MHz	1755 MHz	1750 MHz	330 mm/13 inches, Triple-slot
Gainward RTX 3070 Red Star OCG	1500 MHz	1755 MHz	1750 MHz	330 mm/13 inches, Triple-slot
GALAX BOY RTX 3070 SG	1500 MHz	1725 MHz	1750 MHz	317 mm/12.5 inches
GALAX RTX 3070 (1-Click OC)	1500 MHz	1725 MHz	1750 MHz	238 mm/9.4 inches, Triple-slot
GALAX RTX 3070 Black General	1500 MHz	1725 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
GALAX RTX 3070 Black General FG	1500 MHz	1725 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot

▼ Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
GALAX RTX 3070 Black General OC	1500 MHz	1755 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
GALAX RTX 3070 Black General OC FG	1500 MHz	1755 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
GALAX RTX 3070 Black General R2	1500 MHz	1725 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
GALAX RTX 3070 Black General R2 FG	1500 MHz	1725 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
GALAX RTX 3070 Black General R2 OC	1500 MHz	1755 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
GALAX RTX 3070 Black General R2 OC FG	1500 MHz	1755 MHz	1750 MHz	300 mm/11.8 inches, Triple-slot
GALAX RTX 3070 BOOMSTAR	1500 MHz	1725 MHz	1750 MHz	316 mm/12.4 inches, Triple-slot
GALAX RTX 3070 BOOMSTAR OC	1500 MHz	1785 MHz	1750 MHz	316 mm/12.4 inches, Triple-slot
GALAX RTX 3070 BOOMSTAR OC FG	1500 MHz	1785 MHz	1750 MHz	316 mm/12.4 inches, Triple-slot
GALAX RTX 3070 EX (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	285 mm/11.2 inches, Triple-slot
GALAX RTX 3070 EX Gamer (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	316 mm/12.4 inches
GALAX RTX 3070 EX Gamer Pink (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	316 mm/12.4 inches
GALAX RTX 3070 EX Gamer White (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	316 mm/12.4 inches
GALAX RTX 3070 EX Pink (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	285 mm/11.2 inches
GALAX RTX 3070 EX White (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	285 mm/11.2 inches
GALAX RTX 3070 GAMER	1500 MHz	1725 MHz	1750 MHz	337 mm/13.3 inches, Triple-slot
GALAX RTX 3070 GAMER FG	1500 MHz	1725 MHz	1750 MHz	337 mm/13.3 inches, Triple-slot
GALAX RTX 3070 GAMER OC	1500 MHz	1800 MHz	1750 MHz	337 mm/13.3 inches, Triple-slot
GALAX RTX 3070 GAMER OC FG	1500 MHz	1800 MHz	1750 MHz	337 mm/13.3 inches, Triple-slot
GALAX RTX 3070 Metal Master	1500 MHz	1725 MHz	1750 MHz	318 mm/12.5 inches
GALAX RTX 3070 Metal Master FG	1500 MHz	1725 MHz	1750 MHz	318 mm/12.5 inches
GALAX RTX 3070 Metal Master OC	1500 MHz	1755 MHz	1750 MHz	318 mm/12.5 inches
GALAX RTX 3070 Metal Master OC FG	1500 MHz	1755 MHz	1750 MHz	318 mm/12.5 inches
GALAX RTX 3070 SG (1-Click OC)	1500 MHz	1725 MHz	1750 MHz	317 mm/12.5 inches
GALAX RTX 3070 Snapdragon	1500 MHz	1725 MHz	1750 MHz	270 mm/10.6 inches, Triple-slot
GALAX RTX 3070 Snapdragon FG	1500 MHz	1725 MHz	1750 MHz	270 mm/10.6 inches, Triple-slot
GIGABYTE AORUS RTX 3070 MASTER	1500 MHz	1845 MHz	1750 MHz	290 mm/11.4 inches, Triple-slot, 3x HDMI 3x DisplayPort
GIGABYTE AORUS RTX 3070 MASTER Rev. 2.0	1500 MHz	1845 MHz	1750 MHz	290 mm/11.4 inches, Triple-slot, 3x HDMI 3x DisplayPort
GIGABYTE RTX 3070 EAGLE	1500 MHz	1725 MHz	1750 MHz	282 mm/11.1 inches, 2x HDMI 2x DisplayPort
GIGABYTE RTX 3070 EAGLE OC	1500 MHz	1770 MHz	1750 MHz	282 mm/11.1 inches, 2x HDMI 2x DisplayPort

▼ Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
GIGABYTE RTX 3070 EAGLE OC Rev. 2.0	1500 MHz	1770 MHz	1750 MHz	282 mm/11.1 inches, 2x HDMI 2x DisplayPort
GIGABYTE RTX 3070 EAGLE Rev. 2.0	1500 MHz	1725 MHz	1750 MHz	282 mm/11.1 inches, 2x HDMI 2x DisplayPort
GIGABYTE RTX 3070 GAMING OC	1500 MHz	1815 MHz	1750 MHz	286 mm/11.3 inches, 2x HDMI 2x DisplayPort
GIGABYTE RTX 3070 GAMING OC Rev. 2.0	1500 MHz	1815 MHz	1750 MHz	286 mm/11.3 inches, 2x HDMI 2x DisplayPort
GIGABYTE RTX 3070 VISION OC	1500 MHz	1815 MHz	1750 MHz	286 mm/11.3 inches, 2x HDMI 2x DisplayPort
GIGABYTE RTX 3070 VISION OC Rev. 2.0	1500 MHz	1815 MHz	1750 MHz	286 mm/11.3 inches, 2x HDMI 2x DisplayPort
HP RTX 3070 LHR OEM	1500 MHz	1725 MHz	1750 MHz	
HP RTX 3070 OEM	1500 MHz	1725 MHz	1750 MHz	
Inno3D AX RENEGADE RTX 3070	1500 MHz	1755 MHz	1750 MHz	293 mm/11.5 inches
Inno3D AX RENEGADE RTX 3070 X3W LHR	1500 MHz	1755 MHz	1750 MHz	293 mm/11.5 inches
Inno3D iChill RTX 3070 X3	1500 MHz	1785 MHz	1750 MHz	300 mm/11.8 inches
Inno3D iChill RTX 3070 X3 LHR	1500 MHz	1785 MHz	1750 MHz	300 mm/11.8 inches
Inno3D iChill RTX 3070 X4	1500 MHz	1785 MHz	1750 MHz	300 mm/11.8 inches
Inno3D iChill RTX 3070 X4 LHR	1500 MHz	1785 MHz	1750 MHz	300 mm/11.8 inches
Inno3D RTX 3070 BLACK GOLD EXTREME	1500 MHz	1740 MHz	1750 MHz	274 mm/10.8 inches, Triple-slot
Inno3D RTX 3070 TWIN X2	1500 MHz	1725 MHz	1750 MHz	240 mm/9.4 inches
Inno3D RTX 3070 TWIN X2 LHR	1500 MHz	1725 MHz	1750 MHz	240 mm/9.4 inches
Inno3D RTX 3070 TWIN X2 OC	1500 MHz	1740 MHz	1750 MHz	240 mm/9.4 inches
Inno3D RTX 3070 TWIN X2 OC LHR	1500 MHz	1740 MHz	1750 MHz	240 mm/9.4 inches
KFA2 RTX 3070 EX (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	285 mm/11.2 inches
KFA2 RTX 3070 EX Gamer (1-Click OC)	1500 MHz	1770 MHz	1750 MHz	316 mm/12.4 inches
KFA2 RTX 3070 EX Gamer (1-Click OC) LHR	1500 MHz	1770 MHz	1750 MHz	316 mm/12.4 inches
KFA2 RTX 3070 EX Gamer Pink (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	316 mm/12.4 inches
KFA2 RTX 3070 EX Gamer White (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	316 mm/12.4 inches
KFA2 RTX 3070 EX Pink (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	285 mm/11.2 inches
KFA2 RTX 3070 EX White (1-Click OC)	1500 MHz	1755 MHz	1750 MHz	285 mm/11.2 inches
KFA2 RTX 3070 SG (1-Click OC)	1500 MHz	1725 MHz	1750 MHz	317 mm/12.5 inches
KUROUTOSHIKOU RTX 3070 GALAKURO GAMING	1500 MHz	1725 MHz	1750 MHz	238 mm/9.4 inches, Triple-slot
Leadtek WinFast RTX 3070 AI BLOWER	1500 MHz	1725 MHz	1750 MHz	264 mm/10.4 inches
Leadtek WinFast RTX 3070 AI BLOWER REV B	1500 MHz	1725 MHz	1750 MHz	264 mm/10.4 inches
Leadtek WinFast RTX 3070 HURRICANE	1500 MHz	1725 MHz	1750 MHz	258 mm/10.2 inches, Triple-slot

▼ Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
Leadtek WinFast RTX 3070 LIFE ES	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches, Triple-slot
Lenovo RTX 3070 OEM	1500 MHz	1725 MHz	1750 MHz	
Lenovo RTX 3070 OEM LHR	1500 MHz	1725 MHz	1750 MHz	
Manli RTX 3070 (M2479+N617-00)	1500 MHz	1725 MHz	1750 MHz	252 mm/9.9 inches, Triple-slot
Manli RTX 3070 Gallardo (M2479+N617-00)	1500 MHz	1740 MHz	1750 MHz	252 mm/9.9 inches, Triple-slot
Manli RTX 3070 LHR (M2479+N617)	1500 MHz	1725 MHz	1750 MHz	252 mm/9.9 inches, Triple-slot
Manli RTX 3070 LHR Gallardo (M2502+N617)	1500 MHz	1740 MHz	1750 MHz	252 mm/9.9 inches, Triple-slot
MAXSUN RTX 3070 iCraft	1500 MHz	1725 MHz	1750 MHz	Triple-slot
MAXSUN RTX 3070 iCraft Aijia Limited OC T0C	1500 MHz	1770 MHz	1750 MHz	Triple-slot
MAXSUN RTX 3070 iCraft OC	1500 MHz	1770 MHz	1750 MHz	Triple-slot
MAXSUN RTX 3070 iCraft OC T1	1500 MHz	1770 MHz	1750 MHz	Triple-slot
MSI RTX 3070 GAMING TRIO	1500 MHz	1770 MHz	1750 MHz	323 mm/12.7 inches
MSI RTX 3070 GAMING TRIO PLUS LHR	1500 MHz	1770 MHz	1750 MHz	323 mm/12.7 inches
MSI RTX 3070 GAMING X TRIO	1500 MHz	1830 MHz	1750 MHz	323 mm/12.7 inches, Triple-slot, 240 W
MSI RTX 3070 GAMING Z TRIO LHR	1500 MHz	1845 MHz	1750 MHz	323 mm/12.7 inches, Triple-slot, 240 W
MSI RTX 3070 SUPRIM	1500 MHz	1830 MHz	1750 MHz	335 mm/13.2 inches, Triple-slot, 270 W
MSI RTX 3070 SUPRIM LHR	1500 MHz	1830 MHz	1750 MHz	335 mm/13.2 inches, Triple-slot, 270 W
MSI RTX 3070 SUPRIM SE	1500 MHz	1770 MHz	1750 MHz	335 mm/13.2 inches, Triple-slot
MSI RTX 3070 SUPRIM SE GODZILLA LHR	1500 MHz	1770 MHz	1750 MHz	335 mm/13.2 inches, Triple-slot
MSI RTX 3070 SUPRIM X	1500 MHz	1905 MHz	1750 MHz	335 mm/13.2 inches, Triple-slot, 280 W
MSI RTX 3070 SUPRIM X LHR	1500 MHz	1905 MHz	1750 MHz	335 mm/13.2 inches, Triple-slot, 280 W
MSI RTX 3070 TWIN FAN	1500 MHz	1725 MHz	1750 MHz	230 mm/9.1 inches
MSI RTX 3070 TWIN FAN LHR	1500 MHz	1725 MHz	1750 MHz	230 mm/9.1 inches
MSI RTX 3070 TWIN FAN OC	1500 MHz	1740 MHz	1750 MHz	230 mm/9.1 inches
MSI RTX 3070 TWIN FAN OC LHR	1500 MHz	1740 MHz	1750 MHz	230 mm/9.1 inches
MSI RTX 3070 VENTUS 2X	1500 MHz	1725 MHz	1750 MHz	232 mm/9.1 inches
MSI RTX 3070 VENTUS 2X LHR	1500 MHz	1725 MHz	1750 MHz	232 mm/9.1 inches
MSI RTX 3070 VENTUS 2X OC	1500 MHz	1755 MHz	1750 MHz	232 mm/9.1 inches
MSI RTX 3070 VENTUS 2X OC LHR	1500 MHz	1755 MHz	1750 MHz	232 mm/9.1 inches
MSI RTX 3070 VENTUS 3X	1500 MHz	1725 MHz	1750 MHz	305 mm/12 inches

▼ Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
MSI RTX 3070 VENTUS 3X LHR	1500 MHz	1725 MHz	1750 MHz	305 mm/12 inches
MSI RTX 3070 VENTUS 3X OC	1500 MHz	1755 MHz	1750 MHz	305 mm/12 inches
MSI RTX 3070 VENTUS 3X OC LHR	1500 MHz	1755 MHz	1750 MHz	305 mm/12 inches
NVIDIA GeForce RTX 3070 Founders Edition	1500 MHz	1725 MHz	1750 MHz	
OCPC RTX 3070	1500 MHz	1725 MHz	1750 MHz	
Palit RTX 3070 GameRock	1500 MHz	1725 MHz	1750 MHz	304 mm/12 inches
Palit RTX 3070 GameRock OC	1500 MHz	1845 MHz	1750 MHz	304 mm/12 inches
Palit RTX 3070 GameRock OC V1	1500 MHz	1845 MHz	1750 MHz	304 mm/12 inches
Palit RTX 3070 GameRock V1	1500 MHz	1725 MHz	1750 MHz	304 mm/12 inches
Palit RTX 3070 GamingPro	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches
Palit RTX 3070 GamingPro OC	1500 MHz	1770 MHz	1750 MHz	294 mm/11.6 inches
Palit RTX 3070 GamingPro OC V1	1500 MHz	1770 MHz	1750 MHz	294 mm/11.6 inches
Palit RTX 3070 GamingPro V1	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches
Palit RTX 3070 JetStream	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches, Triple-slot
Palit RTX 3070 JetStream OC	1500 MHz	1815 MHz	1750 MHz	294 mm/11.6 inches, Triple-slot
Palit RTX 3070 JetStream OC V1	1500 MHz	1815 MHz	1750 MHz	294 mm/11.6 inches, Triple-slot
Palit RTX 3070 JetStream V1	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches, Triple-slot
PCYES RTX 3070 Graffiti	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches
PNY RTX 3070 UPRISING Dual Fan	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches, Triple-slot
PNY RTX 3070 UPRISING Dual Fan LHR	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches, Triple-slot
PNY XLR8 RTX 3070 REVEL EPIC-X Triple Fan	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches
PNY XLR8 RTX 3070 REVEL EPIC-X Triple Fan LHR	1500 MHz	1725 MHz	1750 MHz	294 mm/11.6 inches
Yeston RTX 3070 Sakura Hitomi Edition	1500 MHz	1725 MHz	1750 MHz	
ZOTAC RTX 3070 AMP Holo	1500 MHz	1785 MHz	1750 MHz	291 mm/11.5 inches, Triple-slot
ZOTAC RTX 3070 AMP Holo LHR	1500 MHz	1785 MHz	1750 MHz	291 mm/11.5 inches, Triple-slot
ZOTAC RTX 3070 Apocalypse GOC	1500 MHz	1755 MHz	1750 MHz	315 mm/12.4 inches, Triple-slot
ZOTAC RTX 3070 Apocalypse OC	1500 MHz	1755 MHz	1750 MHz	315 mm/12.4 inches, Triple-slot
ZOTAC RTX 3070 Medion Erazer OEM	1500 MHz	1725 MHz	1750 MHz	
ZOTAC RTX 3070 OEM	1500 MHz	1725 MHz	1750 MHz	
ZOTAC RTX 3070 PGF OC	1500 MHz	1785 MHz	1750 MHz	309 mm/12.2 inches, Triple-slot
ZOTAC RTX 3070 Twin Edge	1500 MHz	1725 MHz	1750 MHz	232 mm/9.1 inches

Name	GPU Clock	Boost Clock	Memory Clock	Other Changes
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Torre Precision 3660

Instalação e especificações

Notas, avisos e advertências

 **NOTA:** NOTA fornece informações importantes para ajudar você a usar melhor o computador.

 **CUIDADO:** Um AVISO indica possíveis danos ao hardware ou perda de dados e ensina como evitar o problema.

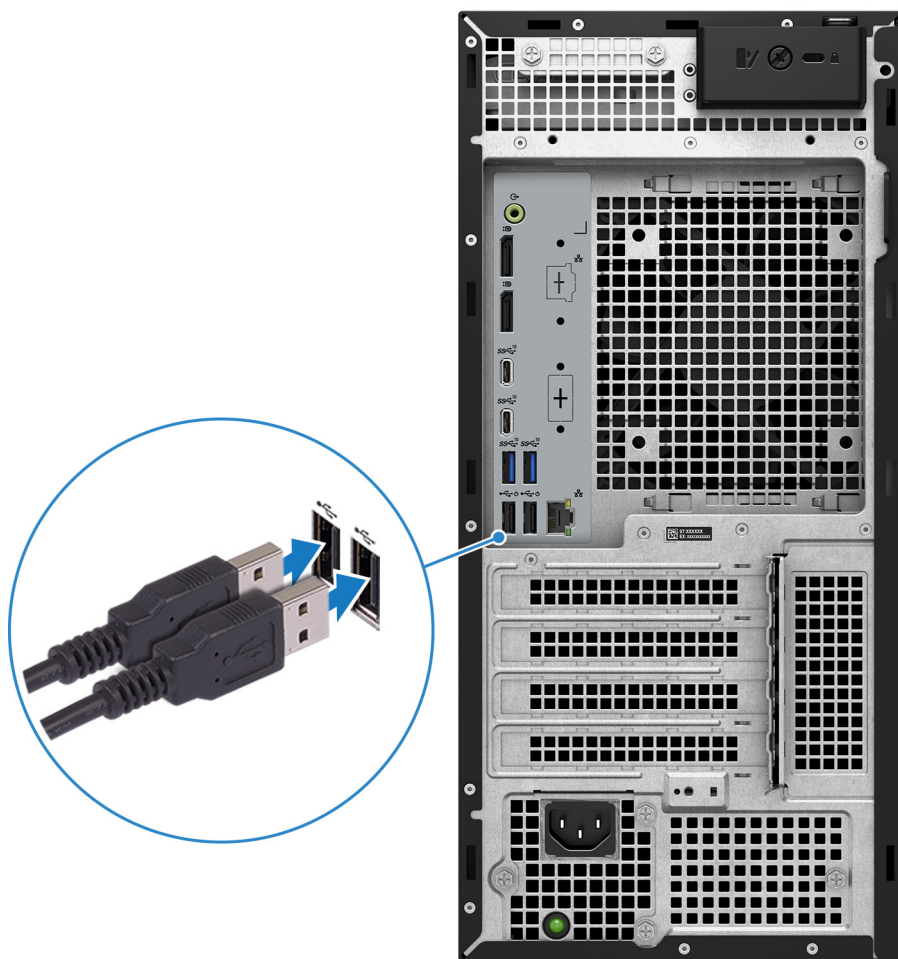
 **ATENÇÃO:** Uma ADVERTÊNCIA indica possíveis danos à propriedade, lesões corporais ou risco de morte.

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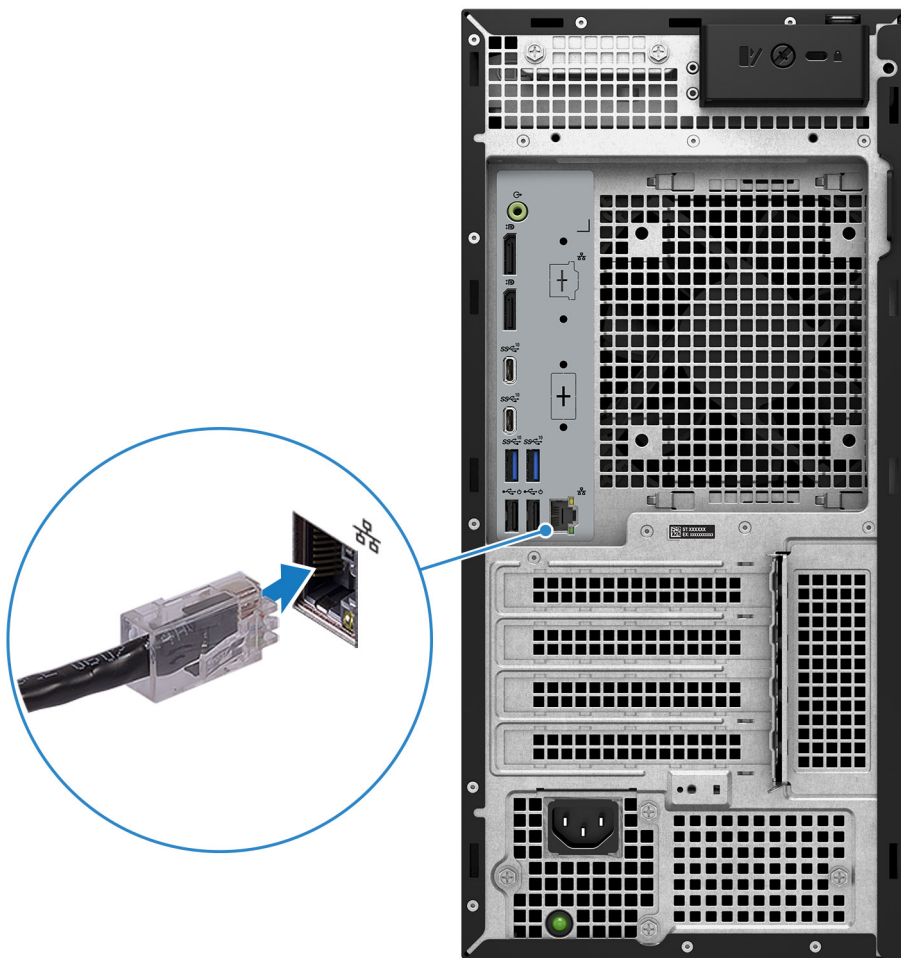
Configurar seu computador

Etapas

1. Conecte o teclado e o mouse.



2. Conecte-se à rede usando um cabo.



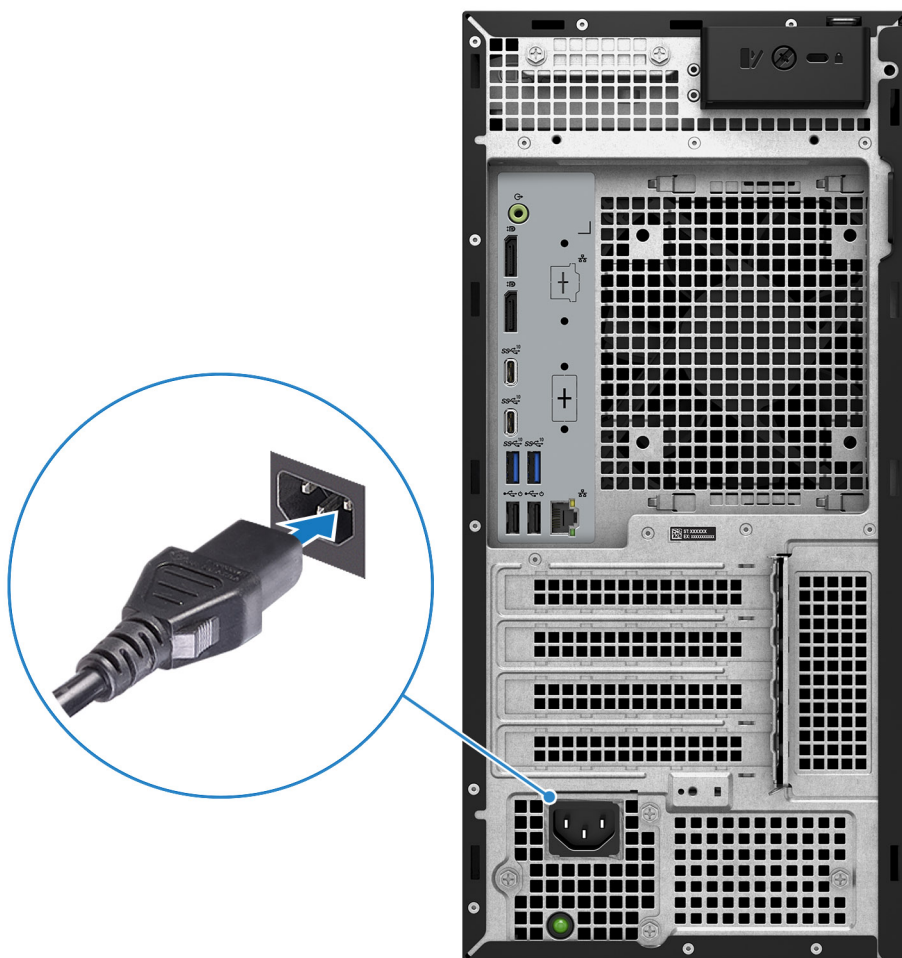
NOTA: Como alternativa, você pode conectar-se a uma rede sem fio.

3. Conecte a tela.



NOTA: Se o computador tiver sido adquirido com uma placa gráfica dedicada, as portas HDMI e DisplayPort no painel traseiro do computador estarão cobertas. Conecte a tela à porta da placa gráfica dedicada.

4. Conecte o cabo de alimentação.



CUIDADO: Conecte o cabo de alimentação a uma unidade de distribuição de energia (PDU) de 16 A e, em seguida, conecte a PDU à tomada de parede.

5. Pressione o botão liga/desliga.



6. Termine a configuração do Windows.

Siga as instruções na tela para concluir a configuração. Quando estiver configurando, a Dell recomenda que você:

- Conecte-se a uma rede para obter as atualizações do Windows.
- **NOTA:** Se estiver se conectando a uma rede de rede sem fio segura, digite a senha de acesso à rede de rede sem fio quando solicitado.
- Se estiver conectado à Internet, faça login ou crie uma conta da Microsoft. Se não estiver conectado à Internet, crie uma conta off-line.
- Na tela **Suporte e proteção**, insira suas informações de contato.

7. Localize e use os aplicativos da Dell no menu Iniciar do Windows (recomendado)

Tabela 1. Localizar aplicativos Dell

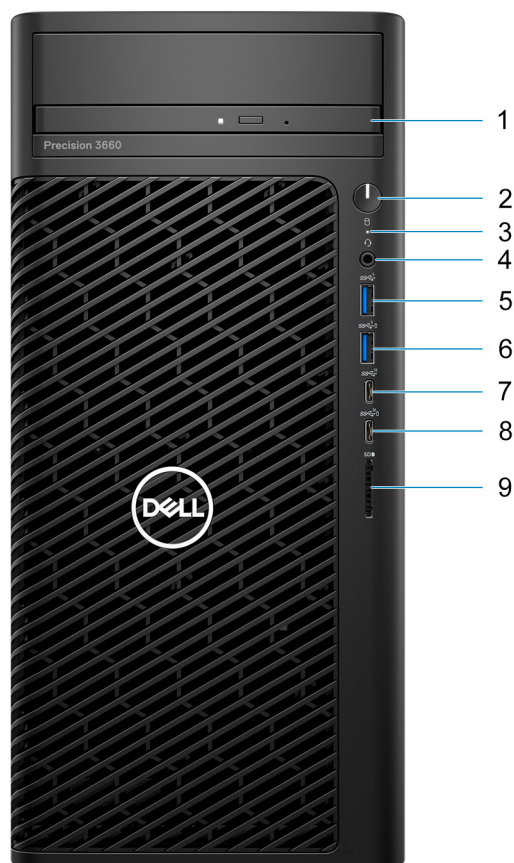
Recursos	Descrição
	Meu Dell Local centralizado para os principais aplicativos da Dell, artigos de ajuda e outras informações importantes sobre seu computador. Ele também notifica você sobre o status da garantia, acessórios recomendados e atualizações de software se disponível.
	SupportAssist O SupportAssist faz a identificação proativa e preditiva de problemas de hardware e software em seu computador e automatiza o processo de engajamento com o suporte técnico da Dell. Ele aborda problemas de desempenho e estabilização, impede ameaças à segurança, monitora e detecta falhas de hardware. Para

Tabela 1. Localizar aplicativos Dell (continuação)

Recursos	Descrição
	obter mais informações, consulte o <i>Guia do usuário do SupportAssist for Home PCs</i> em www.dell.com/serviceabilitytools. Clique em SupportAssist e, em seguida, clique em SupportAssist for Home PCs.  NOTA: No SupportAssist, clique na data de vencimento da garantia para renovar ou atualizar sua garantia.
	Dell Update Atualiza seu computador com correções críticas e os drivers de dispositivos mais recentes à medida que ficarem disponíveis. Para obter mais informações sobre como usar o Dell Update, pesquise no recurso da base de conhecimento em www.dell.com/support.
	Dell Digital Delivery Faça download dos aplicativos de software que são adquiridos, mas não são pré-instalados em seu computador. Para obter mais informações sobre como usar o Dell Digital Delivery, pesquise no recurso da base de conhecimento em www.dell.com/support.

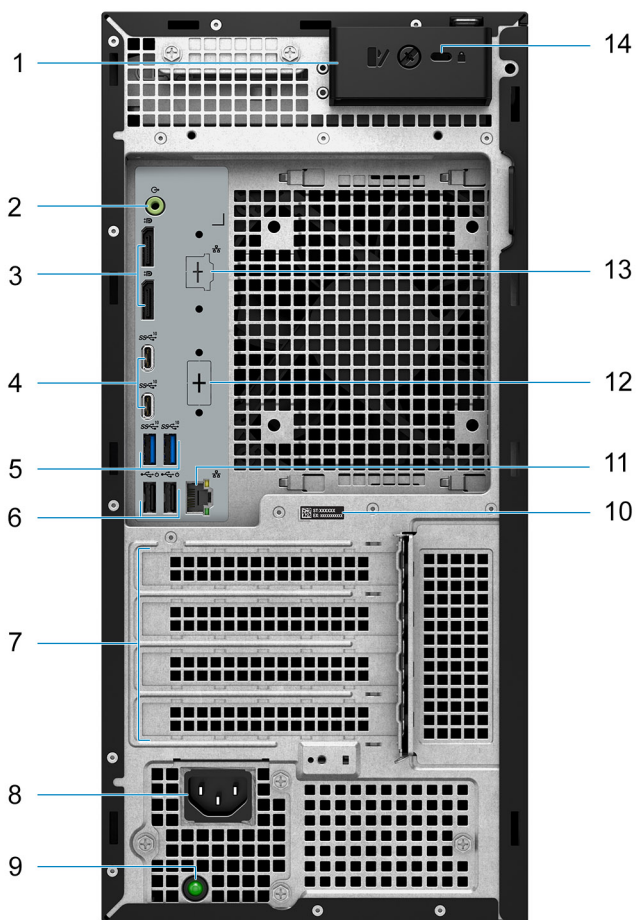
Visão geral do chassi

Tela



1. Unidade de disco óptico
2. Botão liga/desliga com LED de diagnóstico
3. Indicador de atividade do disco rígido
4. Tomada universal de áudio
5. Porta USB 3.2 de 1ª geração (5 Gbps)
6. Porta USB 3.2 de 1ª geração (5 Gbps) com PowerShare
7. Porta USB 3.2 Type-C de 2ª geração (10 Gbps)
8. Porta USB 3.2 Type-C x2 de 2ª geração (20 Gbps) com PowerShare
9. Leitor de cartão SD 4.0

Parte traseira



1. Trava de liberação da tampa lateral
2. Porta de áudio de saída de linha
3. Duas portas DisplayPort 1.4
4. Duas portas USB 3.2 Type-C de 2ª geração (10 Gbps)
5. Duas portas USB 3.2 de 2ª geração (10 Gbps)
6. Duas portas USB 2.0 (480 Mbps) com SmartPower
7. Slots da placa de expansão
8. Porta do conector do cabo de alimentação
9. Luz de diagnóstico da fonte de alimentação
10. Rótulo da etiqueta de serviço
11. Porta RJ45 de 10/100/1.000 IMbps
12. HDMI 2.0/DisplayPort 1.4/VGA/USB Type-C com DisplayPort modo alternativo (opcional)
13. Porta RJ-45 GbE 2.5 (opcional)
14. Slot do cabo de segurança Kensington

Especificações do Torre Precision 3660

Dimensões e peso

A tabela a seguir lista a altura, a largura, a profundidade e o peso do Torre Precision 3660.

Tabela 2. Dimensões e peso

Descrição	Valores
Altura	372,90 mm (14,68 pol.)
Largura	173,00 mm (6,81 pol.)
Profundidade	420,20 mm (16,54 pol.)
Peso  NOTA: O peso do computador depende da configuração solicitada e da variabilidade na fabricação.	- Mínimo - 8,44 kg (18,60 lb) - Máximo - 16,36 kg (36,06 lb)

Processadores

A tabela a seguir mostra os detalhes dos processadores compatíveis com o Torre Precision 3660.

Tabela 3. Processadores

Processadores	Potência	Contagem de núcleos	Contagem de threads	Velocidade	Cache	Placa gráfica integrada
Intel Core i9-13900K de 13ª geração, vPro	125 W	24	32	2,2 GHz a 5,8 GHz	36 MB	Placa gráfica Intel UHD 770
Intel Core i9-13900 de 13ª geração, vPro	65 W	24	32	1,5 GHz a 5,6 GHz	36 MB	Placa gráfica Intel UHD 770
Intel Core i7-13700K de 13ª geração, vPro	125 W	16	24	2,5 GHz a 5,4 GHz	30 MB	Placa gráfica Intel UHD 770
Intel Core i7-13700 de 13ª geração, vPro	65 W	16	24	1,5 GHz a 5,2 GHz	30 MB	Placa gráfica Intel UHD 770
Intel Core i5-13600K de 13ª geração, vPro	125 W	14	20	2,6 GHz a 5,1 GHz	24 MB	Placa gráfica Intel UHD 770
Intel Core i5-13600 de 13ª geração, vPro	65 W	14	20	2,0 GHz a 5,0 GHz	24 MB	Placa gráfica Intel UHD 770

Tabela 3. Processadores (continuação)

Processadores	Potência	Contagem de núcleos	Contagem de threads	Velocidade	Cache	Placa gráfica integrada
Intel Core i5-13500 de 13ª geração, vPro	65 W	14	20	1,8 GHz a 4,8 GHz	24 MB	Placa gráfica Intel UHD 770
Intel Core i5-13400 de 13ª geração	65 W	10	16	1,8 GHz a 4,6 GHz	20 MB	Placa gráfica Intel UHD 730
Intel Core i3-13100 de 13ª geração	60 W	4	8	3,4 GHz a 4,5 GHz	12 MB	Placa gráfica Intel UHD 730
Intel Core i9-12900K de 12ª geração, vPro	125 W	16	24	3,2 GHz a 5,2 GHz	30 MB	Placa gráfica Intel UHD 770
Intel Core i9-12900 de 12ª geração, vPro	65 W	16	24	2,4 GHz a 5,1 GHz	30 MB	Placa gráfica Intel UHD 770
Intel Core i7-12700K de 12ª geração, vPro	125 W	12	20	3,6 GHz a 5,0 GHz	25 MB	Placa gráfica Intel UHD 770
Intel Core i7-12700 de 12ª geração, vPro	65 W	12	20	2,1 GHz a 4,9 GHz	25 MB	Placa gráfica Intel UHD 770
Intel Core i5-12600K de 12ª geração, vPro	125 W	10	16	3,7 GHz a 4,9 GHz	20 MB	Placa gráfica Intel UHD 770
Intel Core i5-12600 de 12ª geração, vPro	65 W	6	12	3,3 GHz a 4,8 GHz	18 MB	Placa gráfica Intel UHD 770
Intel Core i5-12500 de 12ª geração, vPro	65 W	6	12	3,0 GHz a 4,6 GHz	18 MB	Placa gráfica Intel UHD 770
Intel Core i3-12100 de 12ª geração	60 W	4	8	3,3 GHz a 4,3 GHz	12 MB	Placa gráfica Intel UHD 730

Chipset

A tabela a seguir lista os detalhes do chipset suportado pelo Torre Precision 3660.

Tabela 4. Chipset

Descrição	Valores
Chipset	W680
Processador	- Intel Core i3/i5/i7/i9 de 13ª geração - Intel Core i3/i5/i7/i9 de 12ª geração

Tabela 4. Chipset (continuação)

Descrição	Valores
Largura do barramento de DRAM	2*32 bits por DIMM
Flash EPROM	16 MB + 32 MB
Barramento PCIe	Até 5ª geração

Sistema operacional

O Torre Precision 3660 suporta os seguintes sistemas operacionais:

- Windows 11 Home, 64 bits
- Windows 11 Pro, 64 bits
- Windows 11 Pro National Education, 64 bits
- Downgrade do Windows 11 (imagem do Windows 10)
- Windows 10 IoT 2021 LTSC (apenas OEM)
- Windows 10 CMIT Government Edition, 64 bits (somente para China)
- Kylin Linux versão 10 SP1 (somente para a China)
- Ubuntu Linux 22.04 LTS, 64 bits
- RHEL 8.6

Memória

A tabela a seguir lista as especificações de memória do Torre Precision 3660.

Tabela 5. Especificações da memória

Descrição	Valores
Slots de memória	Quatro slots DIMM  NOTA: Até 128 GB ou até 4.400 MHz ECC e DDR5 não ECC
Tipo de memória	DDR5
Velocidade da memória	Velocidade máxima: 4.400 MHz  NOTA: A velocidade máxima da memória varia de acordo com a configuração a seguir em cada canal. Se a configuração 2 DIMM não for simétrica, a velocidade máxima pode cair. • 4.400 MHz: 1 DIMM-1R/2R • 4.000 MHz: 2 DIMM-1R • 3.600 MHz: 2 DIMM-2R
Configuração máxima de memória	128 GB
Configuração mínima de memória	8 GB
Tamanho da memória por slot	8 GB, 16 GB e 32 GB
Configurações de memória suportadas	• 8 GB, 1 x 8 GB, DDR5, 4.400 MHz, não ECC • 16 GB, 2 x 8 GB, DDR5, 4.400 MHz, não ECC, dual channel • 32 GB, 2 x 16 GB, DDR5, 4.400 MHz, não ECC, dual channel • 64 GB, 2 x 32 GB, DDR5, 4.400 MHz, não ECC, dual channel • 32 GB, 4 x 8 GB, DDR5, 4.000 MHz, não ECC, dual channel

Tabela 5. Especificações da memória (continuação)

Descrição	Valores
	64 GB, 4 x 16 GB, DDR5, 4.000 MHz, não ECC, dual channel 128 GB, 4 x 32 GB, DDR5, 3.600 MHz, não ECC, dual channel 16 GB, 1 x 16 GB, DDR5, 4.400 MHz, ECC 32 GB, 2 de 16 GB, DDR5, 4.400 MHz, ECC, dual channel 64 GB, 2 de 32 GB, DDR5, 4.400 MHz, ECC, dual channel 64 GB, 4 de 16 GB, DDR5, 4.000 MHz, ECC, dual channel 128 GB, 4 de 32 GB, DDR5, 3.600 MHz, ECC, dual channel  NOTA: A memória ECC não é compatível com os processadores Intel Core i3-12100, i3-13100 e i3-13400.

Matriz de memória

A tabela a seguir lista as configurações de memória compatíveis da Torre Precision 3660.

Tabela 6. Matriz de memória

Configuração	Slot			
	DIMM1	DIMM2	DIMM3	DIMM4
DDR5 de 8 GB	8 GB	NA	NA	NA
DDR5 de 16 GB	16 GB	NA	NA	NA
DDR5 de 16 GB	8 GB	8 GB	NA	NA
DDR5 de 32 GB	16 GB	16 GB	NA	NA
DDR5 de 64 GB	32 GB	32 GB	NA	NA
DDR5 de 32 GB	8 GB	8 GB	8 GB	8 GB
DDR5 de 64 GB	16 GB	16 GB	16 GB	16 GB
DDR5 de 128 GB	32 GB	32 GB	32 GB	32 GB

 **NOTA:** A configuração de 8 GB está disponível apenas para memória não ECC.

Portas externas

A tabela a seguir lista as portas externas do Torre Precision 3660.

Tabela 7. Portas externas

Descrição	Valores
Porta de rede	- Uma porta Ethernet RJ45, 1 GbE - Uma porta Ethernet RJ45, 2,5 GbE (opcional)
Portas USB	Parte frontal:

Tabela 7. Portas externas (continuação)

Descrição	Valores
	• Uma porta USB 3.2 de 1ª geração (5 Gbps) com PowerShare • Uma porta USB 3.2 de 1ª geração (5 Gbps) • Uma porta USB 3.2 Type-C de 2ª geração (10 Gbps) • Uma porta USB 3.2 Type-C x2 de 2ª geração (20 Gbps) com PowerShare Parte traseira: • Duas portas USB 2.0 (480 Mbps) com Smart Power On • Duas portas USB 3.2 de 2ª geração (10 Gbps) • Duas portas USB 3.2 Type-C de 2ª geração (10 Gbps)
Porta de áudio	• Parte frontal: tomada de áudio universal • Parte traseira: porta de áudio de saída de linha
Porta de vídeo	• Duas portas DisplayPort 1.4 HBR2 • Uma porta de vídeo opcional (HDMI 2.0/DisplayPort 1.4 (HBR3)/VGA/USB Type-C com modo alternativo de DisplayPort)  NOTA: Faça download e instale o driver mais recente da placa gráfica Intel www.dell.com/support para ativar vários monitores.
Leitor de cartão de mídia	Um slot de cartão SD
Porta do adaptador de energia	NA
Slot do cabo de segurança	Um slot do cabo de segurança Kensington

Slots internos

A tabela a seguir lista os slots internos da Torre Precision 3660.

Tabela 8. Slots internos

Descrição	Valores
M.2	• Um slot M.2 2230 para placa combinada Wi-Fi e Bluetooth • Dois slots M.2 2230/2280 (SSD0 e SSD1) para unidades de estado sólido • Um slot M.2 2280 (SSD2) para unidade de estado sólido  NOTA: O slot SSD0 é compatível nativamente com as SSDs M.2 2280. As SSDs M.2 2230 podem ser instaladas neste slot usando apenas uma peça extensora.  NOTA: O slot SSD1 é compatível nativamente com as SSDs M.2 2230 e M.2 2280.  NOTA: O slot SSD2 é compatível nativamente apenas com as SSDs M.2 2280.  NOTA: Para saber mais sobre os recursos de diferentes tipos de placas M.2, consulte o artigo na base de conhecimento em www.dell.com/support.
SATA	• Cinco slots SATA 3
PCIe	• Um PCIe x16 de 5ª geração (somente placa gráfica dedicada)

Tabela 8. Slots internos (continuação)

Descrição	Valores
	- Um PCIe x4 de 4ª geração - Um PCIe x4 de 3ª geração

Ethernet

A tabela a seguir mostra as especificações de rede local Ethernet com fio (LAN) da Torre Precision 3660.

Tabela 9. Especificações de Ethernet

Descrição	Opção um	Opção dois
Número do modelo	Intel I219-LM	Intel I225 (opcional)
Taxa de transferência	10/100/1.000 Mbps	10/100/1000/2500 Mbit/s

Módulo sem fio

A tabela a seguir lista os módulos de rede local sem fio (WLAN) compatíveis com o Torre Precision 3660.

Tabela 10. Especificações do módulo sem fio

Descrição	Opção um	Opção dois
Número do modelo	Intel AX211	Qualcomm WCN6856-DBS
Taxa de transferência	2.400 Mbps	Até 3.571 Mbps
Bandas de frequência suportadas	2,4 GHz/5 GHz/6 GHz <i>i</i> NOTA: A frequência de 6 GHz é compatível apenas com computadores instalados com o sistema operacional Windows 11.	2,4 GHz/5 GHz/6 GHz <i>i</i> NOTA: A frequência de 6 GHz é compatível apenas com computadores instalados com o sistema operacional Windows 11.
Padrões sem fio	- Wi-Fi 802.11a/b/g - Wi-Fi 4 (Wi-Fi 802.11n) - Wi-Fi 5 (Wi-Fi 802.11ac) - Wi-Fi 6E (Wi-Fi 802.11ax)	- Wi-Fi 802.11a/b/g - Wi-Fi 4 (Wi-Fi 802.11n) - Wi-Fi 5 (Wi-Fi 802.11ac) - Wi-Fi 6E (Wi-Fi 802.11ax)
Criptografia	64 bits/WEP de 128 bits - AES-CCMP - TKIP	- WEP de 64 bits e 128 bits - AES-CCMP - TKIP
Placa de rede sem fio Bluetooth	5,3	5,3
	<i>i</i> NOTA: A versão da placa de rede sem fio Bluetooth pode variar dependendo do sistema operacional instalado no computador.	

Audio

A tabela a seguir lista as especificações de áudio do Torre Precision 3660.

Tabela 11. Especificações de áudio

Descrição		Valores
Tipo de áudio		Codec de áudio de alta definição em 4 canais
Controlador de áudio		Realtek ALC3246-CG
Conversão estéreo		DAC (digital para analógico) e ADC (analógico para digital) de 24 bits
Interface de áudio interna		Áudio Intel HDA (áudio de alta definição)
Interface de áudio externa		• Uma tomada de áudio universal (frontal) • Uma porta de saída de áudio (parte traseira)
Número de alto-falantes		Um (opcional)
Amplificador interno de alto-falante		Integrada no ALC3246-CG (Classe D 2 W)
Controles de volume externo		Controles de atalho do teclado
Saída do alto-falante:		
	Saída média do alto-falante	2 W
	Saída de pico do alto-falante	2,2 W
Saída do caixa acústica de sons graves (subwoofer)		Não suportado
Microfone		Não suportado

Armazenamento

Esta seção lista as opções de armazenamento na Torre Precision 3660.

- Inicialização de SSD M.2 + SSDs M.2 opcionais - Essa configuração permite a inicialização em SSD NVMe M.2 com até três SSDs NVMe adicionais. Nenhum disco rígido SATA é configurado nessa opção.
- Inicialização de disco rígido SATA de 2,5" + discos rígidos SATA opcionais de 2,5" - Essa configuração permite a inicialização em disco rígido SATA de 2,5" com até três discos rígidos SATA adicionais de 2,5".
- Inicialização de disco rígido de 3,5" + discos rígidos opcionais de 3,5" - Essa configuração permite a inicialização em disco rígido de 3,5" com até um disco rígido adicional de 3,5".
- Inicialização de SSD M.2 + SSDs M.2 opcionais + disco rígido SATA de 2,5" + discos rígidos SATA opcionais de 2,5" - Essa configuração permite a inicialização em SSD NVMe M.2 com até três SSDs NVMe adicionais, um disco rígido SATA de 2,5" e até três discos rígidos SATA adicionais de 2,5".
- Inicialização de SSD M.2 + SSD M.2 opcional + disco rígido SATA de 3,5" + discos rígidos SATA opcionais de 3,5" - Essa configuração permite a inicialização em SSD NVMe M.2 com até três SSDs NVMe adicionais, um disco rígido SATA de 3,5" e um disco rígido SATA adicional de 3,5".
- Inicialização de SSD M.2 + SSDs opcionais + disco rígido SATA de 2,5" acessível pela parte frontal + discos rígidos SATA opcionais de 2,5" - Essa configuração permite a inicialização em SSD NVMe M.2 com até três SSDs NVMe adicionais, um disco rígido SATA de 2,5" acessível pela parte frontal e dois discos rígidos SATA adicionais de 2,5".
- Inicialização de SSD M.2 + SSDs opcionais + disco rígido SATA de 3,5" acessível pela parte frontal + discos rígidos SATA opcionais de 3,5" - Essa configuração permite a inicialização em SSD NVMe M.2 com até três SSDs NVMe adicionais, um disco rígido SATA de 3,5" acessível pela parte frontal e até dois discos rígidos SATA adicionais de 3,5".
- RAID 0/1/5/10 disponíveis.

 **NOTA:** A SSD NVMe M.2 não pode criar um disco RAID com nenhuma unidade SATA.

 **NOTA:** A placa-mãe do Precision 3660 aceita até duas SSDs NVMe M.2 2230 ou até três SSDs NVMe M.2 2280.

Tabela 12. Especificações de armazenamento

Tipo de armazenamento	Tipo de interface	Capacidade
Disco rígido de 2,5 polegadas e 7.200 RPM	SATA 3.0	Até 1 TB
Disco rígido de 2,5 polegadas e 7.200 RPM, Opal 2.0 com criptografia automática FIPS	SATA 3.0	500 GB
Disco rígido de 3,5 polegadas e 5.400 RPM	SATA 3.0	4 TB
Disco rígido de 3,5 polegadas e 7.200 RPM	SATA 3.0	Com 2 TB
Disco rígido Enterprise de 3,5 polegadas e 7.200 RPM	SATA 3.0	Até 8 TB
Unidade de estado sólido M.2 2230	PCIe NVMe de 3ª geração x4, Classe 35	256 GB
Unidade de estado sólido M.2 2230	PCIe NVMe 4ª geração x4, Classe 35	256 GB
Unidade de estado sólido M.2 2280	PCIe NVMe de 4ª geração x4, Classe 40	Até 4 TB
Unidade de estado sólido M.2 2280 com criptografia automática Opal	PCIe NVMe de 3ª geração x4, classe 40	Até 1 TB
Unidade de estado sólido M.2 2280 com criptografia automática Opal	PCIe NVMe de 4ª geração x4, Classe 40	Até 1 TB

Leitor de cartão de mídia

A tabela a seguir mostra as placas de mídia suportadas pelo Torre Precision 3660.

Tabela 13. Especificações do leitor de cartão de mídia

Descrição	Valores
Tipo de cartão de mídia	Um slot de cartão SD  NOTA: O leitor de cartão SD pode ser de fabricantes diferentes e exigirá a instalação de drivers específicos.
Cartões de mídia com suporte	- Secure Digital (SD) - Secure Digital High Capacity (SDHC) - Secure Digital Extended Capacity (SDXC)
 NOTA: A capacidade máxima permitida pelo leitor de cartão de mídia depende do padrão do cartão de mídia instalado no computador.	

Especificações de alimentação

A tabela a seguir lista as especificações da classificação de energia da Torre Precision 3660.

Tabela 14. Especificações de alimentação

Descrição	Valores			
Tipo	Unidade de distribuição de energia interna de 300 W, 92% eficiente, 80 Plus Platinum	Unidade de distribuição de energia interna de 500 W, 92%	Unidade de distribuição de energia interna de 750 W, PSU 92%	Unidade de distribuição de energia interna de 1.000 W, PSU 92%

Tabela 14. Especificações de alimentação (continuação)

Descrição	Valores			
		eficiente, 80 Plus Platinum	eficiente, 80 Plus Platinum	eficiente, 80 Plus Platinum
Tensão de entrada	90 VCA a 264 VCA	90 VCA a 264 VCA	90 VCA a 264 VCA	90 VCA a 264 VCA
Frequência de entrada	47 Hz a 63 Hz	47 Hz a 63 Hz	47 Hz a 63 Hz	47 Hz a 63 Hz
Corrente de entrada (máxima)	4,2 A	7 A	10 A	13,6 A
Corrente de saída (contínua)	12 VA/18 A 12 VB/18 A Modo de espera: 12 VA/1,5 A 12 VB/3,3 A	12 VA/18 A 12 VB/18 A 12 VC/18 A Modo de espera: 12 VA/1,5 A 12 VB/3,3 A 12 VC/0 A	12 VA/36 A 12 VB/27 A 12 VC/36 A Modo de espera: 12 VA/1,5 A 12 VB/5 A 12 VC/0 A	12 VA/36 A 12 VB/27 A 12 VC/36 A Modo de espera: 12 VA/1,5 A 12 VB/5 A 12 VC/0 A
Tensão de saída nominal	12 VA 12 VB	12 VA 12 VB 12 VC	12 VA 12 VB 12 VC	12 VA 12 VB 12 VC
Faixa de temperatura				
De operação	5 °C a 45° C (41 °F a 113 °F)	5 °C a 45° C (41 °F a 113 °F)	5 °C a 45° C (41 °F a 113 °F)	5 °C a 45° C (41 °F a 113 °F)
Armazenamento	-40 °C a 70 °C (-40 °F a 158 °F)	-40 °C a 70 °C (-40 °F a 158 °F)	-40 °C a 70 °C (-40 °F a 158 °F)	-40 °C a 70 °C (-40 °F a 158 °F)

conector da fonte de alimentação

A tabela a seguir mostra as especificações do conector da fonte de alimentação da Torre Precision 3660.

Tabela 15. conector da fonte de alimentação

300 W (80 PLUS Platinum)	- Dois conectores de 4 pinos para o processador - Um conector de 8 pinos para a placa de sistema
500 W (80 PLUS Platinum)	- Dois conectores de 4 pinos para o processador - Um conector de 8 pinos para a placa de sistema - Um conector de 6 pinos e um conector de 2 + 6 pinos para a placa gráfica
750 W (80 PLUS Platinum)	- Dois conectores de 4 pinos para o processador - Um conector de 8 pinos para a placa de sistema - Dois conectores de 6 pinos e dois conectores de 2 + 6 pinos para a placa gráfica
1.000 W (80 PLUS Platinum)	- Dois conectores de 4 pinos para o processador - Um conector de 8 pinos para a placa de sistema - Dois conectores de 6 pinos e dois conectores de 2 + 6 pinos para a placa gráfica

 **NOTA:** Esta workstation usa uma unidade de distribuição de energia de alta potência e precisa estar sempre conectada a uma PDU (unidade de distribuição de energia) para a proteção do equipamento.

GPU — integrada

A tabela a seguir mostra as especificações da unidade de processamento gráfico (GPU) integrada suportada pelo Torre Precision 3660.

Tabela 16. GPU — integrada

Controlador	Suporte a monitor externo	Tamanho da memória	Processador
Placa gráfica Intel UHD 730	- Duas portas DisplayPort 1.4 - Uma porta de vídeo opcional (HDMI 2.0b/DisplayPort 1.4/VGA/USB Type-C com DisplayPort de modo alternativo)	Memória do sistema compartilhada	- Intel Core i3-12100 de 12ª geração - Intel Core i3-13100 e i5-13400 de 13ª geração
Placa gráfica Intel UHD 770	- Duas portas DisplayPort 1.4 - Uma porta de vídeo opcional (HDMI 2.0b/DisplayPort 1.4/VGA/USB Type-C com DisplayPort de modo alternativo)	Memória do sistema compartilhada	- Intel Core i5/i7/i9 12ª geração - Intel Core i7/i9, i5-13500, i5-13600 e i5-13600k de 13ª geração

Matriz de suporte para várias telas

A tabela a seguir lista a matriz de suporte para várias telas da Torre Precision 3660.

Tabela 17. Matriz de suporte para várias telas

Descrição	Opção um	Opção dois
Placa gráfica integrada	Placa gráfica Intel UHD 730	Placa gráfica Intel UHD 770
Módulo opcional	HDMI 2.0/DisplayPort 1.4/VGA/USB Type-C com modo alternativo de DisplayPort	HDMI 2.0/DisplayPort 1.4/VGA/USB Type-C com modo alternativo de DisplayPort
Compatível com telas 4K	DP 1.4 HBR2, 4096 x 2304 a 60 Hz	DP 1.4 HBR2, 4096 x 2304 a 60 Hz
Compatível com telas 5K	Resolução em blocos 5K (5120 x 2880) suporte em painéis DP. NOTA: Precisa de dois cabos DP orientados por dois DDIs separados da fonte e usando o mecanismo DP-SST (Single Stream Transport).	Resolução em blocos 5K (5120 x 2880) suporte em painéis DP. NOTA: Precisa de dois cabos DP orientados por dois DDIs separados da fonte e usando o mecanismo DP-SST (Single Stream Transport).

GPU — dedicada

A tabela a seguir mostra as especificações das unidades de processamento gráfico (GPU) dedicadas compatíveis com a Torre Precision 3660.

Tabela 18. GPU — dedicada

Controlador	Suporte a monitor externo	Tamanho da memória	Tipo de memória
NVIDIA RTX 3060	Quatro portas DisplayPort 1.4	12 GB	GDDR6
NVIDIA RTX 3070	Quatro portas DisplayPort 1.4	8 GB	GDDR6
NVIDIA RTX 3080	Quatro portas DisplayPort 1.4	10 GB	GDDR6X
NVIDIA RTX 3080TI	Quatro portas DisplayPort 1.4	12 GB	GDDR6X

Tabela 18. GPU — dedicada (continuação)

Controlador	Suporte a monitor externo	Tamanho da memória	Tipo de memória
NVIDIA RTX 3090	• Quatro portas DisplayPort 1.4	24 GB	GDDR6X
NVIDIA RTX 3090TI	• Quatro portas DisplayPort 1.4	24 GB	GDDR6X
NVIDIA RTX A2000	• Quatro miniportas DisplayPort (mDP)	12 GB	GDDR6
NVIDIA RTX A4000	• Quatro portas DisplayPort 1.4	16 GB	GDDR6
NVIDIA RTX A4500	• Quatro portas DisplayPort 1.4	20 GB	GDDR6
NVIDIA RTX A5000	• Quatro portas DisplayPort 1.4	24 GB	GDDR6
NVIDIA RTX A5500	• Quatro portas DisplayPort 1.4	24 GB	GDDR6
NVIDIA RTX A6000	• Quatro portas DisplayPort 1.4	48 GB	GDDR6
NVIDIA T1000	• Quatro portas DisplayPort 1.4	8 GB	GDDR6
NVIDIA T400	• Três portas mini DisplayPort (mDP)	4 GB	GDDR6
AMD Radeon Pro RX6900XT	• Duas portas DisplayPort 1.4 • Uma porta HDMI 2.1 • Uma porta USB Type-C	16 GB	GDDR6
AMD Radeon Pro W6800	• Seis miniportas DisplayPort (mDP)	32 GB	GDDR6
AMD Radeon Pro W6600	• Quatro portas DisplayPort 1.4	8 GB	GDDR6
AMD Radeon Pro W6400	• Quatro miniportas DisplayPort (mDP)	4 GB	GDDR6

Segurança de hardware

A tabela a seguir lista a segurança de hardware da sua Torre Precision 3660.

Tabela 19. Segurança de hardware

Segurança de hardware
Slot do cabo de segurança Kensington
Volta de cadeado
Suporte para trava do chassi - parafuso prisioneiro
Borda frontal com trava e chave para disco rígido SATA acessível pela parte frontal  NOTA: Incluído nas configurações de armazenamento acessíveis pela parte frontal
Interruptor de invasão para chassi
Proteção para cabos com trava
Alertas de violação da cadeia de suprimentos

Tabela 19. Segurança de hardware (continuação)

Segurança de hardware
SafeID inclui módulo TPM (Trusted Platform Module) 2.0
Teclado Smart Card (FIPS)
Microsoft Windows 10 Device Guard e Credential Guard (Enterprise SKU)
Microsoft Windows Bitlocker
Limpeza de dados do disco rígido local por meio do BIOS (apagamento seguro)
Unidades de armazenamento com criptografia automática (Opal, FIPS)
Módulo Trusted Platform Module TPM 2.0 (certificado FIPs 140-2)  NOTA: Nenhum TPM de hardware será implementado.
China TPM
Inicialização segura da Intel
Autenticação da Intel
SafeBIOS: inclui o BIOS Verification, BIOS Resilience, BIOS Recovery e controles adicionais do BIOS fora do host da Dell

Requisitos ambientais

A tabela a seguir lista as especificações ambientais do Torre Precision 3660.

Tabela 20. Requisitos ambientais

Recurso	Valores
Embalagem reciclável	Sim
BFR/sem PVC	Não
Suporte para embalagem de orientação vertical	Sim
Embalagem Multi-pack	Sim (apenas EUA) (opcional)
Fonte de alimentação com uso eficiente de energia	Padrão
Compatível com ENV0424	Sim

 **NOTA:** As embalagens de fibra à base de madeira contêm um mínimo de 35% de conteúdo reciclado, em peso total de fibra à base de madeira. As embalagens sem fibra de madeira podem ser consideradas como não aplicáveis. Os critérios antecipados requeridos para a EPEAT 2018.

Conformidade com normas

A tabela a seguir lista a conformidade com normas do Torre Precision 3660.

Tabela 21. Conformidade com normas

Conformidade com normas
Segurança do produto, EMC e especificações ambientais
Página inicial de conformidade com normas da Dell

Tabela 21. Conformidade com normas (continuação)

Conformidade com normas
Dell e o meio ambiente

Ambiente de operação e armazenamento

Esta tabela lista as especificações de operação e armazenamento do Torre Precision 3660.

Nível de poluentes transportados: G1, conforme definido pela norma ISA-S71.04-1985

Tabela 22. Características ambientais do computador

Descrição	Operação	Armazenamento
Faixa de temperatura	10 °C a 35 °C (50 °F a 95 °F)	-40 °C a 65 °C (-40 °F a 149 °F)
Umidade relativa (máxima)	20 a 85%* (sem condensação) (sem condensação, temperatura máxima do ponto de orvalho = 26 °C)	0% a 95% (sem condensação) 5% a 95% (temperatura máxima do ponto de orvalho, sem condensação = 33 °C)
Vibração (máxima)*	0,52 GRMS aleatório a 5 Hz-350 Hz	2,0 GRMS aleatório a 5 Hz-500 Hz
Choque (máximo)	Pulso inferior de meio seno de 40 G (2,5 ms)	Pulso de meio seno de 105 G (2,5 ms)
Faixa de altitude	-15,2 m a 3.048 m (4,64 pés a 10.000 pés)	-15,2 m a 10.668 m (-4,64 pés a 35.000 pés)
 CUIDADO: Os intervalos de temperatura de armazenamento e de operação podem ser diferentes entre os componentes. Assim, operar ou armazenar o dispositivo fora desses intervalos pode afetar o desempenho de componentes específicos.		

* Medida usando um espectro de vibração aleatório que simula o ambiente do usuário.

† Medida usando um pulso de meio seno de 2 ms.

Como obter ajuda e entrar em contato com a Dell

Recursos de auto-ajuda

Você pode obter informações e ajuda sobre produtos e serviços da Dell, usando estes recursos de auto-ajuda:

Tabela 23. Recursos de auto-ajuda

Recursos de auto-ajuda	Local do recurso
Informações sobre produtos e serviços da Dell	www.dell.com
Aplicativo My Dell	
Dicas	
Entrar em contato com o suporte	Na pesquisa do Windows, digite Contact Support e pressione a tecla Enter.
Ajuda online para sistema operacional	www.dell.com/support/windows www.dell.com/support/linux
Acesse as principais soluções, diagnósticos, drivers e downloads, e saiba mais sobre seu computador por meio de vídeos, manuais e documentos.	Seu computador Dell é identificado exclusivamente por uma etiqueta de serviço ou código de serviço expresso. Para ver os recursos de suporte relevantes para seu computador Dell, digite a etiqueta de serviço ou o código de serviço expresso em www.dell.com/support . Para obter mais informações sobre como localizar a etiqueta de serviço de seu computador, consulte Localizar a etiqueta de serviço em seu computador .
Artigos da base de conhecimento da Dell para solucionar diversos problemas relacionados ao computador.	1. Acesse www.dell.com/support. 2. Na barra de menu, na parte superior da página suporte, selecione Suporte > Base de Conhecimento. 3. No campo de pesquisa da página da base de conhecimento, digite a palavra-chave, o assunto ou o número do modelo e, em seguida, clique ou toque no ícone de pesquisa para visualizar os artigos relacionados.

Como entrar em contato com a Dell

Para entrar em contato com a Dell para tratar de assuntos de vendas, suporte técnico ou questões de atendimento ao cliente, consulte www.dell.com/contactdell.

 **NOTA:** A disponibilidade varia de acordo com o país/região e com o produto, e alguns serviços podem não estar disponíveis em seu país/sua região.

 **NOTA:** Se não tiver uma conexão Internet ativa, você pode encontrar as informações de contato sobre sua fatura, nota fiscal, nota de compra ou no catálogo de produtos Dell.

Voltar			
Especificações Técnicas(#techspecs_section)	Conheça o produto	Análises(#ratings_section)	Drivers, Manuais e Suporte(#support_section)
Ver todos os desktops e PCs All in One(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sc/desktops)			
Computador i3(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/intel-core-i3?appliedRefinements=38648)			
Computador i5(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/intel-core-i5?appliedRefinements=38647)			
Computador i7 e i9(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/intel-core-i9?appliedRefinements=38643,38645)			
Computador SSD 256GB HD(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/256-gb?appliedRefinements=38709)			
Computador SSD 512GB HD(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/512-gb?appliedRefinements=38707)			
Computador 1TB HD(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/1-tb?appliedRefinements=38706)			
Computador 8GB RAM(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/8-gb?appliedRefinements=38697)			
Computador 16GB RAM(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/16-gb?appliedRefinements=38695)			
Computador 32GB ou mais RAM(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/32-gb-ou-mais?appliedRefinements=38693)			
Mini PC(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/pequeno?appliedRefinements=41014)			
Computador All in One(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/all-in-one?appliedRefinements=38623)			
Desktops e all in ones por marca			
Voltar			
Ver todos os desktops e PCs All in One(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sc/desktops)			
Desktops XPS(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/xps-desktops)			
Desktops OptiPlex(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/optiplex-desktops)			
All in ones e desktops Inspiron(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/inspiron-desktops)			
Desktops Vostro(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/vostro-desktops)			
Desktops Alienware(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/alienware-desktops)			
Workstations fixas Precision(//www.dell.com/pt-br/shop/isv-workstations-certificadas/sr/workstations/precision-desktops)			
Monitores			
Voltar			
Ver todos os monitores(//www.dell.com/pt-br/shop/monitors-monitor-accessories/sac/monitors)			
Monitor 23 - 24 polegadas(//www.dell.com/pt-br/shop/monitores/ar/8605/23-24-polegadas?appliedRefinements=24272)			
Monitor 25 - 27 polegadas(//www.dell.com/pt-br/shop/monitores/ar/8605/25-27-polegadas?appliedRefinements=24271)			
Monitor 30 - 34 polegadas(//www.dell.com/pt-br/shop/monitores/ar/8605/30-34-polegadas?appliedRefinements=43287)			
Monitor 4K(//www.dell.com/pt-br/shop/monitores/ar/8605/4k?appliedRefinements=40603)			
Monitor Full HD(//www.dell.com/pt-br/shop/monitores/ar/8605/full-hd?appliedRefinements=40607)			
Monitor QHD(//www.dell.com/pt-br/shop/monitores/ar/8605/qhd?appliedRefinements=40606)			
Monitor 144Hz(//www.dell.com/pt-br/shop/monitores/ar/8605/144-hz?appliedRefinements=40660)			
Monitor 165Hz(//www.dell.com/pt-br/shop/monitores/ar/8605/165-hz?appliedRefinements=40659)			
Monitor 360Hz(//www.dell.com/pt-br/shop/monitores/ar/8605/360-hz?appliedRefinements=40657)			
Monitor curvo(//www.dell.com/pt-br/shop/monitores/ar/8605/tela-curva?appliedRefinements=40618)			
Monitor touch screen(//www.dell.com/pt-br/shop/monitores/ar/8605/tela-touch?appliedRefinements=40623)			
Gaming			
Voltar			
Alienware(//www.dell.com/pt-br/gaming/alienware)			
Dell Gaming(//www.dell.com/pt-br/shop/scc/sc/game)			
Notebook Alienware(//www.dell.com/pt-br/shop/notebooks/sr/laptops/alienware-laptops)			
PC Alienware(//www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/sr/desktops/alienware-desktops)			
Notebook gamer(//www.dell.com/pt-br/shop/gaming-and-games/sc/game-laptops)			
PC gamer(//www.dell.com/pt-br/shop/gaming-and-games/sc/game-desktops)			
Acessórios gamer(//www.dell.com/pt-br/shop/acessórios-para-jogos/ac/6488)			
Monitores gamer(//www.dell.com/pt-br/shop/monitores-gamer/ar/8439)			
Processador i5 gamer(//www.dell.com/pt-br/shop/notebooks-pcs-e-acessórios-gamer/sr/game/intel-core-i5?appliedRefinements=41646)			
Processador i7 gamer(//www.dell.com/pt-br/shop/notebooks-pcs-e-acessórios-gamer/sr/game/intel-core-i7?appliedRefinements=41644)			
Processador i9 gamer(//www.dell.com/pt-br/shop/notebooks-pcs-e-acessórios-gamer/sr/game/intel-core-i9?appliedRefinements=41642)			
Acessórios e eletrônicos			
Voltar			
Ver todos os produtos acessórios e eletrônicos(//www.dell.com/pt-br/shop/accessories)			
Peças, baterias e upgrades(//www.dell.com/pt-br/shop/partsforyourdell)			
Teclado gamer(//www.dell.com/pt-br/shop/acessórios-para-jogos/ar/6488/teclados-para-jogos?appliedRefinements=39817)			
Mouse gamer(//www.dell.com/pt-br/shop/acessórios-para-jogos/ar/6488/mouses-e-mousepads-para-jogos?appliedRefinements=39818)			
Headset gamer(//www.dell.com/pt-br/shop/acessórios-para-jogos/ar/6488/headsets-gamer?appliedRefinements=43634)			
Teclado Bluetooth(//www.dell.com/pt-br/shop/teclados/ar/8545/bluetooth?appliedRefinements=44435)			
Mouse Bluetooth(//www.dell.com/pt-br/shop/mouses/ar/6593/bluetooth?appliedRefinements=44435)			
Caixa de som(//www.dell.com/pt-br/shop/alta-voz/ar/8448)			
Webcams(//www.dell.com/pt-br/shop/webcams/ar/8332)			
Dock Station(//www.dell.com/pt-br/shop/dock-stations/ar/8407)			
Mochila para notebook(//www.dell.com/pt-br/shop/mochila-para-notebook/ar/7303)			
Capa para notebook(//www.dell.com/pt-br/shop/capas-para-notebook/ar/7306)			
Thin clients(//www.dell.com/pt-br/shop/endpoints-e-software-wyse/sc/cloud-client)			
Workstations			
Voltar			
Ver todas as workstations(//www.dell.com/pt-br/shop/isv-workstations-certificadas/sc/workstations)			
Workstation notebook(//www.dell.com/pt-br/shop/isv-workstations-certificadas/sr/workstations/precision-laptops)			
Workstation PC(//www.dell.com/pt-br/shop/isv-workstations-certificadas/sr/workstations/precision-desktops)			
Serviços			
Voltar			
Visualizar todos os serviços(//www.dell.com/pt-br/dt/services/index.htm)			
Serviços de consultoria(//www.dell.com/pt-br/dt/services/consulting-services/index.htm)			
Serviços de implantação(//www.dell.com/pt-br/dt/services/deployment-services/index.htm)			
Serviços de suporte(//www.dell.com/pt-br/dt/services/support-services/index.htm)			
Serviços de residência(//www.dell.com/pt-br/dt/services/deployment-services/residency-services.htm)			
Education Services(//www.dell.com/pt-br/dt/services/education-services.htm)			
Tecnologia de serviços(//www.dell.com/pt-br/dt/services/support-deployment-technologies/index.htm)			
Premier: provisionamento eletrônico e integrações(//www.dell.com/pt-br/lp/dt/dell-premier)			
Suporte			
Voltar			
Página de suporte(//www.dell.com/support/home/pt-br)			
Biblioteca de suporte(//www.dell.com/support/contents/pt-br/category/product-support/self-support-knowledgebase)			
Serviços de suporte e contratos(//www.dell.com/support/contractservices/pt-br/)			
Drivers e downloads(//www.dell.com/support/home/pt-br?app=drivers)			
Manuais e documentação(//www.dell.com/support/home/pt-br?app=manuals)			
Diagnóstico e ferramentas(//www.dell.com/support/home/pt-br/quicktest)			
Autorreparo e peças(//www.dell.com/support/contents/pt-br/article/warranty/Self-Repair)			
Chamados e status de despacho(//www.dell.com/support/incidents-online/pt-br/srsearch)			
Suporte a pedidos(//www.dell.com/support/order-status/pt-br/order-support)			
Entre em contato com o suporte(//www.dell.com/support/contents/pt-br/category/Contact-Information)			
Comunidade(//www.dell.com/community/Comunidade-da-Dell/ct-p/Portuguese?profile.language=pt)			
Promoção			
Voltar			
Ver todas as Promoções(//www.dell.com/pt-br/shop/deals)			
Notebooks em Promoção(//www.dell.com/pt-br/shop/deals/promocao-notebook)			
Computadores e PCs em Promoção(//www.dell.com/pt-br/shop/deals/promocao-computador)			
PCs e Notebooks Gamer em Promoção(//www.dell.com/pt-br/shop/deals/promocao-notebook-gamer)			
Monitores em Promoção(//www.dell.com/pt-br/shop/deals/promocao-monitor)			
Acessórios em Promoção(//www.dell.com/pt-br/shop/deals/promocao-acessorios-pc)			
Descontos para Membros			
Voltar			

Memória Especificações Técnicas(#techspecs_section) Ajude-me a escolher (//www.dell.com/pt-br/lp/hmc-precision-memory-t36-t56-t76)	Conheça o produto	Análises(#ratings_section).	Drivers, Manuais e Suporte(#support_section)
64GB DDR5 ECC (4x16GB) 4000 MT/s			+ R\$ 4.499,00
32GB DDR5 ECC (2x16GB) 4400 MT/s			+ R\$ 1.799,00
64GB DDR5 (2x32GB) 4400 MT/s			+ R\$ 2.099,00
64GB DDR5 (4x16GB) 4000 MT/s			+ R\$ 2.099,00
32GB DDR5 (2x16GB) 4400 MT/s			R\$ 0,00
16GB DDR5 (2x8G) 4400 MT/s			- R\$ 900,00
16GB DDR5 ECC (1x16G) 4400 MT/s			Selecionado

Armazenamento

Ajude-me a escolher (//www.dell.com/pt-br/lp/hmc-mobile-workstation-hdd).

Disco rígido SATA de 2.5", 1TB e 7200rpm	R\$ 0,00
Disco rígido SATA de 2.5", 500GB e 7200rpm	- R\$ 100,00
Disco rígido SATA de 3.5", 1TB e 7200rpm	Selecionado
Disco rígido SATA de 3.5", 2TB e 7200rpm	+ R\$ 100,00
Sem disco rígido	- R\$ 400,00

2º disco rígido adicional

Disco rígido SATA de 2.5", 1TB e 7200rpm	+ R\$ 400,00
Disco rígido SATA de 2.5", 500GB e 7200rpm	+ R\$ 300,00
Disco rígido SATA de 3.5", 1TB e 7200rpm	+ R\$ 400,00
Disco rígido SATA de 3.5", 2TB e 7200rpm	+ R\$ 500,00
Sem disco rígido	Selecionado

3º disco rígido adicional

Disco rígido SATA de 2.5", 1TB e 7200rpm	+ R\$ 400,00
Disco rígido SATA de 2.5", 500GB e 7200rpm	+ R\$ 300,00
Disco rígido SATA de 3.5", 1TB e 7200rpm	+ R\$ 400,00
Disco rígido SATA de 3.5", 2TB e 7200rpm	+ R\$ 500,00
Sem disco rígido	Selecionado

4º disco rígido adicional

Disco rígido SATA de 2.5", 1TB e 7200rpm	+ R\$ 400,00
Disco rígido SATA de 2.5", 500GB e 7200rpm	+ R\$ 300,00
Sem disco rígido	Selecionado

Armazenamento Especificações Técnicas (#techspecs_section) Ajude-me a escolher (/www.dell.com/pt-br/lp/hmc-mobile-workstation-hdd).		Conheça o produto	Análises(#ratings_section).	Drivers, Manuais e Suporte(#support_section)
SSD M.2 1TB PCIe NVME™ Classe 40				+ R\$ 299,00
SSD M.2 PCIe NVMe de 2 TB, classe 40				+ R\$ 1.800,00
SSD M.2 512GB PCIe NVME™ Classe 40				Selecionado
SEM DELL PLUS (disponível somente com software de imagem padrão)				- R\$ 900,00

SSD adicional

SSD M.2 1TB PCIe NVME™ Classe 40		+ R\$ 1.562,00
2TB PCIe NVMe™ Class 40 M.2 SSD		+ R\$ 3.903,00
SSD M.2 512GB PCIe NVME™ Classe 40		+ R\$ 976,00 
SSD M.2 Dual 1TB PCIe NVMe™ Classe 40		+ R\$ 3.124,00
SSD M.2 Dual 512GB PCIe NVMe™ Classe 40		+ R\$ 1.952,00
Sem disco rígido		Selecionado 

Resfriamento Térmico

Cooler de Ar de CPU Avançado		Selecionado
Cooler de Ar de CPU Padrão		- R\$ 179,00

Teclado

Nenhum teclado selecionado		- R\$ 88,00
Teclado multimídia Dell KB216, preto, em Português (Brasil), ABNT2		Selecionado

Mouse

Nenhum mouse selecionado		- R\$ 70,00
Mouse óptico Dell - MS116 (preto)		Selecionado

Wireless

[Ajude-me a escolher \(/www.dell.com/pt-br/lp/hmc-wireless-cards-consumer\).](#)

Intel® Wi-Fi 6E AX211, 2x2, 802.11ax, placa de rede wireless com Bluetooth®		+ R\$ 179,00
Sem placa de rede sem fio		Selecionado

Unidade óptica

[Ajude-me a escolher \(/www.dell.com/pt-br/lp/hmc-optical-drives\).](#)

Unidade de Disco Óptico 8x DVD+/-RW 9.5mm		+ R\$ 86,00
Sem Unidade Óptica		Selecionado

Software óptico

PowerDVD Software não incluso		Selecionado
Cyberlink Media Suite Essentials para Windows 10 e DVD drive (sem Media)		+ R\$ 13,00

Placa de rede Especificações Técnicas (#techspecs_section) Sem placa de rede adicional selecionada (NIC integrado incluído)	Conheça o produto	Análises (#ratings_section)	Drivers, Manuais e Suporte (#support_section)
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Portas USB Extras

Sem porta adicional

Economia de Energia

[Ajude-me a escolher \(//www.dell.com/pt-br/lp/hmc-energy-efficient-options\)](#)

Não qualificado Energy Star	R\$ 0,00
Qualificado ENERGY STAR	Selecionado

EPEAT

Registro EPEAT 2018 (dourado)

Conectividade RAID

[Ajude-me a escolher \(//www.dell.com/pt-br/lp/hmc-raid-configuration\)](#)

Sem RAID	Selecionado
RAID 0 para SSD M.2 NVMe	R\$ 0,00
RAID 1 para SSD M.2 NVMe	R\$ 0,00
RAID 5 para SSD M.2 NVMe	R\$ 0,00

Configuração de HD

C1: M.2 SSD de inicialização + M.2 SSD opcional (sem disco rígido SATA)	R\$ 0,00
C4: SSD M.2 de inicialização + SSD M.2 opcional + disco rígido SATA 2.5"	R\$ 0,00
C5: SSD M.2 de inicialização + SSD M.2 opcional + disco rígido SATA de 3.5"	Selecionado

Gerenciamento de sistemas

Gerenciamento Intel Básico (Standard Manageability)	Selecionado
Gerenciamento Intel vPro	R\$ 0,00
Sem Gerenciamento Remoto	- R\$ 75,00

Segurança TPM

Dell Precision TPM

Opções de Chassi

Precision 3660 Tower with 500W (80 Plus Platinum) PSU, RPL and ADL Compatible

Serviços e Softwares

Assistência técnica

[Ajude-me a escolher \(//www.dell.com/pt-br/lp/dt/sb-support-for-pcs\)](#)

Assistência no Local

1 ano de assistência técnica no local após diagnóstico remoto por telefone	Selecionado
3 anos de assistência técnica no local após diagnóstico remoto por telefone	+ R\$ 945,00
4 anos de assistência técnica no local após diagnóstico remoto por telefone	+ R\$ 1.419,00
5 anos de garantia básica no local	+ R\$ 1.895,00

ProSupport

3 anos de ProSupport com serviço no local, Brasil	+ R\$ 1.790,00
4 anos de ProSupport com serviço no local, Brasil	+ R\$ 2.527,00
5 anos de ProSupport com serviço no local, Brasil	+ R\$ 3.320,00

Especificações Técnicas(#techspecs_section).	Conheça o produto	Análises(#ratings_section).	Drivers, Manuais e Suporte(#support_section)
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ProSupport Plus

3 anos de ProSupport Plus com serviço no local, Brasil	+ R\$ 2.158,00
Recomendado pela Dell	
4 anos de ProSupport Plus com serviço no local, Brasil	+ R\$ 3.055,00
5 anos de ProSupport Plus com serviço no local, Brasil	+ R\$ 3.901,00

Software de Segurança

Ajude-me a escolher (//www.dell.com/pt-br/lp/hmc-mcafee-commercial).



Sem software anti-vírus

- Adquira o McAfee® Business Protection para ter a proteção e premiada de dispositivos
- Tenha mais tranquilidade com assinaturas de 3 anos, disponíveis apenas na Dell

Opções disponíveis

☒	Sem software anti-vírus	Selecionado
☐	McAfee® Business Protection Avaliação de 30 dias	R\$ 0,00
☐	McAfee® Business Protection 1 ano	+ R\$ 297,00
☐	Recomendado pela Dell McAfee® Business Protection 3 anos Compre agora e economize!	+ R\$ 684,00 + R\$ 581,00

Microsoft Office

Ajude-me a escolher (//www.dell.com/pt-br/lp/hmc-microsoft-office).

Licença Permanente do Microsoft Office para 1 PC



Nenhuma licença do Microsoft Office incluída (somente a oferta de avaliação de 30 dias*)

Selecione seu produto Microsoft Office

Opções disponíveis

☒	Nenhuma licença do Microsoft Office incluída (somente a oferta de avaliação de 30 dias*)	Selecionado
☐	Recomendado pela Dell Microsoft Office Home & Business 2021	+ R\$ 1.658,00
☐	Microsoft Office Professional 2021	+ R\$ 2.919,00

Others

Especificações Técnicas(#techspecs_section).

Conheça o produto

Análises(#ratings_section).

Drivers, Manuais e Suporte(#support_section)

Microsoft

Others

Selecione seu produto Microsoft Office

Opções disponíveis

Mantenha seu disco rígidoMicrosoft Office Home & Business 2021 com Foxit PDF Editor Pro v12

+ R\$ 3.595,00

[Ajude-me a escolher \(//www.dell.com/pt-br/lp/hmc-keep-your-hard-drive\).](#)

None

Microsoft 365 Personal - Assinatura Anual (1 usuário)

+ R\$ 367,00

Selecionado

Mantenha Seu Disco Rígido, 1 Ano, Brasil

+ R\$ 38,00

Mantenha seu Hard Drive, 3 anos

+ R\$ 86,00

Mantenha seu Hard Drive, 4 anos

+ R\$ 97,00

Mantenha seu Hard Drive, 5 anos

+ R\$ 118,00

Soluções para Foto, Vídeo e Mídia

[Ajude-me a escolher \(//www.dell.com/pt-br/lp/hmc-digital-software\).](#)

Cyberlink

PowerDirector 2024

ULTRA

PhotoDirector 2024

ULTRA

CyberLink

CyberLink PowerDirector 19 e PhotoDirector 12 Ultra

Crie vídeos e fotos de tirar o fôlego com tecnologia de IA. Faça edições usando efeitos especiais, ferramentas e filtros surreais ao estilo hollywoodiano.

✔ Ano Novo, Novos Descontos em Software

+R\$ 352,00 + R\$ 299,00

PowerDVD

CyberLink

CyberLink Media Player com PowerDVD 21 Ultra

Organize fotos e reproduza DVDs, vídeos e músicas com aprimoramentos do TrueTheater em Ultra HD, 4K, HDR e 8K.

+ R\$ 546,00

Director Suite 365

Promeo

CyberLink

CyberLink Director Suite 365 with Promeo

Seu estúdio de edição de fotos e vídeos completo com tecnologia de IA. Acesso a milhões de fotos e vídeos sem direitos autorais.

+ R\$ 915,00

Adobe

Especificações Técnicas(#techspecs_section).

Conheça o produto

Análises(#ratings_section).

Drivers, Manuais e Suporte(#support_section)

Adobe

Ps Lr

Creative Cloud Photography plan

ADOBE CREATIVE CLOUD PHOTOGRAPHY PLAN - 12 MONTH SUBSCRIPTION

Ferramentas profissionais de edição de fotos para fotógrafos experientes e aspirantes. Inclui o Adobe Photoshop e Lightroom.

+ R\$ 1.218,00

Others

Adobe

Photoshop Elements 2023 & Premiere Elements 2023

Recomendado pela Dell

Adobe Photoshop Elements 2023 & Premiere Elements 2023 Bundle

Software de edição de fotos e vídeos para clientes criativos. Orientação detalhada para criar fotos e vídeos incríveis, com facilidade.

+ R\$ 1.086,00

Soluções para PDF

Ajude-me a escolher (//www.dell.com/pt-br/lp/hmc-pdf-solutions).

Adobe

Adobe Acrobat 2020

Foxit PDF

Soluções para PDF

Escolha uma solução para criar, assinar e proteger PDFs

Opções disponíveis

None

Selecionado

Foxit PDF Editor v12

+ R\$ 907,00

Adobe Acrobat Standard DC: assinatura de 1 ano

+ R\$ 1.657,00

Adobe Acrobat Standard 2020

+ R\$ 1.415,00

Recomendado pela Dell

Adobe Acrobat Standard 2020

+ R\$ 1.481,00

Adobe Acrobat Professional 2020

+ R\$ 3.258,00

Dell Endpoint Security

None

None

Selecionado

https://www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/workstation-precision-3660/spd/precision-3660-workstation/xcto02p3660mtrplbcc_p12?view=configurations&configurationid=34f5c06a-0ec9...

9/19

Especificações Técnicas(#techspecs_section).	Conheça o produto	Análises(#ratings_section).	Drivers, Manuais e Suporte(#support_section).
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SafeGuard and Response

Crowdstrike Endpoint Protection Pro,Prevent Device Ctrl,Ctrl-Respond,Essential Support 1yr	+ R\$ 192,00
Crowdstrike Endpoint Protection Pro,Prevent Device Ctrl,Ctrl-Respond,Essential Support 3yr	+ R\$ 456,00
Crowdstrike Endpoint Prot Ent,Prevent Insight,EDR XDR,Device Ctrl,ThreatGraph,Essential Support 1yr	+ R\$ 390,00
Crowdstrike Endpoint Prot Ent,Prevent Insight,EDR XDR,Device Ctrl,ThreatGraph,Essential Support 3yr	+ R\$ 1.050,00

Others

Antivírus de última geração VMware Carbon Black Cloud Endpoint Standard, detecção e resposta de endpoint por comportamento, com Dell ProSupport, 1 ano	+ R\$ 224,00
Antivírus de última geração VMware Carbon Black Cloud Endpoint Standard, detecção e resposta de endpoint por comportamento, com Dell ProSupport, 3 anos	+ R\$ 539,00
Crowdstrike Endpoint Protection Pro-Prevent Device Ctrl+Absolute Ctrl-Persistence(Pro)Bundle,1 Year	+ R\$ 429,00

Dell Endpoint Security Ofertas adicionais

Ajude-me a escolher ([//www.dell.com/pt-br/lp/hmc-absolute-security-airwatch-management](http://www.dell.com/pt-br/lp/hmc-absolute-security-airwatch-management)).

☐ Absolute Visibility (Standard), 1 years	+ R\$ 184,00
☐ Absolute Visibility (Standard), 3 years	+ R\$ 470,00
☐ Absolute Visibility (Standard), 5 Years	+ R\$ 738,00
☐ Absolute Control (Professional), 1 year	+ R\$ 369,00
☐ Absolute Control (Professional), 3 years	+ R\$ 942,00
☐ Absolute Control (Professional), 5 Years	+ R\$ 1.477,00
☐ Absolute Resilience (Premium), 1 year	+ R\$ 554,00
☐ Absolute Resilience (Premium), 3 years	+ R\$ 1.413,00
☐ Absolute Resilience (Premium), 5 Years	+ R\$ 2.217,00
☐ Absolute Resilience (Premium) for Education, 1 year	+ R\$ 424,00
☐ Absolute Control (Professional) for Government, 1 year	+ R\$ 332,00
☐ Absolute Control (Professional) for Government, 3 years	+ R\$ 847,00
☐ Absolute Control (Professional) for Government, 5 Years	+ R\$ 1.330,00
☐ Absolute Resilience (Premium) for Government, 1 year	+ R\$ 499,00
☐ Absolute Resilience (Premium) for Government, 3 years	+ R\$ 1.271,00
☐ Absolute Resilience (Premium) for Government, 5 years	+ R\$ 1.996,00

Universal Endpoint Management

None	- R\$ 166,00
Serviços de configuração, VMware Workspace ONE, provisionamento de fábrica	Selecionado

Regulamentação

Sem alto-falante externo

Qual é o grau de dificuldade em comparar e selecionar opções para este produto?

Muito Difícil

1

2

3

4

5

6

7

Muito Fácil

Sistema operacional

Disponível com Windows 11, Windows 10 ou Ubuntu.



Alta escalabilidade no design de minitorre

Opção de refrigeração da CPU

Melhore a refrigeração com os coolers avançados a ar e os modelos premium a líquido.

Armazenamento com parte frontal removível e trava de segurança

Armazenamento de dados seguro e acessível.

Portas mais rápidas

Acesso fácil às portas (até 20 Gbit/s).

Fonte de alimentação removível

Use a trava para remover facilmente a fonte de alimentação.



Alto desempenho

Você não vai acreditar no que vai ver

Esteja você trabalhando no design de sites ou no CAD, a placa gráfica integrada Intel ou as placas gráficas AMD Radeon Pro ou NVIDIA Pro (até 400 W) garantem sempre uma experiência visual perfeita e de alta qualidade.

Desacelerar não é uma opção

Processadores Intel Core™ até i9, 24 (8P + 16E) e placas de vídeo NVIDIA RTX A6000. Memória DDR5 de até 128 GB ou até 4.400 MHz Até 28TB de armazenamento compatível com RAID.

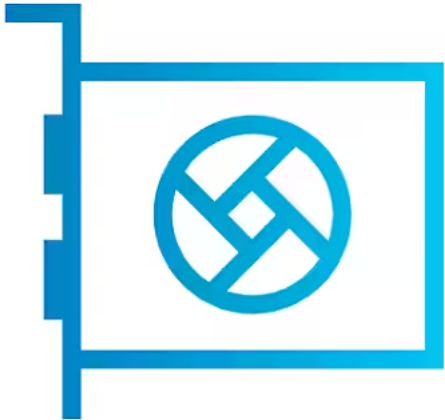
Conectividade conveniente

Wi-Fi 6 e Bluetooth 5.2 integrados ao vPro.



Refrigeração a ar e líquida opcional

O fluxo de ar ou líquido mantém a parte interna resfriada e seu espaço de trabalho silencioso, para que sua criatividade flua sem interrupções. Sistemas térmicos avançados ajudam a manter o sistema funcionando com desempenho máximo.



Reliable Memory Technology Pro

Funciona com a memória ECC para detectar memórias com defeito, corrigir erros, mapear setores danificados da memória e gerar relatórios.



Certificação de fornecedor de software independente (ISV)

As Workstations Dell Precision são testadas para garantir o pleno funcionamento dos aplicativos de alto desempenho que você usa todos os dias. ⓘ

Dell Optimizer for Precision*

Nossa plataforma de IA integrada aprende como você trabalha e se adapta para criar uma experiência mais inteligente e personalizada.

*Nem todos os recursos do Dell Optimizer for Precision estão disponíveis em todas as workstations Precision.



Intelligent Audio

O Intelligent Audio aprimora a qualidade de áudio e reduz os ruídos de fundo, para que você possa ouvir e ser ouvido, criando uma melhor experiência de conferência para todos.



ExpressResponse

Com a tecnologia Intel® Adaptix™, você prioriza os aplicativos mais importantes para que eles sejam abertos mais rápido e funcionem melhor.



ExpressConnect

O novo ExpressConnect se conecta automaticamente ao ponto de acesso mais forte do escritório e direciona a largura de banda aos aplicativos essenciais, onde quer que você trabalhe.

Especificações Técnicas(#techspecs_section).	Conheça o produto	Análises(#ratings_section).	Drivers, Manuais e Suporte(#support_section).
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Lógica analítica

Analise o sistema e gere relatórios sobre a carga de trabalho, o desempenho e autodiagnósticos para obter informações que ajudam a ter um desempenho personalizado para a forma como você trabalha.



Novo conceito de realidade

Crie conteúdo de realidade virtual totalmente imersivo com a placa gráfica integrada Intel® ou as placas gráficas AMD Radeon Pro ou NVIDIA Pro (até 350 W).



Criação inteligente

Desenvolva a IA em qualquer lugar com o Linux Ubuntu instalado de fábrica, opções de armazenamento rápido, grande capacidade de memória e CPUs Intel®.



A velocidade da IA

As tecnologias cognitivas são a área que mais cresce na computação moderna. Os aplicativos que antes exigiam inteligência humana agora são aumentados por algoritmos potentes de aprendizado de máquina, reduzindo o tempo entre ideias e resultados.

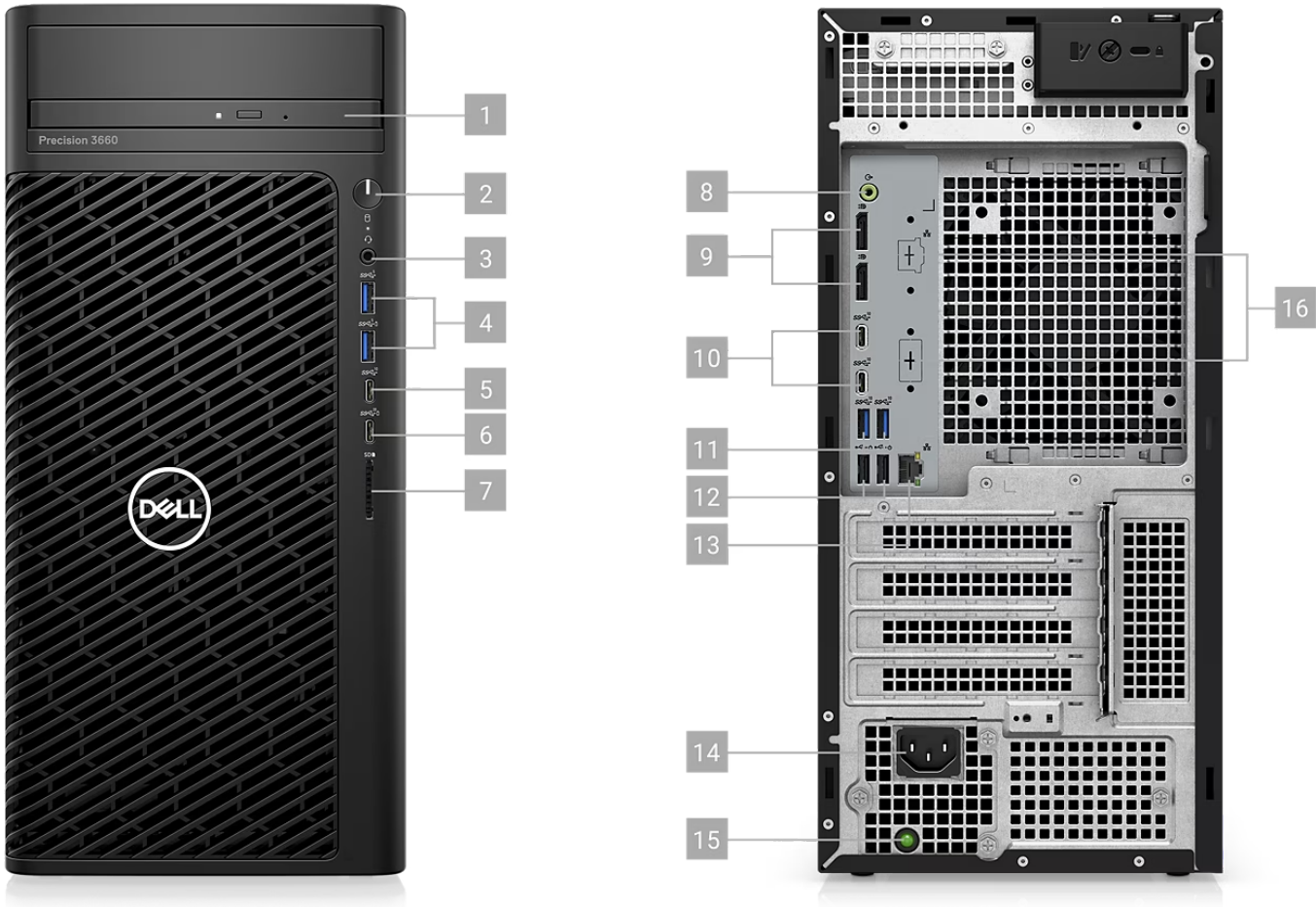


Mantenha a segurança e a produtividade

Inicie com segurança. Mantenha a segurança. As organizações relatam uma queda de 58% nos incidentes de segurança com dispositivos Windows 11 Pro. ⓘ

Os dispositivos Windows 11 Pro ajudam você a simplificar seu dia de trabalho e aumentar a produtividade. Alterne facilmente entre locais. Aproveite sua lista de tarefas realizando multitarefa com tecnologia de IA, recursos para se organizar em um piscar de olhos e desempenho para acelerar as cargas de trabalho exigentes e concluir 42% mais rápido, em média. ⓘ

Saiba mais ([//www.dell.com/pt-br/work/lp/windows-11](https://www.dell.com/pt-br/work/lp/windows-11))



Portas e slots

- 1. Unidade óptica (opcional)
- 2. Botão liga/desliga

Especificações técnicas(#techspecs_section)	Conheça o produto	Análises(#ratings_section).	Drivers, Manuais e Suporte(#support_section).
3. Entrada combinada de áudio e microfone (3,5 mm) 4. (2) USB 3.2 Type-A de 1ª geração (5 Gbit/s) 5. USB 3.2 Type-C de 2ª geração (10 Gbit/s), somente dados 6. USB 3.2 Type-C x2 de 2ª geração (20 Gbit/s), somente dados 7. leitor de cartão SD 4.0 8. saída de áudio (conector de 3,5 mm) 9. (2) DP1.4++ HBR2 10. (2) USB 3.2 Type-C de 2ª geração (10 Gbit/s) com Power Delivery 11. (2) USB 3.2 Type-A de 2ª geração (10 Gbit/s) 12. 2 portas USB 2.0 Type-A 13. RJ45 i219 LAN (1G) 14. Conector de energia 15. Luz indicadora de LED 16. Porta de vídeo opcional (VGA HD15, HDMI 2.0, DP++ 1.4 HBR3, USB Type-C com DP modo alternativo DP 1.4 HBR2)			



Dimensões e peso

- 1. Altura: 369,0 mm (14,52 pol.)
- 2. Largura: 173,0 mm (6,81 pol.)
- 3. Profundidade: 420,0 mm (16,53 pol.)

Folheto de especificações do View 3660 (<https://www.delltechnologies.com/asset/en-us/products/workstations/technical-support/precision-3660-spec-sheet.pdf>) (em inglês)

Peso inicial: 8,5 kg (18,739 lb) ⓘ

Adequado para qualquer projeto

Não importa se você trabalha com design ou aplicativos criativos nos setores de educação, varejo ou entretenimento, ele está pronto para o que você precisar.



Design- 2D, 3D, CAD



Design e layout de lojas de varejo



Aplicativos criativos



Educação



Finanças



Área da saúde

Veja seu trabalho em 8K

Porta DP 1.4 opcional com suporte a 8K, duas portas DP 1.4 com suporte a 5K



FullHD(2K)
1920 x 1080



Ultra HD 5K
5120 x 2880



Ultra HD 8K
7680 x 4320

Especificações Técnicas(#techspecs_section).	Conheça o produto	Análises(#ratings_section).	Drivers, Manuais e Suporte(#support_section).
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Certificação EPEAT

As workstations Precision têm certificação EPEAT (<https://epeat.net/computers-and-displays-search-result/page-1/size-25?manufacturerId=317&productStatusId=1&productTypeId=185437%20Progress> link: <https://corporate.delltechnologies.com/asset/en-us/solutions/business-solutions/briefs-summaries/delltechnologies-fy21-progress-made-real-report.pdf>) (em inglês) ⓘ em todo o portfólio. A maioria é EPEAT Gold, o que significa que atendem aos mais altos padrões de critérios de sustentabilidade.

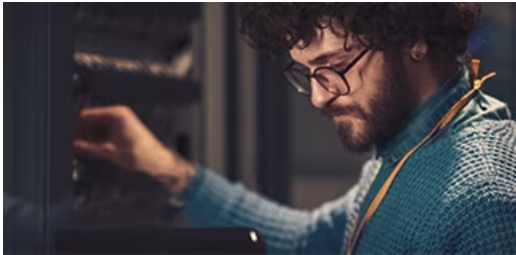
Embalagem responsável

Hoje 87% das embalagens da Dell são feitas de materiais reciclados ou renováveis. Até 2030, serão 100%. Saiba mais sobre nossas metas moonshot e outras iniciativas em nosso relatório de Progresso real.

Futuro verde

Ajude-nos em nossa missão de fabricar produtos com pelo menos 50% de conteúdo reciclado ou renovável. Envie seu lixo eletrônico (qualquer marca) para reciclagem ou reutilização em apoio a uma economia circular.

Saiba mais em Dell.com/Recycle (http://www.dell.com/pt-br/dt/corporate/social-impact/advancing-sustainability/how-to-recycle.htm?gacd=9643275-1040-5761040-266682520-0&dgc=st&gclid=CjwKCAjwtdcFBhBAEiwAKOlY538kGiyQ3FURqhKqjrl6_uP0W-yJ6-Yajxc3elEeVJ_VQGor7aaWBRoCgAkQAvD_BwE&gclsrc=aw.ds#/cdt/home/pcs-and-laptops).



Temos o que sua empresa precisa

ProDeploy Client Suite:

Maior velocidade, menos trabalho e mais controle.

ProSupport:

Acesso 24x7 a especialistas em tecnologia avançada na região.

ProSupport Plus:

Todos os recursos do ProSupport e muito mais.

Análises de especialistas e prêmios

 SINGAPORE GOOD DESIGN 2023	 iF DESIGN AWARD 2023
<u>Vencedor do Singapore Good Design 2023: Linguagem de Design das Workstations Fixas Dell Precision (em inglês)</u> (https://sgmark.org/winners/precision-fixed-workstation-design-language/).	<u>Vencedor do iF Design Awards 2023: Linguagem de Design da Família Dell Precision (em inglês)</u> (https://ifdesign.com/en/winner-ranking/project/dell-precision-family-design-language/569473).
Categoria: Design de Produto	Categoria: Computador - Linguagem de Design de Família de Computadores

Avaliações

Nenhuma avaliação publicada até o momento.

Dúvidas

Fazer uma pergunta

1–10 de 63 Dúvidas	Classificar por: Mais respondida ▼
alex · 2 meses atrás boa noite, quero adicionar cyberlink 365. preco de cyberlink com promeo e anual ou one time pagamento Responder esta dúvida	2 respostas

Especificações Técnicas(#techspecs_section).

Conheça o produto

Análises(#ratings_section).

Drivers, Manuais e Suporte(#support_section)

Matheus,

muito obrigado. pode ser que nao explicei bem. gostaria adicionar director suite 365 com promeo por 915rs. esse preco e subscricao anual ou pagamento da licenca para sempre? desculpa qualquer confusao

Útil?

Sim · 0

Não · 0

Reportar

Anderson · 4 dias atrás

Notei que possui portas mDP Existe alguma opção com HDMI?

Responder esta dúvida

Dell RR · 4 dias atrás

Olá, Anderson!

Sim é possível pedir que a Torre Precision 3660 venha com uma porta HDMI. Para isso, você deve fazer a cotação com um de nossos consultores. Você encontra os canais de contato neste link: <https://dell.to/3wiz8Ap> (<https://dell.to/3wiz8Ap>)

- Matheus@DellBrasil

Útil?

Sim · 0

Não · 0

Reportar

Evandro · 5 dias atrás

Qual a memória da placa de vídeo intel?

Responder esta dúvida

Dell RR · 21 horas atrás

Olá, Evandro!

A placa de vídeo Intel usa a memória RAM do sistema, e pode chegar a usar até a metade da memória RAM total quando exigida.

- Matheus@DellBrasil

Útil?

Sim · 0

Não · 0

Reportar

Anônimo · 8 dias atrás

O NIC integrado é gigabit?

Responder esta dúvida

Dell RR · 7 dias atrás

Olá, obrigado pela pergunta!

Sim, o módulo Ethernet da Torre Precision 3660 é Gigabit.

- Matheus@DellBrasil

Útil?

Sim · 0

Não · 0

Reportar

Rafael · 17 dias atrás

Gostaria de saber se teremos novas promoções dessa máquina. Quero pegar uma dessa.

Responder esta dúvida

Dell RR · 15 dias atrás

Oi,

Recomendamos falar com nossa equipe de vendas (Brasil) para obter assistência: <https://url.dell.com/f22a14> (<https://url.dell.com/f22a14>)

- Mohammed@Dell

Útil?

Sim · 0

Não · 0

Reportar

Andre · 2 meses atrás

No site só a opção de compra com sistema operacional Windows. Gostaria de saber se eu posso instalar o sistema operacional Linux sem perder a garantia.

Responder esta dúvida

Dell RR · 2 meses atrás

Olá, Andre!

Em caso de substituição do sistema operacional de fábrica, planos de suporte técnico que oferecem cobertura ao software perderão esse direito.

Você pode entrar em contato com um de nossos consultores para verificar a possibilidade de adquirir a Torre Precision 3660 com Linux de fábrica. Segue o link com todos os canais de contato: <https://dell.to/3wiz8Ap> (<https://dell.to/3wiz8Ap>)

- Matheus@DellBrasil

Útil?

Sim · 0

Não · 0

Reportar

Leonel · 2 meses atrás

Tenho que saber sobre estas opções para fazer a compra da Torre Precision 3660. -Cooler de Ar de CPU Avançado -SEM DELL PLUS (somente com software de imagem padrão). -Vou Instalar Windows 11 no SSD, e tenho 3 HD 3.5", quais opção escolher.

Responder esta dúvida

Dell RR · 2 meses atrás

Olá, Leone!

Para receber um atendimento personalizado e encontrar a configuração que mais faz sentido para sua necessidade, por favor entre em contato com um de nossos consultores pelo link: <https://dell.to/3wiz8Ap> (<https://dell.to/3wiz8Ap>)

- Matheus@DellBrasil

Útil?

Sim · 0

Não · 0

Reportar

Renato · 2 meses atrás Especificações técnicas (#techspecs_section). É possível adicionar um HDD SATA III de 3,5"?	Conheça o produto	Análises (#ratings_section).	Drivers, Manuais e Suporte (#support_section)	1 resposta
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Responder esta dúvida

Dell RR · 2 meses atrás

Olá, Renato!

A Torre Precision 3660 conta com 5 slots SATA 3, onde podem ser instalados HDS de 3,5". Na hora de personalizar a configuração, antes de adicioná-la ao carrinho, você terá diversas opções de discos rígidos adicionais para escolher.

- Matheus@DellBrasil

Útil? **Sim · 0** **Não · 0** **Reportar**

Anônimo · 2 meses atrás

Boa noite, vejo que o item 16, no detalhamento permite adicionar uma porta de video. Porem ao ir no menu de editar nao exhibe a opção.

1
resposta

Responder esta dúvida

Dell RR · 2 meses atrás

Olá, obrigado pelo contato.

Para incluir essa porta de vídeo adicional na configuração, você deve fazer essa solicitação a um de nossos consultores. Siga o link com os diferentes canais de atendimento: <https://dell.to/3wiz8Ap> (<https://dell.to/3wiz8Ap>)

- Matheus@DellBrasil

Útil? **Sim · 0** **Não · 0** **Reportar**

Leonel · 2 meses atrás

Qual a quantidade máxima de memória suportada pelo Workstation Precision 3660.

1
resposta

Responder esta dúvida

Dell RR · 2 meses atrás

Olá, Leone!!

A Workstation Precision 3660 suporta até 128GB de memória RAM.

Você encontra as especificações completas de memória do modelo neste link: <https://dell.to/47JGldX> (<https://dell.to/47JGldX>)

- Matheus@DellBrasil

Útil? **Sim · 1** **Não · 0** **Reportar**

1–10 de 63 Dúvidas



► (https://www.dell.com/pt-br/shop/computadores-all-in-ones-e-workstations/workstation-precision-3660/spd/precision-3660-workstation/xcto02p3660mtrplbcc_p12?view=configurations&configurationid=34f5c06a-0ec9-4df6-b077-7b106ab330ee&bvstate=pg:2/ct:q)

Drivers, Manuais e Suporte

Suporte Dell

O suporte a produtos da Dell oferece tudo o que você precisa: drivers e downloads, manuais e artigos de suporte, ferramentas de diagnóstico e peças de substituição.

Confira aqui ([//www.dell.com/support/home/br/pt/brbsd1/product-support/product/precision-3660-workstation/diagnose](https://www.dell.com/support/home/br/pt/brbsd1/product-support/product/precision-3660-workstation/diagnose)).

BR/PT	Conta Conta	Suporte Suporte	Fale conosco Fale conosco	Mapa do site (//www.dell.com/pt-br/sitemap)
Mapa do site (//www.dell.com/pt-br/sitemap)	Minha conta (//www.dell.com/myaccount/pt-br)	Página de suporte (//www.dell.com/support/home/pt-br)	Comunidade (//www.dell.com/community/Comunidade-da-Dell/ct-p/Portuguese?profile.language=pt)	BR/PT
	Status do pedido (//www.dell.com/myaccount/pt-br/orders)	Entre em contato com o suporte (//www.dell.com/support/contents/pt-br/category/Contact-Information)	Fale conosco (//www.dell.com/pt-br/lp/contact-us)	
	Meus Produtos (//www.dell.com/support/mps/pt-br/myproducts)	Tempo estimado de entrega (//www.dell.com/pt-br/lp/data-estimada-entrega)	Facebook (//pt-br.facebook.com/DellBrasil)	
		Política de Devolução (//www.dell.com/pt-br/lp/return-policy)	Twitter (//twitter.com/DellNoBrasil)	
			Instagram (//www.instagram.com/dellnobrasil)	
			YouTube (//www.youtube.com/user/dellnobrasil)	

Nossas ofertas Nossas ofertas	Nossa empresa Nossa empresa	Nossos parceiros Nossos parceiros	Recursos Recursos
APEX (//www.dell.com/pt-br/dt/apex/index.htm)	Quem somos (//www.dell.com/pt-br/dt/corporate/about-us/who-we-are.htm)	Encontre um parceiro (//dellcommunities.force.com/FindAPartner/s/partnersearch?language=pt&country=br)	Blog (//www.dell.com/pt-br/blog/)
Produtos (//www.dell.com/pt-br)	Carreiras profissionais (//carreiras.dell.com/)	Localize um Varejista (//www.dell.com/pt-br/lp/reseller_store_locator)	Eventos (//www.dell.com/pt-br/dt/events/index.htm)
Soluções (//www.dell.com/pt-br/lp/dt/solutions)	Notícias (//www.dell.com/pt-br/dt/corporate/newsroom.htm)	Soluções de OEM (//www.dell.com/pt-br/dt/oem/index.htm)	Centro de privacidade (//www.dell.com/pt-br/lp/privacy-center)
Serviços (//www.dell.com/pt-br/dt/services/index.htm)	Reciclagem (//www.dell.com/pt-br/dt/corporate/social-impact/advancing-sustainability/electronics-recycling/index.htm)	Programa de parceria (//www.delltechnologies.com/partner/pt-br/partner/partner.htm)	Biblioteca de recursos (//www.dell.com/pt-br/dt/resource-library.htm)
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Especificações técnicas (#techspecs_section)

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